



Environmental Protection & Compliance Division (EPC-DO) Los Alamos National Laboratory PO Box 1663, K491 Los Alamos, New Mexico 87545 (505) 667-2211 Date: JA

Date: JAN 3 1 2018 Symbol: EPC-DO: 18-052 LA-UR: 17-31305 Locates Action No.: N/A

Ms. Judi Kahl, Bureau Chief NMED – Construction Programs Bureau 1190 St. Francis Drive PO Box 5469 Santa Fe, NM 87502-5469

Subject: Submittal of Final Construction Scope and Schedule for the Los Alamos National Laboratory Supplemental Environmental Project - Addendum 4 - Water Line Improvement and Metering Upgrade Project

Dear Ms. Kahl:

In order to satisfy requirements outline in the Settlement Agreement and Stipulated Final Order HWB-14-20 - Addendum 4 and to address the agreement reached on January 23, 2018 between NMED/DOE/LANS on the final deliverables, the following information is enclosed:

- 1. Phase Description Diagram
- 2. 100% Drawings
- 3. 100% Technical Specifications
- 4. Construction Schedule
- 5. Engineer Estimate
- 6. LANS Response to NMED's January 2, 2018 Review Letter

Pursuant to provisions contained in 40 CFR 141.3, NMED determined that a final regulatory review by the Drinking Water Bureau will not be required. Contract bid documents, requested in NMED's review letter of January 2, 2018, will not be provided at this time but will be submitted upon completion of the final bid package.

Please contact me at (505) 667-3430 or by email at <u>bbateman@lanl.gov</u> if you have questions.

-2-

Sincerely,

Ben J/Bateman

Project Manager

BJB/MTS/RMG: am

Enclosure(s):

- 1) Phase Description Diagram Water Line Improvement and Metering Upgrade Project
- 2) 100% Settlement Water Line Improvement and Metering Upgrade Project Drawings 1/18/2018
- 100% Settlement Water Line Improvement and Metering Upgrade Project Technical Specifications - 1/19/2018
- 4) Construction Schedule
- 5) Engineer Estimate
- 6) LANS Response to NMED Review Letter of January 2, 2018

Copy: Stephanie Stringer, NMED/DWB, Santa Fe, NM, (E-File w/o enc) John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File w/o enc) Neelam Dhawan, NMED/HWB, Santa Fe, NM, (E-File w/o enc) Sarah Holcomb, NMED/SWQB, Santa Fe, NM, (E-File w/o enc) Peter Maggiore, NA-LA, (E-File w/o enc) Jaime E. Navarro, LASO-O-SME, (E-File) Michael T. Brandt, ADESH, (E-File w/o enc) John C. Bretzke, EPC-DO, (E-File w/o enc) Benjamine B. Roberts, EPC-DO, (E-File w/o enc) Andrew W. Erikson, UI-DO, (E-File w/o enc) Taunia S. Van Valkenburg, EPC-DO, (E-File w/o enc) Aaron D. Hobson, ES-EPD, (E-File) Michael A. Saladen, EPC-CP, (E-File w/o enc) Robert M. Gallegos, EPC-CP, (E-File) adesh-records@lanl.gov, (E-File) locatesteam@lanl.gov, (E-File) epc-correspondence@lanl.gov, (E-File) epccat@lanl.gov, (E-File)

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Construction Programs Bureau New Mexico Environment Dept,

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ENCLOSURE 1

Phase Description Diagram - Water Line Improvement and Metering Upgrade Project

EPC-DO: 18-052

LA-UR-17-31305

Date:

JAN 3 1 2018



ENCLOSURE 2

100% Settlement Water Line Improvement and Metering Project Drawings - 1/18/2018

EPC-DO: 18-052

LA-UR-17-31305

JAN 3 1 2018

Date:

			LIS	F OF DRAWING	is a second s
		REVISION NUMBER	SHEET	DISCIPLINE SHEET NUMBER	DRAWING TITLE
		D	01 02	G-0001 G-0002	COVER SHEET GENERAL NOTES AND LEGEND GENERALNOLAL AND LITUITY POTHOLE SCHEDULES
	Ϋ́.	U	03 04	G-0003 G-0004	GEOTECHNICAL AND UTILITY FOTHOLE SCHEDULES GEOTECHNICAL AND UTILITY POTHOLE SCHEDULES
	PROJECT DESIGN DATA	D D D	05 06 07	C-1000 C-1001 C-1002	OVERALL SITE PLAN PHASE A - SITE PLAN PHASE B - SITE PLAN
c	TO ESTABLISH A BASIS FOR THE DESIGN, PROVIDE CODES AND	D	08	C-1003 C-1004	PHASE C - SITE PLAN PHASE D - SITE PLAN
	STANDARDS OF RECORD AND A SUMMARY CODE ANALYSIS. ALSO INCLUDE THE MANAGEMENT LEVEL AND PERFORMANCE		10	C-1005	
	CATEGORY/RISK CATEGORY FOR THE PROJECT	ים נ	12	C-1007	
	 ENGINEERING STANDARDS MANUAL, LOS ALAMOS NATIONAL LABORATORY, REVISION 3 5/27/15 - ESM CHAPTER 3 	D	13 14	C-1008 C-1009	PHASE A - E. JEMEZ ROAD PLAN AND PROFILE PHASE A - E. JEMEZ ROAD PLAN AND PROFILE
		D	15 16	C-1010 C-1011	PHASE A - E. JEMEZ ROAD PI AN AND PROFILE PHASE A - E. JEMEZ ROAD PLAN AND PROFILE
		D D	17 18	C-1012 C-1013	PHASE B - BIKINI ATOLL ROAD PLAN AND PROFILE PHASE B - BIKINI ATOLL ROAD PLAN AND PROFILE
	3. AVVVA/ASTMISTANDARDS	D	19	C-1014 C-1015	PHASE C - PAJARITO ROAD ALIGNMENT 1 PLAN AND PROFILE PHASE C - PAJARITO ROAD ALIGNMENT 1 PLAN AND PROFILE
	4 CAD STANDARD MANUAL, STD-342-300		21	C-1016 C-1017	PHASE C - ALIGNMENT 2 PLAN AND PROFILE PHASE C - ALIGNMENT 2 PLAN AND PROFILE
•	5. MASTER SPECIFICATIONS INDEX, STD-342-200	D	22	C-1017	PHASE C - GAMMA RAY ALIGNMENT 3 PLAN AND PROFILE
	 SETTLEMENT WATERLINE REPLACEMENT AND METERING, PR-ID 16P-0066 	D D	24 25	C-1019 C-1020	PHASE C - GAMMA RAY ALIGNMENT 3 PLAN AND PROFILE PHASE C - PAJARITO ROAD ALIGNMENT 4 PLAN AND PROFILE
		D D	26 27	C-1021 C-1022	PHASE C - GAMMA RAY ALIGNMENT 4 PLAN AND PROFILE PHASE D - PAJARITO ROAD PLAN AND PROFILE
	PR-ID 16P-0100	D	28 29	C-1023 C-1024	PHASE D - PAJARITO ROAD PLAN AND PROFILE METER STATION SITE PLANS
	8. NATIONAL ELECTRICAL CODE, NFPA 70		30	C-1025	METER STATION SITE PLANS METER STATION SITE PLANS
	9. INTERNATIONAL FIRE CODE, IFC	L L	31	0 5000	
	10. LIFE SAFETY CODE, NFPA 101	D	32 33	C-5000 C-5001	WATER LINE DETAILS WATER LINE DETAILS
	11 FIRE CODE NEPA 1	D	34 35	C-5002 C-5003	WATER LINE DETAILS STANDARD METER VAULT DESIGN
B		D D	36 37	C-5004 C-5005	STANDARD PRV VAULT DESIGN PHASE A - E. JEMEZ ROAD CONNECTIONS DETAILS
	MEXICO, IAPMO UPC	Ď	38	C-5006 C-5007	PHASE A - E. JEMEZ ROAD CONNECTIONS DETAILS PHASE B - BIKINI ATOLL ROAD CONNECTIONS DETAILS
	13. UNIFORM MECHANICAL CODE AS AMENDED BY THE STATE OF	D	40	C-5008	PHASE B - BIKINI ATOLL ROAD CONNECTIONS DETAILS PHASE B - BIKINI ATOLL ROAD CONNECTIONS DETAILS
	NEW MEXICO, IAPMO UMC	D	41	C-5010	PHASE C - CONNECTIONS DETAILS
	14. INTERNATIONAL BUILDING CODE, IBC	ם ס	43 44	C-5011 C-5012	PHASE C - CONNECTIONS DETAILS PHASE C - CONNECTIONS DETAILS
	15. LANL FIRE PROTECTION PROGRAM, LANL PD1220, REV 4	D D	45 46	C-5013 C-5014	PHASE D - PAJARITO ROAD CONNECTIONS DETAILS PHASE D - PAJARITO ROAD CONNECTIONS DETAILS
	16. SAFEGUARDS AND SECURITY PROGRAM, DOE P 470.1	с	47	E-0001	ELECTRICAL GENERAL INFORMATION
	17. PROTECTION PROGRAM OPERATIONS, DOE O 473.3	Č C	48 49	E-5000 E-5001	ELECTRICAL DETAILS - E2 METER CABINET ELECTRICAL DETAILS - E2A METER CABINET
	18. DEPARTMENTAL SUSTAINABILITY, DOE O 436.1	č	50	E-5002	ELECTRICAL DETAILS E4 METER CABINET
	19. FACILITY SAFETY, DOE O 420.1C	C	51 52	E-5003 E-6000	
		C C	53 54	E-6001 E-6002	ELECTRICAL DIAGRAMS - METERING - E2A CABINET ELECTRICAL DIAGRAMS - METERING - E4 CABINET
		C C	55 56	E-6003 E-6004	ELECTRICAL DIAGRAMS - METERING - UTILITY SERVICE ELECTRICAL DIAGRAMS - METERING - INSTRUMENTATION
		Č C	57	E-7000 E-7001	SCHEDULES - METERING - E2 CABINET SCHEDULES - METERING - E2A CABINET
		č	59	E-7002	SCHEDULES - METERING - E4 CABINET
		C	60	TC-1000	TRAFFIC CONTROL GENERAL NOTES AND SIGNS
		C	61 62	TC-1001 TC-1002	OVERALL TRAFFIC CONTROL PHASING
		c c	63 64	TC-1003 TC-1004	TRAFFIC CONTROL PHASE 1A TRAFFIC CONTROL PHASE 1A
		Ċ	65	TC-1005 TC-1006	TRAFFIC CONTROL PHASE 2A TRAFFIC CONTROL PHASE 2A
		č	67	TC-1007	TRAFFIC CONTROL PHASE B
		C	69	TC-1008	TRAFFIC CONTROL PHASE 10 & 20
		C C	70 71	TC-1010 TC-1011	TRAFFIC CONTROL PHASE 1D TRAFFIC CONTROL PHASE 2D
		С	72	TC-4000	TRAFFIC CONTROL ENLARGED PLAN





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	FILE NO.	SYMBOL	DESCRIPTION	FILE NO.	SYMBOL	DESCRIPTION	ACRONYMS	
			PROPERTY LINE INDICATOR		C		PRS - POTENTIAL RELEASE SITES	
			SURFACE DRAINAGE				SWPPP - STORM WATER POLLUTION PREVENTION PLAN	
P		~EL	EXISTING CONTOUR	C17	⊗ ≺	G - NATURAL GAS MANHOLE	ESM - ENGINEERING STANDARDS MANUAL	
		EL	FINISHED CONTOUR			S - SEWER MANHOLE T - TELEPHONE MANHOLE	LANL - LOS ALAMOS NATIONAL LABORATORY	ц.
			UNDISTURBED EARTH OR TUFF			W - WATER MANHOLE	HDD - HORIZONTAL DIRECTIONAL DRILL	
	CE ON			C18	X	FIRE HYDRANT		
	EREN		SELECT COMPACT FILL	640				
	REF USE		ROCK	CIa		UTILITY-WATER REGULATOR VALVE		
	FOF	TRACTAC		C20	ТМ	PRECAST CONCRETE, MANHOLE, TRANSFORMER VAULT		
				C21		PULL BOX		
		1515	FINE POROUS FILL	C22	-0-	MAN HOLE		
11		∇	TOP OF SLOPE		<u> </u>			
			TOE OF SLOPE	C23	•	TURNING POINT		
C	C01		BENCHMARK INDICATOR	C24	Ę	CENTERLINE		
	C02	EL		C25	PL	PROPERTY LINE		
		↓ ↓ NO		C26	Æ	FLOW LINE		
	C03	ΨĒL	NO-SEQUENTIAL DESIGNATION EL=ELEVATION		φ			
	C04	€ NO EL	BORING INDICATOR NO-SEQUENTIAL DESIGNATION	C27	5.	HANDICAP DESIGNATION		
	C05	EL		C28	(25)	INTERSTATE ROUTE		
->		× IEL			Š	US ROUTE		
	C06	× –	FINISH ELEVATION INDICATOR	C29	(66)			
	C07	0	STEAM/COMMUNICATIONS MANHOLE	C30	50	STATE ROUTE		
	C08		STORM DRAIN GRATE	C31	0 -	EXISTING PROPERTY CORNER		
				000	- -	INDICATOR NEW PROPERTY CORNER		
			E - PRECAST CONCRETE, ELECTRICAL VAULT	032				
Ľ	C09	\mathbb{X}	F - PRECAST CONCRETE, FUEL OIL VAULT	033	MATERIAL	VAULI		0
			G - PRECAST CONCRETE, NATURAL GAS VAULT	C34	°	CLEANOUT		
			T - PRECAST CONCRETE, TELEPHONE VAULT	C35	00	DOUBLE CLEANOUT		
				C36	СВ	CATCH BASIN		
	C10		THRUST BLOCK			SITE UTILITIES (PIPING)		
\mid	C11				W	POTABLE WATER		
	012			~		HYDROGEN GAS STEAM CONDENSATE		
			G - UTILITY, METER, NATURAL GAS	ONL	G	NATURAL GAS HIGH PRESSURE (>5 PSI)		
	C14	\otimes	S - UTILITY, METER, SANITARY	RENCE	SD	STORM SEWER		
		- U	W - UTILITY, METER, WATER	REFER SE LI	F SWTE	FIRE PROTECTION WATER SANITARY WASTEWATER TREATED EFFLUENT		
A	C15		CULVERT/END SECTION	FOR I	— E1UG —	PRIMARY ELECTRICAL SECONDARY ELECTRICAL		
	C16		DRAINAGE ARROW		—T	TELECOMMUNICATION		
						INDUSTRIAL INDUSTRIAL WASTE		
					— IWMA — X —	INDUSTRIAL WASTE MONITOR ALARM LINE SECURITY		
					<u> </u>	UNKNOWN		
	L			·	<u>}</u>			

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GENERAL	NOTES:
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- 1. ALL DISTURBED SOILS SHALL BE REVEGETATED FOLLOWING CONSTRUCTION.
- PRIOR TO COMMENCEMENT OF SOIL DISTURBANCE, THE SUBCONTRACTOR SHALL CERTIFY THE LANL PREPARED STORM WATER POLLUTION PREVENTION PLAN (SWPPP), SUBMIT TO EPA A NOTICE OF INTENT FOR COVERAGE UNDER THE NPDES CONSTRUCTION GENERAL PERMIT, AND IMPLEMENT THE SWPPP.

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- 3. IMPLEMENT & MAINTAIN BEST MANAGEMENT PRACTICES IN ACCORDANCE WITH THE PROJECT SWPPP,
- EXISTING UTILITIES SHOWN HEREON ARE APPROXIMATE IN THEIR LOCATION AND ELEVATION AND SHALL BE FIELD VERIFIED BY SUBCONTRACTOR PRIOR TO COMMENCEMENT OF EXCAVATION OR EARTHWORK
- BACKGROUND DATA FOR EXISTING UTILITIES, CONTOURS, TEXT, AND STRUCTURE INFORMATION COMES FROM UTILITIES UMAP GROUP AND DOES NOT MEET CURRENT LANL ESM STANDARDS.
- 6. PRS SITE GENERAL INFORMATION: SUBCONTRACTOR SHALL NOT REMOVE NATIVE SOIL FROM SITE. EXCAVATED SOIL THAT IS NOT USED AS BACKFILL SHALL BE EVENLY DISTRIBUTED ON SITE AND NOT INTERFERE WITH EXISTING SITE DRAINAGE. RESEED THESE AREAS PER THE PROJECT SWPPP AND SEEING SPECIFICATION 32 9219.
- 7. UNLESS OTHERWISE NOTED ON POTHOLE SCHEDULE, UTILITY DEPTHS SHOWN ARE BASED UPON LANL STANDARD UTILITY DEPTHS, CONTRACTOR SHALL VERIFY DEPTH AND LOCATION PRIOR TO CONSTRUCTION.
- 8. DURING CONSTRUCTION STR WILL NEED TO COORDINATE WITH LANL UTILITIES AND FP-DO ON SHUT DOWN SCHEDULE FOR ALL FACILITIES.

SWPPP NOTES:

- INSTALL BEST MANAGEMENT PRACTICES (BMPs) IN ACCORDANCE WITH THE PROJECT SWPPP PRIOR TO STARTING SOIL DISTURBANCE ACTIVITIES. SEE PROJECT SWPPP FOR ADDITIONAL DETAILS.
- 2. INSTALL PERIMETER CONTROLS ON DOWNSLOPE SIDE OF TRENCH PRIOR TO SOIL DISTURBANCE IN ACCORDANCE WITH THE PROJECT SWPPP.
- THE SUBCONTRACTOR WILL STABILIZE ALL AREAS DISTURBED BY CONSTRUCTION IN ACCORDANCE WITH THE PROJECT SWPPP, SEE SPECIFICATION 32-9219 SEEDING AND THE PROJECT SWPPP FOR MORE DETAILS.
- 4. SOIL DISTURBED OVER AREAS OF CONCENTRATED FLOW WILL REQUIRE ADDITIONAL STORMWATER CONTROLS AND TRM FOR STABILIZATION. SEE PROJECT SWPPP FOR THESE SPECIFIC AREAS AND NECESSARY CONTROLS.

NÖ	DATE	CLASS	DC	DESC	RIPTION	DWN	DSGN	снкр	SUB	AP
N &	COMP				ENCOR		A	AE Albuqu AEAN	A PC RCAL ENGIN	accann Minic
		SETT	LEME		FER LINE		DRAWN	GI	JPSHAV	N
	R	EPLA	CEMEI	NT AND	METERING	3 [DESIGN	8.4	MBRO	GI
		GE		DTES AND	LEGEND		1.2.2.2.2	-		
						1	HECKE	D	BRAND	_
TA-	INFR				BLDG NA	Ē	DATE	D D 1/	BRAND 19/2018	
TA-		şi			BLDG NA APPROVED FOR RELEA MICHAEL WILLIAMS	ASE	DATE	D D 1/	BRAND 19/2018	
TA- SUBN BRU		81			BLDG NA APPROVED FOR RELEA MICHAEL WILLIAMS	ASE	DATE	D D 1/	BRAND 19/2018	2
TA- SUBM BRU				P0 Box 1663 .os Alamos, N	BLDG NA APPROVED FOR RELEA MICHAEL WILLIAMS	ASE	DATE G	D 1/	BRAND 19/2018	23
TA- SUBN BRU			L	P0 Box 1663 .os Alamos, N : Donald YAR	BLDG NA APPROVED FOR RELE. MICHAEL WILLIAMS ew Mexico 8754	ASE	DATE G	D D 1/ 1/ OF TE	BRAND 19/2018	23

			GEO	DTECHNICAL	. B	ORING SCHED	ULE						UTILIT	Y POTHOL
	Project Phase	Bore #	Sta,	Description		Easting	Northing		Depth	PRS (yes/No)	Project Phase	PH #	Sta.	Utility Description
	A	61	9+77_07	CONNECTION LOCATION	-	1619047 944	1774412 276		8'	N	в	PH1	10+00.00	Water
	A	G2	15+96.23			1619611.070	1774588 749		10'	N	- B	PH1A	11+18.34	E2UG
	A	G3	19+67.68		_	1619792 329	1774906 269		8'	N	8	PH2 PH3	11+19.53	E1UG
ol -	A	G4	36+31.23	Receiveing pit (option)	+	1621381.007	1774816 233		8' o'	N		PH4	13+13.60	WATER
-	A	65	77+37.00	Drill oit	+	1625189.423	1773622.315		8	N	8	PH5	14+63.90'	E2UG
											B	PH6	14+70.93'	TEL
	8	61	10+00.00	Drill pit.	_	1616702.057	1774165.064		8'	N	B	PH7	15+74.30	WATER
11	8	62	18+08-03	Drill pit.	-	1617070.150	1773667.064		8' 6'	N	в	PH9	16+05.65	WATER
	в	63	22400.00	טרווז פוז.	+	1617190.644	1773307,150		0	N.	8	PH10	17+68.48	SAS
	C	61	10+00.00	CONNECTION LOCATION		1619501 518	1771647 936		8'	N	B	PH10A PH10B	18+16-80'	SAS
	С	G2	20+28.46	Pajarito rd crossing, to be added	_	1622603.607	1770189.114		8'	N	В	PH10C	18+28.10	TEL
											В	PH11	18+53.66	WATER
							65				B	PH12 PH13	18+60.07	FILG
			UTILI'	TY POTHOLI	NG	SCHEDULE - F	PHASE	EA			B	PH14	18+94.54	TEL
			-								В	PH15	19+52.67, OFF: 9.41	WATER
										N	B	PH16 PH17	21+89.80	SAS
	Project Phase	РНЯ	Sta	Utility Description	Depth	Condition Assessment hold Point (yes/no) PRS (yes/NO)	Easting	g	wortning	В	PH18	22+42 32'	TEL/ELEC
	A	PHO	9+77.07	Water		Yes	N	1619047.5	9442	1774412.2759	В	PH18A	22+50.44	ST
	A	PHOA	10+38 11	ST/ST			N	1619108.4	4932	1774420.0011	B	PH19	22+52.44	GAS
	A	PH1	10+54.05	ST/E2UG/TEL			N	1619124.3	3084	1774422.0189	B	PH19A PH19B	25+76.46	SD
1	A .	PHZ	11+02.22	GAS			N	1619142.7	0881	1774428 1149	8	PH20	25+80.48'	WATER
	A	PH3A	11+17,29	TEL			N	1619187.0	0438	1774430 0230			UTIL 11	EXPOTHOL
1	A	рнэв	11+23.61	E1UG			N	1619193	3114	1774430.8227			<u></u>	
	A	PH3C	12+51.37	E2UG E2UG			N AD	1619275.4	9951	1774564,9074			1	1
	A	PH5	16+04.16	WATER/WATER		Yes	N	1619615.3	3201	1774595 4492	Project Phase	PH#	Sta.	Utility Description
	A	PH6	16+20.58	GAS/WATER			N	1619624.1	1166	1774609.3170			10.12.11	
	Α	PH7	16+50.33	WATER		Yes	N	1619640.0	2499	1774634.4363	C	PH1 PH1	10+00.00	WATER
1		PHS	16+92.97	FOLIG			N	1619662.5	1979 1979	1774670,4471	C	PH2A	12+41 29	TEL
	A	PH11	17+49.32	E2UG/Tel/E2UG			N	1619693.0	1733	1774718.0287	c	PH2B	12+60.99	GAS
	A	PH12	18+60.18	E2UG/TEL			N	1619752.4	1547	1774811.6444	<u>c</u>	PH2C	12+71 22	WATER
	Λ	PH13	19+26.58	TEL			N	1619788 (1044	1774867.7310	C	PH3	14+04.95	TEL
	A	PH14 PH146	19+28.08	E2UG E1UG/TEL			N	1619/88.8	9254	1774915 9425	C	PH5	16+61.04	WATER
	Â	PH20	21+07.37	TEL			N	1619917 5	5501	1774968 1684	C	PH6	17+62.53	WATER
1	A	PH20A	21+20 53	GAS			N	1619929 3	3492	1774974.0009	С	PH6A	17+72.79	WATER
	A	PH21	21+53.63	WATER		Yes	N	1619959.0	171	1774988.6662	C C	PH68	18466.32	WATER
	A	PH22 PH23	22+01.30	E20G			N	1620085.2	2632	1775051 0718	c	PH7	19+16.35	WATER
	A	PH24	23+05.12	TR.			N	1620094.8	3251	1775055 7984	c	PH7A	19+83.94	IWMA
1	A	PH25	23+17,32	IEL			N	1620105.7	7618	1775061 2046	c	PH7B PH7C	19+89.29	TEI
ł.	A	PH26 PH264	23+23.93	TEL	_		N	1620111 6	1053	1775054,4995	c	PH7D	22+57.60	E2UG
	A	PH268	26+56.06'	TEL			N	1620434.0	7736	1775030.0534	С	PHB	18+65.47	H2
	A	PH26C	27+27 32'	E1UG	_		N	1620504.0	1745	1775016 6809	C	PH8A	18+87.28	TEL
	A	PH27	27+38.09'	SAS/GAS			N	1620514 6	5525	1775014 6601	<u>с</u>	PH11 PH12	10+63.17	WATER
L .	A	PH278	27+54.20	TEL	_		N	1620530.4	777	1775011.6370	¢	PH12A	10+05.03	WATER - CONNECTION POINT
	A	PH27C	27+58.60'	WATER			N	1620534.7	963	1775010.8120	C	PH128	10+19.06	WATER
	A	PH27D	27+68 21'	TEL		I	N	1620544.2	344	1775009.0090	c	PH13	24+62.17	WATER - NO CONNECTION
1.	Α Δ	PH28 PH28A	27+80.71	TEI	_		N	1620571.1	157	1775003.8737	C	PH14 PH15	10+00 00	WATER - CONNECTION POINT
	A	PH28B	27+99.31	TEL			N	1620574 7	810	1775003.1735	С	PH15A	13+45.84	TEL
	A	PH29	31+06.35'	WATER			N	1620874.2	143	1774936.4217	С	PH15B	13+58.48	WATER - CONNECTION POINT
1	A	PH29A	32+60.59	WATER			N	1621020 7	7833 7662	1774890,7784	C C	PH16A	14+49.67	H2
	A	PH30 PH31	34+09.04	SD			N	1621022.7	1763	1774852.6557	C	PH168	21+75 33	WATER
	A	PH32	34+17.64	WATER			: N:	1621170.7	157	1774850_9696	c	PH16C	21+85.81	GAS
1	A	PH32A	35+08.48	TEL	_		N	1621259.6	619	1774832.5078	¢	PH16D	22+99 24	GAS
1	A	PH328 PH32C	40+12.53	TEL			N	1621372.3	192	1774745.9475	c	PH10E PH17	23+12.28	GAS
	A	PH32D	42+76.16	TEL			N	1622013 4	838	1774690.6629	С	PH18	24+00.34	GAS
1	A	PH33	45+14.07	TEL			N	1622243 6	888	1774633,1962	С	PH19	25+04.21	GAS/WATER
	A .	PH46	50+91.39	E1UG	_		N	1622783.9	859	1774430.2096	C	PH19A	25+76 93	WATER
	A	PH47 PH478	52+05.85'	GAS			N	1672888.1	323	1774382.8320	C	PH190	27+34.71	FIFC
	A	PH47A	51+93.73'	TEL			N	1622876 9	846	1774387.6031	с	PH19D	27+61.54	SAS
	A	PH55	71+89.10'	SD			N	1624641.6	288	1773611.4259	c	PH19E	30+05.17	WATER - CONNECTION POINT
	A	PH61	77+44.11	WATER	_		N	1625196.5	312	1773622,4498	C C	PH20	10+00.00	CAS AWATER
1	A	PH62A	81+16.75	TEL			N	1625565.3	654	1773640.9259	C	PH22	15+16.26	WATER
L .	A	PH62B	81+34.03	TEL			N	1625575 9	391	1773648.3212	С	PH23	15+20.58	TEL
1	A	PH63	82+01 36'	TEL			N	1625643.2	270	1773653.2782	с	PH24	15+61.45	WATER
	A	PH66	83+44.16	TEL/SAS			N	1625785.5	205	1773648.1513	C	PH25	16+18.78	ELEC
1	A	PH68	83+69.95'	SAS			N	1625811.1	293	1773644.5762	- C	PH26 PH27	19+73.02	F2UG
	A	PH68A	83+97.89	E2UG			N	1625838 7	983	1773640 7024	c	PH28	20+47.92	ELEC
1	A	PH68B	85+27.31	GAS			N	1625964.6	201	1773632.0463	c	PH28A	20+68.28	SS
1	A	PH68C	85+66 10'	WATER - end of phase A		Yes	I N	1626001.7	942	1773623.2219	C	PH29	20+79.35	EFFL
1											c	PH29A PH29B	21+29.41 21+32.70	COM
											c	PH29C	22+60.40	COM
											С	PH30	24+81.04	BT
												and the second s		
											C	PH31	26+36.80	TEL
											C C	PH31 PH32 PH33	26+36 80 29+16 93 29+34 67	TEL WATER WATER

ING SCHEDULE - PHASE B Northing ndition Assessment hold Point (yes/no) PR5 (yes/No) Easting Depth
 1616702 0569
 1774165 0642

 1616806 5591
 1774109 6054

 1616807 6503
 1774109 0477

 1616854 4402
 3774084 2251
 N N N N N 1774073.2367 1773992.8161 1773985.9009 1773884.1022 1616983 5780 1617069 6302 1617070 8506 Yes N N 1617070 8505 1617088 8173 1617090 3284 1617092 8314 1617076 1268 1617079 6504 1617079 6504 N Ye 1773875 5402 1773853 2243 14 Yes N

4

.ING SCHEDULE - PHASE C

Project Phase	PH#	Sta.	Utility Description	Depth	Condition Assessment hold Point (yes/no)	PRS (yes/No)	Easting	Northin
C	PH1	10+00.00	WATER		YES	N	1619501_5179	1771647.9
c	PH2	10+06.69	WATER			N	1619506.1350	1771637.3
C	PH2A	12+41 29	TEL			N	1619738.2154	1771602
c	PH2B	12+60.99	GAS			N	1619757,4545	1771598
c	PH2C	12+71.22	WATER			N	1619767.4488	1771596.3
С	PH3	14+04.95	ELEC			N	1619898.0293	1771567.2
с	PH4	14+13.65	TEL			N	1619906.5323	1771565.4
C	PH5	16+61.04	WATER			N	1620147.0481	1771507.2
C	PH6	17+62.53	WATER			N	1620247_2068	1771490
C	PH6A	17+72.79	WATER		YES	N	1620257.2246	1771487
c	PH68	18+66.32	WATER			N	1620347_5740	1771461
с	PHEC	18+83 90	WATER			0.04	1620364.7340	1771457.6
C	PH7	19+16.35	WATER		YES	N	1620925.2249	1771340
C	PH7A	19+83.94	IWMA			N	1620990,9490	1771324
c	PH7B	19+89.29	IW			N	1620996.1341	1771323.3
C	PH7C	20+01.32	TEL			N	1621007 8476	1771320.5
С	PH7D	22+57.60	E2UG			N	1621231.2245	1771207.0
с	PHB	18+65.47	H2	-		N	1620921.3966	1771384.4
C	PH8A	18+87.28	TEL			N	3620939.0121	1771362
C	PH11	11+21.05	WATER			N	1620384.8256	1771509 9
C	PH12	10+63 17	WATER		YES	N	1620328.2888	1771522 (
C	PH12A	10+05.03	WATER - CONNECTION POINT		YES	N	1620281-4886	1771555.1
C	PH128	10+19.06	WATER			N	1620290.4582	1771543 5
c	PH13	24+62.17	WATER - NO CONNECTION			N	1621392 8713	1771081.6
С	PH14	26+89 54	WATER - CONNECTION POINT			N	1621573 2270	1770943
С	PH15	10+00 00	WATER - CONNECTION POINT	-		N	1622152.1851	1770602 2
С	PH15A	13+45.84	TEL			N	1622487.7041	1770520 9
С	PH15B	13+58.48	WATER - CONNECTION POINT			N	1622500 0234	1770518.1
с	PH16	14+49.67	EFFL			N	1622588 9257	1770497.8
с	PH16A	14+55.04	H2			N	1622594 1580	1770496.6
C	PH168	21+75 33	WATER			7.9	1623295.0371	1770332
c	PH16C	21+85 81	GAS			Y	1623304 5812	1770327.9
¢	PH16D	22+99 24	GAS			Y	1623407.6967	1770280.7
с	PH16E	23+05 69	WATER			Y	1623413 5839	1770278.0
с	PH17	23+12.28	GAS			Y	1623419 5913	1770275.3
С	PH18	24+00.34	GAS			Y	1623494_0673	1770228
с	PH19	25+04.21	GAS/WATER		YES	Y	1623580.4132	1770170.9
с	PH19A	25+76.93	WATER		YES	Y	1623637.8683	1770126
c	PH19B	27+23.19	TEL			Y	1623762.4439	1770049
С	PH19C	27+34.71	FLEC			Y	1623772 0279	1770042
с	PH190	27+61.54	SAS			¥.	1623794-3242	1770027.9
c	PH19E	30+05 17	WATER - CONNECTION POINT			N	1623996 8570	1769892
C	PH20	10+00.00	WATER - CONNECTION POINT			Y	1621741 9956	1770748
C .	PH21	13+06 21	GAS/WATER			N	1621990 4085	1770569.3
C	PH22	15+16.26	WATER		YES	N	1622161.0514	1770446.1
С	PH23	15+20.58	TEL			N	1622164-5589	1770444
с	PH24	15+61.45	WATER			N	1622199.5607	1770423
С	PH25	16+18.78	ELEC			N	1622249 1679	1770394
c	PH26	16+42.10	TEL			N	1622269 3393	1770382 1
c	PH27	19+73.02	E2UG			N	1622555 6475	1770216
C	PH28	20+47.92	ELEC			N	1622616 7714	1770215
C	PH28A	20+68.28	55			N	1622625 8544	1770233
C	PH29	20+79-35	EFFL			N	1622630 7961	1770243
č	PH29A	21+29.41	ELEC			N	1622653 1331	1770288
c	PH29B	21+32.70	COM			N	1622654 5991	1770291
c	PH29C	22+60.40	COM			N	1622744 0444	1770368
c	PH30	24+81.04	BT			N	1622949 7132	1770298
C	PH31	26+36.80	TEL			N	1623092 3813	1770236
C	PH32	29+16.93	WATER			N	1623349 2614	1770124
C	PH33	29+34 67	WATER			N	1623365 4687	1770117
						N	1672477 7332	1220064



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BACKGROUND DATA FOR EXISTING UTILITIES, CONTOURS, TEXT, AND STRUCTURE INFORMATION COMES FROM UTILITIES UMAP GROUP AND DOES NOT MEET CURRENT LANL ESM STANDARDS. 1

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UNLESS DEPTH IS SPECIFICALLY PROVIDED ON UTILITY POTHOLING SCHEDULE, DEPTH IN PLAN AND PROFILE DRAWING IS ASSUMED TO BE SHOWN AT LANL STANDARD DEPTHS. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE DEPTH AND LOCATION OF ALL UTILITIES LISTED OR SHOWN IN THESE PLANS PRIOR TO CONSTRUCTION. SHOULD A UTILITY SOURCE FUEL OF OUTDATION OF UNAL UNIVERSITY FOR FOR 2 CONFLICT EXIST, CONTRACTOR SHALL IMMEDIATELY NOTIFY STR FOR DIRECTION ON HOW TO PROCEED, UTILITY LOCATING AND POTHOLING BY THE CONTRACTOR SHALL BE COMPLETED IN ACCORDANCE WITHIN LANL POTHOLING REQUIREMENTS.

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NÖ	DATE	CLASS REV	DC	DESC	RIPTION	DWN	DSGN	снкр	SUB	A
1M	COMP	DINI NY			ENCOR	<u>c.</u>	A	AE Albeor AEAN	A PC ICAL ENGI TROLL, NIN	NCTRI MIN
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		GE	OTECHNI	CAL AND U	ITILITY	¢.	CHECKE	D D	BRAND	G
TA-	INFR	GE	OTECHNI	CAL AND U	ITILITY LES BLDG	S NA	DATE	B / D D 1/	BRAND 19/2018	i <u>G</u>
TA-		GE	OTECHNI	CAL AND U	BLDG APPROVED FOR MICHAEL WILL	NA RELEASE AMS	DATE	B /	BRAND 19/2018	G
TA- SUBM BRM		GE		CAL AND U E SCHEDU PO Box 1663 os Alamos, N	APPROVED FOR MICHAEL WILLI	S NA Release AMS SHEET	DATE	B / D D. 1/	BRAND 19/2018	3
TA- SUBM BRM		GE		CAL AND U E SCHEDUI	BLDG APPROVED FOR MICHAEL WILLI ew Mexico 87	S NA RELEASE AMS SHEET		B	BRAND 19/2018	3

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1617101.2477 1617105.6147

1617103.0147 1617119.5627 1617129.1061 1617156.9330 1617188.8718 1617196.9804

UTILITY POTHOLING SCHEDULE - PHASE D

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Project Phase	PH#	Sta,	Utility Description	Depth	Condition Assessment hold Point (yes/no)	PRS (yes/No)	Easting	Northing
D	PHD	10+00.00	WATER - CONNECTION		YES	N	1617779.4145	1774372.301
D	PH1	13+31.09	ELEC			N	1617836.9147	1773996 240
D	PH2	14+35.83	WATER		YES	N	1617855.1049	1773893 091
D	PH3	15+15.37	GAS			N	1617868.9177	1773814.764
D	РНЗА	15+33.02	E1UG			N	1617871.9835	1773797 379
D	PH4	15+57.05	ELEC			N	1617876.1556	1773773.721
U	PH5	15+99.37	ELEC			Y	161/883.50/1	17/3/32.034
D	PH5A	16+17.32	ELEC			N	1617886.6230	1773714.365
D	PHSB	16+26.95	545			N	1617888.2971	1773704,872
D	PHSC	15+64.95	COND	-		N	1617894.8953	1773667.456
D	PH5D	16+72.74	COND			N	1617896.2480	1773659.785
D	PHSE	16+78 27	COND			N	1617897.2084	1773654 340
D	PHSF	16+83.80	ST			N	1617898.1687	1773648.894
D	PH5G	16+97.53	ST			N	1617900.5531	1773635.373
D	PHSH	17+10.09	ST			N	1617902.7346	1773623.002
0	PH5I	18+28.91	E1UG			N	1617923.2700	1773506 554
0	PHố	18+98.88	WATER			N	1617935.4217	1773437.648
D	PHGA	19+48.38	BLOWDOWN/SAS			N	1617942.8882	1773390 243
D	PH7	19+51.01	545			N	1617941.4624	1773388-034
D	PH7A	20+58.63	FLEC			N	1617953.9044	1773284.014
D	PH8	21+09.32	WATER			N	1617962.3198	1773234 035
D	PH8A	21+13 12	TEL			N	1617962.9698	1773230 283
D	PH8B	21+25 14	CMP			N	1617964 9890	1773218 436
D	PH9	21+28.47	GAS			N	1617965.5400	1773215.150
D	PH9A	21+28.66	ST			N	1617965.5721	1773214 961
D	PH98	21+30,47	COND			N	1617965.8761	1773213 178
D	PH9C	21+34.85	CMP	-		N	1617966.6115	1773208.866
Ð	PH9D	21+38.62	FLEC			N	1617967.2456	1773205 147
D	PH9E	21+67.31	COND			N	1617971 9987	1773177.271
D	PH10	22+73.77	WATER - CONNECTION POINT		YES	N	1617991 9801	1773072 725
D	PH11	16+14.56 OFF: 30.49	GAS			N	1617856 1147	1773711 786
D	PH12	16+16 04 OFF: 31.84'	WATER			N	1617855.2918	1773709 590
D	PH13	16+50 87 OFF: 31.52'	GAS			N	1617861.4090	1773675,834
D	PH14	16+50 87 OFF: 31.69'	WATER			N	1617861 2723	1773675.591

UTILITY POTHOLING SCHEDULE - INTERPOLATED

	Project Phase	MEASUREMENT	Sta.	Utility Description	Upstream Inv. Depth	Downstream Inv. Depth	Length from Upstream	Length from Downstream	Calculated Depth	PRS (yes/No)
	A	- 11	17+08.10	SAS						N
	A	16	22+76.98	SD						N
1.1	A	17	32+76.97	TEL						Ň
	A	18	34+85.44	TEL						N
	Α	19	36+14.42	TEL	-					N
	В	11	12+54.07	SD						N
	с	11	10+94.31	TEL						N
	с	12	11+01.81	ELEC						N
	с	13	24+13.52	WATER						N
	С	- 14	24+41.40	WATER						N
	C	15	23+30.43	SAS						N
	с	16	14+58.98	SAS						N
	С	16A	14+75.66	SD						N
	C	16B	17+41.77	SAS						N
	с	16C	19+38.47	SD						N
	с	I6D	20+87.58	SAS						N
	С	16E	20+90.89	SAS	_					N
	D	U.	10+21.85	SD			-			N
	D	HA	10+24.39	E2UG						N
	D	11B	10+29.01	SD			1			N
	D	12	10+34.35	TEL/E2UG	1					N
	D	12A	15+39.11	SD						N
	D	I2B	15+80.31	SD						
1	D	13	16+11-18	TEL						N
	D	-15	17+68.20	COND_ABIP						N
	D	15A	17+70 20	COND_ABIP						N
	D	16	20+02-10	SAS						N
- [D	18	21+65 31	COND_ABIP						N
1	D	19	21+91.42	SAS						N
l í	D	19A	21+95.81	SAS						N





EPC-DO: 18-052

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REPLACEMENT AND METERING

GEOTECHNICAL AND UTILITY

POTHOLE SCHEDULES

P0 Box 1663 Los Alamos, N 6

BACKGROUND DATA FOR EXISTING UTILITIES, CONTOURS, TEXT, AND STRUCTURE INFORMATION COMES FROM UTILITIES UMAP GROUP AND DOES NOT MEET CURRENT LANL ESM STANDARDS.

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TA-INFR SUBMITTED BRIAN AMB

· Los Alamos

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LA-l	JR-´	17-3	1305

BLDG NA APPROVED FOR RELEASE MICHAEL WILLIAMS

New Mexico 8754

C57500-DWG-INFR-G-0004

DESIG

DATE

AMBROO

D BRAND

1/19/2018

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G-0004

OF

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GENERAL NOTES:

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ENCLOSURE 2

	6
GENERAL NO	TES:
1. IF THIS SHEET IS I	NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.
KEYED NOTE	S:
1 PHASE A - E, JE	MEZ - DIAMOND DRIVE TO LANSE METER
PHASE B - BIKIN PROVIDED BY V	II ATOLL FROM WEST JEMEZ ROAD TO MERCURY DRIVE. ENCOR
3 PHASE C - PAJA	RITO ROAD FROM DIAMOND DRIVE TO TA-48.
PHASE D - PAJA	RITO ROAD FROM W, JEMEZ ROAD TO MERCURY DRIVE,
5 PRS SITES	
6 LANSCE METER	SITE
7 MERCURY RD M	IETER SITE
8 S-SITE METER S	SITE
(9) TA-3 SM-142 ME	TER SITE
10 TA-59 METER SI	TE
11 TA-9 METER SIT	E
12 ANNIVERSARY	TANK SITE PLAN

NO DATE CL	ASS DC	DESCRIPTION	DWM	DSGN	HKD SUB	
&COMPAN	Ŷ	VENCOR	-	AA	AEA PC DECURICAL ENGL AlbLOH HOLD, NEW AEANMLCOM	
S	ETTLEME	NT WATER LINE	:	DRAWN	C. UPSHA	
REP	LACEMEN	ENT AND METERING			B. AMBROGI	
	OVERAL	RALL SITE PLAN		CHECKED	D. BRAND	
TA-INFR		BLDG	NA	DATE	1/19/2018	
SUBMITTED BRIAN AMBROGI		APPROVED FOR R MICHAEL WILLIAM	ELEASE			
API IN THE PROPERTY AND			SHEET	C	·100	
A						
· Los Ala		0 Box 1663 s Alamos, New Mexico 875	A10	5	OF 17	
		0 Box 1663 s Alamos, New Mexico 875 DONALD YARDOO	Inle	5		



ENCLOSURE 2

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S	EN	EK	AL.	N.	V.		-

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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY

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KEYED NOTES:

1 CONNECT TO EXISTING 10" CI WATER LINE

- 2 CONNECT TO EXISTING 6" AND 8" CI WATER LINE
- 3 INSTALL NEW PRV STATION.
- 4 CONNECT TO EXISTING 8" CI WATER LINE.
- 5 INSTALL NEW HYDRANT
- INSTALL NEW LANSCE METER, CONNECT TO EXISTING 10" CI WATER LINE.
- (7) INSTALL NEW ELK RIDGE CONNECTION.
- B CONNECT TO EXISTING FIRE HYDRANT.
- 9 PRS SITES

LINE TABLE					
LINE NO	LENGTH	DIRECTION			
L1	165.00'	N82° 43' 44 96"E			
L2	118.68'	N35° 43' 44 96"E			
L3	335 28'	N79° 51' 00_71"E			
L4	338 92'	N32° 23' 14 40'E			
L5	27.76	N6" 41' 57_94"W			
L6	4.77	N38° 18' 02.06"E			
L7	88,73*	N63° 41' 45 72"E			
L8	312 29'	N63° 41' 45 72"E			
L9	628.95'	S79° 11' 05 56'E			
L10	251.75'	S74° 14' 04 62'E			
L11	33 26'	S52° 43' 37 77''E			
L12	226 39'	S78° 42' 06 29'E			
L13	22.37'	N88° 44' 35 49"E			
L14	370 24'	S80° 00' 24 51"E			
L15	572 21	S77° 52' 41.09"E			
L16	111_12	S66° 37' 41.09"E			
L17	472.90	S70° 06' 27 76"E			
L18	163 31'	\$65° 23' 52 54"E			

LINE TABLE				
LINE NO	LENGTH	DIRECTION		
L19	313_41'	S58° 18' 48 64"E		
L20	270 25'	S53° 09' 41, 94"E		
L21	133 41'	S42° 53' 05 19"E		
L22	186 17'	S56° 43' 22 69"E		
L23	184.33'	S56° 43' 22 69"E		
L24	213,85'	S66° 20' 16 94"E		
L25	259.50'	S77° 36' 15 02"E		
L26	99 35'	S68° 08' 49 82"E		
L27	384,85'	N88° 33' 58 57'E		
L28	524.81'	N88° 54' 34,78"E		
L29	302 86'	N89° 11' 12 75"E		
L30	34,71'	N44° 11' 12 75"E		
L31	171_17'	N89° 24' 35 59"E		
L32	203 31'	S82° 01' 48 38"E		
L33	14 12'	N56° 06' 47, 35"E		
L34	46.68'	S78° 53' 12.65"E		
L35	2,12'	\$33° 53' 12 65"E		

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NO DATE CLA	ASS DC	DESC	RIPTION	DW	DSGN	снкр	SUB	ļ
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	PHASE	A - SITE PL	AN		CHECKEI	D D B	BRAND	
				1	DATE	4/	19/2018	
TA-INFR			BLDG	NA	UATE	1. 17		
TA-INFR SUBMITTED			APPROVED FOR MICHAEL WILLI	RELEASE AMS	DATE	1	_	
TA-INFR SUBMITTED BRIAN AMBROGI			BLDG APPROVED FOR MICHAEL WILL!	RELEASE AMS SHEET		-10	00	1
TA-INFR SUBMITTED BRIAN AMBROGI	nos	P0 Box 1663 Los Alamos, N	BLDG APPROVED FOR MICHAEL WILLIN ew Mexico 875	RELEASE	C 6	-1(00	1
	REVIEWE	P0 Box 1663 Los Alamos, N R: DONALD YAR	BLDG APPROVED FOR MICHAEL WILLIN ew Mexico 875	RELEASE AMS SHEET	C 6			1370



ENCLOSURE 2

GENERAL NOTES:

1, IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY,

6

KEYED NOTES:

1 CONNECT TO EXISTING 12" CI WATER LINE

2 PROPOSED TA-03 SM-142 1-METER.

5

EXISTING WATER LINE TO BE ABANDONED IN PLACE AND CAPPED BY OWNER (LANL)

PRS SITES

5 CONNECT TO EXISTING 12" CI WATER LINE.

6 CONNECT TO LATERAL LINE

	LINE TABLE					
LINE NO	LENGTH	DIRECTION				
L36	237.44'	S62° 03' 15.86"E				
L37	69.50'	N71° 12' 32 21"E				
L38	28,16'	S63° 47' 27.79"E				
L39	31 11'	N71° 12' 32 21"E				
L40	28.11'	S63° 47' 27.79"E				
L11	334.37	S10° 00' 32 90"E				
L42	79.34	S34° 59' 27. 10"W				
L43	103.15'	S42° 57' 37 71"E				
L44	441.34'	S10° 00' 32 90"E				
L45	7 18'	S34° 59' 27. 10''W				
L46	27, 55'	S10° 24' 22 80"E				
L47	6.82'	S55° 48' 12 69"E				
L48	169 13'	S10° 00' 32 90"E				
L49	7.07'	\$55° 00' 32 90"E				
L50	10,22	810° 00' 32 90"E				

NO	DATE	CLASS	DC	DESC	RIPTION	DW	DSGN	снкр	SUB	A
M &	COMP	ON			ENCOR	46	A.	AEAN	A PC	eter Mo
		SET	LEME	NT WA	TER LIN	IE	DRAWN	V c	UPSHA	w
	R	EPLA	CEME	T AND	METER	RING	DESIGN	NB	AMBRC	GI
			PHASE	B - SITE PI	AN		CHECKE	D O	BRAND	,
TA-	INFR				BLD	g na	DATE	1/	19/2016	3
TA-		31			BLD APPROVED FO MICHAEL WILL	G NA R RELEASE	DATE	1/	19/2016	3
TA- SUBN BRU		31			BLD APPROVED FO MICHAEL WILI	G NA R RELEASE LIAMS SHEET		יי ג-1	00	, 2
TA- SUBN BRU			, 1	P0 Box 1663 os Alamos, N	BLDO APPROVED FO MICHAEL WILL New Mexico 87	G NA R RELEASE LIAMS SHEET		1/ -1	00	23
TA- SUBN BRU			L	P0 Box 1663 os Alamos, N DONALD YA	BLDO APPROVED FO MICHAEL WILL New Mexico 87	G NA R RELEASE LIAMS SHEET		1/	00	23



ENCLOSURE 2

CEMED		NO	TEC.
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1 IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

6

KEYED NOTES:

- (1) CONNECT TO EXISTING 12" CI WATER LINE.
- 2 CONNECT TO EXISTING 12" CI WATER LINE,
- 3 CONNECT TO EXISTING 12" CI WATER LINE.
- CONNECT TO EXISTING 12" CI WATER LINE.
- 5 CONNECT TO EXISTING 12" CI WATER LINE.
- 6 CONNECT TO EXISTING 12" CI WATER LINE
- CONNECT TO EXISTING 12" CI WATER LINE.
- 8 CONNECT TO EXISTING 12" CI WATER LINE.
- (9) CONNECT TO EXISTING 12" CI WATER LINE.
- 10 INSTALL NEW TA-59 METER

	LINE TA	ABLE
LINE NO.	LENGTH	DIRECTION
L51	22 17'	S78° 10' 00 40"E
L52	170,39	S81° 20' 13 46"E
L53	655 57'	S77° 34' 14 01"E
L54	60 49'	S79° 29' 18 77'E
L55	10 54'	333° 01' 26 10"E
L56	507_09'	S77° 36' 48 56"E
L57	4.68'	N9° 45' 11.23"E
L58	13 26'	S83° 38' 26 95"E
L59	52 64'	S55° 06' 45.48"E
L60	80,78'	S77" 34' 33 48"E
L61	440.74	N78° 32' 28.12"E
L62	117.67'	\$71° 25' 53 31"E
L63	215.85'	S6° 16' 35.62'W
L64	208 81'	S76° 29' 03 65"E
L65	160 96'	S52° 08' 16.38"E

	LINE TA	ABLE
LINE NO.	LENGTH	DIRECTION
L66	418 42'	\$53° 16' 16 90"E
L67	7,29'	N83° 31' 29 69"E
L68	106 15	S73° 22' 32 62"E
L69	245.04	S77° 07' 47 57"E
L70	706 78'	S77° 07' 47 57"E
L71	172 69'	\$65° 27' 56 65"E
L72	677 22'	S56° 13' 54 43"E
L73	527 15'	S54° 15' 47 60"E
L74	501.31'	S59° 54' 10_11"E
L77	79 65'	N70° 30' 00,51"E
L78	258.44'	S67° 35' 31.98"E
L79	14,22'	S77° 45' 46 25"E
L80	350.00'	S66° 31' 21 07"E
L81	150 92'	S66° 03' 49 29"E
L82	9.91	S58° 32' 35.01"E

NO	DATE	CLASS REV	DC	DESC	RIPTION	DW	N DSGN	CHKD	SUB
M &	COMP	ANY			NCOR	<u>.</u>	A		A PC HCAL INKA SEGLA, NUM N. COM
		SET	TLEME	NT WAT		IE	DRAWN	C.L	IPSHA
	R	EPLA	CEMEN	IT AND	METER	ING	DESIGN	в./	MBRO
PHASE C			PHASE (C - SITE PL	AN		CHECKE	D	BRAND
						-		1	
TA-	INFR				BLDC	3 NA	DATE	1/	19/2016
TA-	INFR NTTED	36			BLDC APPROVED FOR MICHAEL WILL	3 NA R RELEASE IAMS	DATE	1	19/2016
TA- SUBV BRV		12			BLDO APPROVED FOR MICHAEL WILL	3 NA RELEASE		/	00
TA- SUBN BRI/				P0 Box 1663 os Alamos, N	BLDG APPROVED FOR MICHAEL WILL ew Mexico 87	3 NA Release IAMS SHEET	DATE C	- 1 (00



ENCLOSURE 2

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GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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KEYED NOTES:

- 1 CONNECT TO EXISTING 10" CI WATER LINE.
- 2 CONNECT TO EXISTING 10" CI WATER LINE.
- 3 CONNECT TO EXISTING 10" CI WATER LINE,
- CONNECT TO EXISTING 10" CI WATER LINE;
- 5 CONNECT TO EXISTING 10" CI WATER LINE
- 6 CONNECT TO EXISTING 10" CI WATER LINE
- 7 CONNECT TO EXISTING 10" CI WATER LINE,
- 8 EXISTING 10" CI WATER LINE,
- 9 EXISTING 6" CI WATER LINE
- 10 EXISTING 10" CI WATER LINE
- 11 EXISTING 10" CI WATER LINE

12 PRS SITE

	LINE T	ABLE
LINE NO	LENGTH	DIRECTION
L83	777,38'	S10° 00' 04 29"E
L84	7 65'	\$32° 30' 04 29"E
L85	157 62'	S10° 01' 41,02"E
L86	19.88'	\$32° 36' 24 83''W
L87	185 16'	S9° 46' 59 05"E
L88	5,44'	S32° 10' 35,26"E
L89	65 20'	S9° 40' 10,63"E
L90	55,46'	S11° 52' 20 27"E

NO DATE CLASS REV	DC DES	CRIPTION	DWN	DSGN	CHKD S	UB AP
&COMPANY		ENCOR	<u>a</u>	AA	АЕА и	C Inclation Mon Mide M
						HAW
REPLA	CEMENT AND	METER	ING [DESIGN	B. AME	BROGI
	PHASE D - SITE P	LAN	¢	CHECKED	D. BRA	ND
TA-INFR		BLDG	NA	DATE	1/19/2	018
SUBMITTED BRIAN AMBROGI		APPROVED FOR	RELEASE			
· Los Alamos	P0 Box 1663 Los Alamos, N	New Mexico 875	SHEET)C	-10 of	04 73
	DEVIEVACE DONALD VA	RDMAN		10/41	E 1/2	211
	DRAWING NO	NDIWING THE REAL	1 1 1 1	-	11	REV



ENCLOSURE 2

					6			_	_	-
GE	NER		DTES							
1,6	IF THIS	SHEET IS	NOT 24'	X36" USE GR	APHIC SCALE AC	CORDI	NGLY			
KE	VED	NOT	-6.							
	10'x'	10' HDD PI	T							
2) STA: WATI JOIN INV E INST/	9+77.07 - ER LINE T) WITH R LEV. 7358 ALL 1-10" (BEGIN N INSTALL ESTRAIN 13. INS GATE VA	EW CONSTRI 1-10"x10" TEI ITS 20' EACH TALL CONCR LVE WITH RE	JCTION. CONNEC E (MECHANICAL J WAY ON MAIN LIN ETE THRUST BLC ISTRAINTS	T TO E OINT X NE AND ICK SEI	XISTIN MECH 1' ON I E DETA	g 10" Anica Bran IL.	CI \L CH,	
3) 10' x :	25' HDD P	т							
	STA	11+42.07 -	INSTALL	. (1) 10" 45° M	J BEND W/ RESTR	RAINTS	INV E	LEV	7358	13,
5	STA	12+60 95 -	INSTALL	. (1) 2" COMB	INATION AIR/ VAC	UUM V	ALVE,			
6 STA 12+60.95 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS. INV ELEV. 7364.68.										
(7) STA 15+96,23 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS, INV ELEV, 7352,92,										
ONNECT TO EXISTING WATER LINES.										
9 STA 19+35,15 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS, INV ELEV, 7344.23										
10	STA ?	19+62,91 -	INSTALL	. (1) 10" 45° M	J BEND W/ RESTR	RAINTS	INV E	LEV,	7340	41.
(11)) STA 1 7340.	19+67,68 - 05.	INSTALL	. (1) 10" 22,5°	MJ BEND W/ RES'	TRAINT	S INV	ELE	/_	
(12)	PRS	SITE								
(13)	GEO	TECH LOC	ATION	SEE TABLE C	N SHEET C-1004,					
165' LF 18" DIA STEEL CASING PIPE. STEEL CASING PER SECTION 710.4.2 NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION. 10" PVC WATER LINE TO BE FULLY RESTRAINED WITHIN CASING.										
(15) EXISTING WATER LINE TO BE ABANDONED IN PLACE, GROUT FILL WATER LINE UNDER ROADWAYS.										
(16) IDEN	TIFIED CS	A - CONT	FRACTOR SH	ALL NOT DISTURE	3 THIS	AREA			
17	SUBC SOIL REMO ORIG	CONTRAC DISTURB/ DVED FRC INAL GRA	TOR WIL ANCE BE M AREA DE TO A	L ENSURE TH TWEEN STA WHEN LINE CCOMMODA	IAT SPOILS FROM 19+25 (PH14) ANE IS INSTALLED ANI TE FUTURE LID PI	1 PIT E) 20+00 D AREA ROJEC	(CAVA ⁻ (PH14/ MUST T IN TH	FIONS A) MU BE LI IS AR	S ANE ST BI EFT A EA) E AT
18	ANY CULT DEPC CONI	WORK CO TURAL SM DSITS, MO DUCTED II	MPLETE E TO BE DNITOR S N THIS A	D WITHIN TH PRÉSENT ON SHALL BE SCI REA	E IDENTIFIED ARE I-SITE TO MONITO HEDULED 48-HOU	EAS SH DR FOR IRS IN /	ALL RE CULTU ADVAN	QUIR JRAL CE OF	E A = WO	RK
(19)	CAP		DON EX	ISTING WATE	RLINE					
20	CUT	AND PLUC	3							
П										_
	DATE	CLASS	DC			DW	DSGN	СНКО	SUB	AP
10		REV	00		ENCOR		10-	AE	PC	
&	OMI	ANY			NGINEERING. LLC.		P.A	Albuous	ROLL ING ROLL, NES ALCOM	Minak D
		SET	TLEM			IG	DRAWN	<u> </u>	IPSHA	N
	IN .		VENI PHASE /	A · E. JEME	Z ROAD		CHECKE	B.A	MBRO	GI
та-1	NFR		PLA	N AND PROI	BLDG N	A	DATE	D. E 1/1	9/2018	
SUBM	TTED N AMBRO	GI			APPROVED FOR RE MICHAEL WILLIAM	LEASE				
1	6	Alonea		P0 Box 166	3	SHEET	AC	-1(00	5
DC	HATIONA	L LABORATOR	REVIEW	Los Alamos, ER: DONALD Y	New Mexico 8754	N/	O	OF	15	17
PROJ		356	DRAWIN	G NO	DWG-INF	C.1	005	1	1	IEV D
	100	~~~							11	_



GENER	AL	NO	TES:
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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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KEYED NOTES:

1 10' x 35' HDD PIT.

STA 23+68.70 - INSTALL (1) 10" 22.5° BEND (MECHANICAL JOINT X MECHANICAL JOINT) AND (1) 10" 11.25° BEND (MECHANICAL JOINT X MECHANICAL JOINT)W/ RESTRAINTS, INV ELEV, 7331.70.

- STA 28+04.51 INSTALL (1) 10"x8" TEE (MECHANICAL JOINT X MECHANICAL JOINT) WITH RESTRAINTS. INV ELEV. 7319.81.
- 4 STA 29+97.65 DEFLECT AS REQUIRED
- 5 PRS SITE
- 6 STA 23+90.00 INSTALL NEW 10" PRV VAULT.

T EXISTING WATER LINE TO BE ABANDONED

(8) STA 26+63.08 - DEFLECT AS REQUIRED INV ELEV 7340.90

9 STA 27+50.00 - DEFLECT AS REQUIRED. INV ELEV. 7320.12

(10) STA 28+00.21 - DEFLECT AS REQUIRED. INV ELEV. 7320.11.

(1) STA 28+63.08 - DEFLECT AS REQUIRED, INV ELEV, 7316.12,

- (12) STA 29+97.65 DEFLECT AS REQUIRED. INV ELEV. 7316.12.
- (13) STA 31+13.08 DEFLECT AS REQUIRED. INV ELEV. 7310.83
- (14) STA 31+63.08 DEFLECT AS REQUIRED. INV ELEV. 7310.65.

(15) GROUT FILL WATER LINE UNDER ROADWAYS

NO	DATE	CLASS REV	DC	DESCRIPTION	DWN	DSGN	снкр	SUB	AP
2	COMP	ANY		VENCOR	-	A	AE AEAN	PC M.COM	ectario Minàn
		SET	LEME	NT WATER LINE		DRAWN	G.1	JPSHAN	N
	R	EPLA	CEMEN	T AND METERI	NG	DESIGN	8.	MBRO	GI
		P	HASE A -	E. JEMEZ ROAD		CHECKE	0 0.1	BRAND	
PLAN AND PF				ND PROFILE			_		_
TA-	INFR			BLDG 1	NA	DATE	1/	19/2018	
TA-		a!:		BLDG APPROVED FOR RI MICHAEL WILLIAM		DATE	1/	19/2018	
TA- SUBM BRV		lamos	P	BLDG 1 APPROVED FOR RI MICHAEL WILLIAM 0 Box 1663 Is Alamos, New Mexico 8754			1/ -1	00 00	63
TA- SUBM BRU			P La	BLDG N APPROVED FOR RI MICHAEL WILLIAW O Box 1663 Is Alamos, New Mexico 875 Donalb YARDWAS	NA ELEASE IS SHEET		1/		63



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	GENERAL NOTES:	
	1 IF THIS SHEET IS NOT 24"X36" USE GRAF	PHIC SCALE ACCORDINGLY
	KEYED NOTES:	
	1 STA 32+49 00 - INSTALL (1) 2" COMBINA	ATION AIR/ VACUUM VALVE
	2 STA 32+49 40 - INSTALL (1) 10" 22.5" MJ 7312.06.	BEND W/ RESTRAINTS, INV ELEV,
	3 STA 32+82.65 - INSTALL (1) 10" 22.5° MJ 7312.05	BEND W/ RESTRAINTS, INV ELEV,
	STA 33+63.08 - DEFLECT AS REQUIRED	D.
	5 STA 35+09.04 - INSTALL (1) 10" 11.25° N	IJ BEND W/ RESTRAINTS
	6 STA 35+31 41 - INSTALL (1) 10" 11 25° M	IJ BEND W/ RESTRAINTS.
	(7) STA 36+31.23 - INSTALL (1) 10"x8" TEE JOINT) WITH RESTRAINTS. INV ELEV.	(MECHANICAL JOINT X MECHANICAL 7309.21.
	8 STA 39+01.66 - DEFLECT AS REQUIRED	D.

(9) STA 40+57.28 - INSTALL (1) 10"x8" TEE (MECHANICAL JOINT X MECHANICAL JOINT) WITH RESTRAINTS. INV ELEV. 7309.01.

(10) INSTALL NEW 10" x 6" TEE, W/ RESTRAINTS 17 FT EACH WAY ON MAIN AND 1' ON BRANCH, WITH 7' LF PIPE TO FIRE HYDRANT, PLACE TWO (2) BOLLARDS.

- 11 TIE INTO EXISTING FIRE HYDRANT.
- (12) GROUT FILL WATER LINE UNDER ROADWAYS.

FROM STATION	TO STATION	UTILITY CONFLICT	SEPARATION DISTANCE	PARALLEL/ PERPENDICULAR
33+58.88	33+77.30	GAS	3.8'	PARALLEL
34+68.96	35+27,39	TELEPHONE	.5' TO 3'	PARALLEL
35+81_15	36+89,37	TELEPHONE	.5' TO 3'	PARALLEL
39+34,49	40+42,49	TELEPHONE	,5' TO 3'	PARALLEL

NO	DATE	CLASS REV	DC	DESCI	RIPTION	DWN	DSGN	снко	SUB	AF
2	MLS	ANY			NCOR	(A		A PC TCAL FINITE TROIT, NEW M.COM	er crei na Mensie
		SET1	LEME	NT WAT	ER LINE		DRAW	N	UPSHA	N.
REPLACEMEN				NT AND	METERIN	G	DESIG	Ν в.	AMBRO	GJ
		F	PHASE A - E. JEMEZ ROAD				CHECKE	D D	BRAND	
PLAN AND F			AND PROFIL	E BLOG N		DATE	1/	19/2018		
TA-	INFR				DEDO N			1000		_
TA-	INFR NTTED				APPROVED FOR REI MICHAEL WILLIAMS	EASE		- I		
TA- SUBN BRV		lamos		P0 Box 1663 os Alamos, No	APPROVED FOR REI MICHAEL WILLIAMS	EASE	2	;-1(00	73
TA- SUBN BRV			REVIEWER	P0 Box 1663 os Alamos, No DONALD YAR	APPROVED FOR REI MICHAEL WILLIAMS	EASE	2	oF	00	73



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GENERAL NOTES):
1. IF THIS SHEET IS NOT 24	"X36" USE GRAPHIC SCALE ACCORDINGLY,
KEYED NOTES:	
1 STA 44+73,86 - INSTAL	L (1) 10" 11,25° MJ BEND W/ RESTRAINTS
2 STA 45+84 98 - DEFLEC	CT AS REQUIRED
3 STA 48+63.00 - INSTAL DEFLECT AS REQUIRE	L (1) 2" COMBINATION AIR/ VACUUM VALVE. D (VERTICAL) INV ELEV. 7315.05
4 STA 50+57.87 - DEFLEC	CT AS REQUIRED INV ELEV 7311 99
5 STA 51+04.87 - DEFLEC	CT AS REQUIRED INV ELEV. 7304 58
6 STA 52+21 19 - INSTAL	L (1) 10" 11.25° MJ BEND W/ RESTRAINTS.
7 PRS SITE	
8 STA 47+50.00 - INSTAL WAY ON MAIN AND 1' (ELEV, 7312.91 PLACE	L NEW 10" x 6" TEE, W/ RESTRAINTS 20 FT EACH ON BRANCH, WITH 7' LF PIPE TO FIRE HYDRANT, INV TWO (2) BOLLARDS,
CLOSE VALVE AND RE ABANDONED	MOVE EXISTING FIRE HYDRANT, WATER LINE TO

(10) STA 49+25.00 - DEFLECT AS REQUIRED, INV ELEV. 7312.58

NO	DATE	CLASS REV	DC	DESCRIPTION	DWN	DSGN	CHKD	SUB	AP
14 &	o DATE CLASS REV DC DESCRIPTION DWN DSGN CHKD SUB WILLSOM WILLSOM WILLSOM WILLSOM WILLSOM ALAR CALAR ALAR CALAR ALAR ALALAR ALAR ALAR		NT FRIM Miraio						
	RI			ENT WATER LINE	,	DRAWN	і <u>с</u> ц	PSHA	N
		F	PHASE A PLAN	- E. JEMEZ ROAD AND PROFILE		HECKE	D. E	RAND	GI
TA-				BLDG NA APPROVED FOR RELE	ASE	DATE	1/1	9/2018	_
-	LOSA	lamos		P0 Box 1663 Los Alamos, New Mexico 87545		/C	-1(00	8
D.C.	-UNED U		REVIEWE	R: DONALD YARDMAN	1	DA	TE:	25	Į,
PROJ	4033	56	DRAWING	57500-DWG-INFR-	C-1	008	1	11	D



ENCLOSURE 2

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GENERAL NOTES	
1. IF THIS SHEET IS NOT 24"	X36" USE GRAPHIC SCALE ACCORDINGLY,
KEYED NOTES:	
1 STA 54+04 87 - DEFLEC	T AS REQUIRED
2 STA 54+64 87 - DEFLEC	T AS REQUIRED INV ELEV. 7292.35

- 3 STA 55+34 60 DEFLECT AS REQUIRED
- 4 STA 58+04,85 INSTALL (1) 10" 11,25° MJ BEND W/ RESTRAINTS.
- 5 STA 59+38 26 INSTALL (1) 10" 11 25° MJ BEND W/ RESTRAINTS.
- 6 STA 60+13_08 DEFLECT AS REQUIRED INV ELEV, 7307.58
- (7) STA 61+63.08 DEFLECT AS REQUIRED INV ELEV. 7319.66.
- (8) STA 63+08.76 INSTALL (1) 10" 11.25" MJ BEND W/ RESTRAINTS, INV ELEV. 7321.32, INSTALL (1) 2" COMBINATION AIR/ VACUUM VALVE.

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9 PRS SITE

(10) STA 57+50.00 - INSTALL 10" x 6" TEE, W/ RESTRAINTS 20 FT EACH WAY ON MAIN AND 1' ON BRANCH, WITH 7' LF PIPE TO FIRE HYDRANT, INV ELEV. 7306.95, PLACE TWO (2) BOLLARDS.

(1) CLOSE VALVE AND REMOVE EXISTING FIRE HYDRANT, WATER LINE TO BE ABANDONED.

NO	DATE	CLASS REV	DC	DESC	RIPTION	DWN	DSGN	снкр	SUB	AP
14 &	COMP	ON			ENCOR		A	AEAN	A PC	il erv Mixk
		SETI	LEME	T WA	FER LINE		DRAW	1 0.1	JPSHA	Ņ
	R	EPLA	CEMEN	T AND	METERING) [DESIGN	N B.	MBRO	GI
		P	HASE A -	E. JEMEZ	ROAD	c	HECKE	D D.	BRAND	
TA-	INFR		PLAN A	BLDG NA			DATE	1/	1/19/2018	
SUBM	ITTED	31			APPROVED FOR RELEA	ASE				
1	LOSA	lamos	P Lo	0 Box 1663 s Alamos, N	ew Mexico 875	HEET	4	-1	00	9
D.C :			REVIEWER	DONALD YAR	IDMAN MICH Y	~~	DA	Te.//	-7	FV
r KOJI	1033	56	C5	7500-0	WG-INFR-	C-1(009	1		D
					A-UR-1	7-	31	30)5	

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GENER/	AL N	OTES:
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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

KEYED NOTES:

(1) STA 65+22,61 - INSTALL (1) 10" 11.25" MJ BEND W/ RESTRAINTS, INV ELEV 7320.12

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C2 STA 67+82.11 - INSTALL (1) 10" 11.25° MJ BEND W/ RESTRAINTS, INV ELEV, 7313.58

3 STA 68+81 47 - DEFLECT AS REQUIRED

4 STA 72+66.31 - DEFLECT AS REQUIRED INVELEV 7301.77

STA 67+50.00 - INSTALL 10" x 6" TEE, W/ RESTRAINTS 20 FT EACH WAY ON MAIN AND 1' ON BRANCH, WITH 7' LF PIPE TO FIRE HYDRANT, INV ELEV. 7314.39, PLACE TWO (2) BOLLARDS.

CLOSE VALVE AND REMOVE EXISTING FIRE HYDRANT. WATER LINE TO BE ABANDONED.

NO DATE CLAS	S DC	DESCRIPTION	DWN	DSGN IC	нко ѕив
&COMPANY	l.	VENCOR	<u>c</u>	AA	
SE	TTLEME	NT WATER LIN	E	DRAWN	C UPSHA
REPL	ACEMEN	T AND METER	ING	DESIGN	B AMBRO
	PHASE A -	E. JEMEZ ROAD	c	HECKED	D. BRAND
TA-INFR	PLAN A	BLDG NA			1/19/2018
SUBMITTED BRIAN AMBROGI		APPROVED FOR MICHAEL WILL	AMS		
· Los Alam	OS P	0 Box 1663 s Alamos, New Mexico 87	SHEET	SC-	101
	REVIEWER.	DONALD YARDMAN	a yana	OATE	1/26
ADDOES	CE	7500.DWG.INF	RIC-1	010	1 1

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GE	NERAL NOTES:
1. I	F THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY
KE	YED NOTES:
\bigcirc	STA 80+93,99 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS.
2	STA 81+28,70 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS.
3	STA 83+00.00 - INSTALL (1) 10" 11,25° MJ BEND W/ RESTRAINTS. INV ELEV. 7270.57.
4	STA 84+75.00 - INSTALL NEW 10" PRV METER VAULT
5	STA 85+03 18 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS INV ELEV. 7263.02
6	9 STA 85+17.30 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS.
7	9 STA 85+63,98 - INSTALL (1) 10" 45° MJ BEND W/ RESTRAINTS.
8	STA 83+75.00 - NEW LANSCE METER INSTALLED IN EXISTING VAULT. SEE LANSCE SITE PLAN ON SHEET C-1024.
9	STA 77+91 13 - DEFLECT AS REQUIRED INV ELEV, 7292 64.
10	INSTALL 10" x 6" TEE, W/ RESTRAINTS 20 FT EACH WAY ON MAIN AND 1' ON BRANCH, WITH 7' LF PIPE TO FIRE HYDRANT. PLACE TWO (2) BOLLARDS, INSTALL TEE W/CAP 5' NORTH OF EXISTING FENCE FOR CONNECTION TO LAC METER.
(11)	CLOSE VALVE AND REMOVE EXISTING FIRE HYDRANT, WATER LINE TO BE ABANDONED.
(12)	STA 85+65,73 - CONNECT INTO EXISTING 10" WATER LINE. INV ELEV. 7263.36.
(13)	EXISTING LAC METER
14	STA 77+37.00 - INSTALL (1) 10"x8" TEE (MECHANICAL JOINT X MECHANICAL JOINT) WITH RESTRAINTS. INV ELEV. 7309.01.
(15)	STA 83+80.00 - DEFLECT AS REQUIRED. INV ELEV. 7270.05
(16)	STA 84+20.00 - DEFLECT AS REQUIRED. INV ELEV. 7266.03.
(17)	GROUT FILL WATER LINE UNDER ROADWAYS.

FROM	TO	UTILITY	SEPARATION	PARALLEL/
STATION	STATION	CONFLICT	DISTANCE	PERPENDICULAR
68+44.66	80+93,99	SEWER	5' TO 8'	PARALLEL

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ENCLOSURE 2

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K	E)	/EI	NOT	ES;							
$\overline{\mathbf{C}}$	D	TIE - ST-C C-50 SEQ	IN INTO 3010-2, S 07 - C-500 UENCING	EXISTING ST-G3010 08 PHAS	G WATERLINE -3 & ST-G3010 SE B - BIKINI A	PER LANL STANDAI -6 SEE CONNECTIO TOLL FOR CONSTR	RD D ON D UCTI	ETAILS ETAILS ON	3: 5 1 - 7	'7	
C	2)	BEG DR-1 AND	INNING O B 235 PS	F PHASE I PIPE, T ER VALVI	E B - STATION IE INTO EXIST E)	10+00: INSTALLATIC ING 12" WATERLINE	DN: 12 E (12"	2" PVC ' HOT 1	C900 AP	I	
C	3)	12" H 10+3	IORIZON 10 (APPRC	TAL DIRE	CTIONAL DRI	LL (DR-18) (FUSIBLE 12+38 (APPROXIMA	C-90	00) STA	TION	I	
C	4)	PRO 1 / 0	POSED C	DPEN TRE	ENCH (12" PVC	C-900 DR-18 235 P	SI PI	PE) SE	E DE	ΓΑΙL	
4	A	PRO 1/ C	POSED C -5000.	PEN TRE	ENCH (10" PVC	C-900 DR-18 235 P	SI PII	PE) SE	E DE	ΓΑΙL	
C	5)	PRO 17+1 DET	POSED F 15 ON WE AIL 1 / C-5	IRE HYD ST SIDE 5001	RANT INSTALI OF BIKINI ATC	ATION PER LANL S	T-G3 ANT	010-4 INSTA	AT S' LLAT	ion	
ASPHALT PATCHING SEE DETAIL 1 / C-5000 FOR OPEN TRENCH IN											
\langle	7)	CON	ICRETE S	URFACE RENCH A	PATCHING C	ONTRACTOR TO RE BANCE TO ORIGINA	ESTO L CO	RE NDITIC	ONS.		
C	B	PRO C-50	POSED T	A-3 SM-1	42 1-METER A	T STATION 10+25	SEE	DETAI	L4/		
C	9)	PRO	POSED 4	5º ELBO\	WS (12" AND 1	0") AT APPROXIMAT	TE ST	ATION	ING		
		эпо		- STA 12	2+37 3+07	F - STA 17+27 G - STA 18+07					
			C D E	- STA 13 - STA 13 - STA 13	3+36 3+66 3+94	H - STA 19+17				14	
\langle	10)	EXIS OW	STING WA	ATERLINE	E TO BE ABAN CONNECTION	DONED IN PLACE A DETAIL 2 / C-5007, I	ND C DETA	APPEI	D BY IASE	В-	
\langle	11)	10" 17+ DIR (API	HORIZON 29 (APPRI ECTIONA PROXIMA	TAL DIRE OXIMATE L DRILL \ .TE).	ECTIONAL DRI) TO STATION WILL NEED TO	LL (DR-18) (FUSIBLE 19+12 (APPROXIMA BE REDIRECTED A	E C-9 ATE). T ST.	00) ST HORIZ ATION	ATION ONT 18+0	AL 7	
C	12)	EXIS USE CON	STING PC ED AS ST/ NTRACTC	DTENTIAL AGING AF	. RELEASE SIT REAS OR EQU	ES (PRS) PRS SITE	ES NO AREA	OT TO AS BY	BE.		
\langle	13)	COI WH COI COI	NNECTION	N INTO E GENERA N DETAIL N	XISTING WAT TE TEMPORA 6 / C-5008, DI	ER LINE AT EXISTIN RY CLOSURE OF DI ETAILS PHASE B - B	ig dr Rive' Ikini	RIVEW WAY, S ATOLI	AY SEE _ FOF	t	
\langle	14)	PRO	OPOSED I	HORIZON	ITAL DIRECTION	ONAL DRILL PIT					
C	15)	FUL COI INTI IS PRO	L ACCE NTRACTO ERRUPTIO REQUIRE DLONGED	SS TO OR MUST ONS TO ED IF IN D	SM-30 WARI PHASE OPEN BUILDING EN ITERRUPTION	EHOUSE REQUIRE I TRENCH INSTALL TRANCES, COORDI TO ACCESS IS	D A ATIOI INATI UNA	t ali n to f on w .voida	. TIN PREV ITH L BLE	IES, ENT ANL OR	
\langle	16	EXI TO REC	STING LA ABANDO QUIRED T	NL WATI N EXISTI O OPER/	ER VALVE LOO NG BIKINI ATO ATE WATER V	Cation to be period DLL Waterline. L/ Alve.	MANI ANL (ENTLY	CLO DINAT	SED 'ION	
C	17	PR((AP VAL HIG DE1	DPOSED PROXIMA VE. REC H POINT TAIL 2 / C-	COMBINA ATE) SEI OMMENE IDENTIFI -5002	ATION / VACUU E DETAIL 2" CO DED THAT COM IED / AGREED	JM VALVE STATION OMBINATION AIR RE NTRACTOR INSTALL UPON BY LANL AND	10+3 ELEA AT / D CO	30 SE / V/ APPAR NTRAC	ACUL ENT CTOR	м	
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ТА	-INF	2		PLA	N AND PROF	BLDG NA		DATE	1/	vasoui 19/18	ΕZ
SUB	METTE	D	31			APPROVED FOR RELEA MICHAEL WILLIAMS	ASE				
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D.C	HAT	CLASS	LABORATOR	REVIEW	Los Alamos, I	New Mexico 87946	U	17 Mex	OF	10	18
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	KE	YED NOT	ES:								
	1	TIE - IN INTO E ST-G3010-2, S C-5009 PHASE	T-G3010-3 B - BIKIN	WATERLINE F & & ST-G3010- I ATOLL FOR	PER LANL STANDAR 6. SEE CONNECTION CONSTRUCTION SI	rd de On de Equei	TAILS: TAILS NCING	1 - 4 .	/		
	2	FULL ACCES CONTRACTOR INTERRUPTIO REQUIRED I PROLONGED	IS TO S R MUST F NS TO BU F INTER	SM-30 WARE PHASE OPEN JILDING ENTR RUPTION T	HOUSE REQUIRE TRENCH INSTALL/ ANCES COORDIN, O ACCESS IS	D AT ATION ATION UNAV	TO P WITH	TIM REVE I LANI BLE	ES. NT LIS OR		
	3	PROPOSED TI DEPTH WITH O OTHERWISE A	RANSITIO OUT THE APPROVE	N AREA: CON USE OF VERT D BY LANL	TRACTOR MUST M ICAL FITTINGS UNI	ATCH LESS	BORE				
		PROPOSED O DETAIL 1 / C-	PEN TREI	NCH (10" PVC	C-900 DR-18 235 P	SI PIPI	E) SEE				
	5	PROPOSED FI / C-5001	RE HYDR	ANT INSTALL	ATION PER LANL S	T-G30	10-4. [DETAI	L 1		
	6	ASPHALT PAT ASPHALT ARE	CHING SI	EE DETAIL 1 /	C-5000 FOR OPEN	TREN					
		CONCRETE S	URFACE F RENCH AI	PATCHING, CO REA DISTURB	ONTRACTOR TO RE	ESTOR L CON	E DITIO	NS.			
	8	BEGIN STA 21+80 (APPROXIMATE) TO 22+80 (APPROXIMATE) : ± 100 LF OF 20' JACK AND BORE STEEL CASING, 10' DIAMETER DUCTILE IRON CARRIER PIPE WITH SPACERS AND RESTRAINTS. A MINIMUM OF 2 FOOT CLEARANCE MUST BE MAINTAINED FROM STEAM PIPE ALONG WITH A 4 FOOT MINIMUM COVER. CONTRACTOR MUST COORDINATE WITH LANL FOR UTILITY CLEARANCE VARIANCE. TRENCH DEPTHS GREATER THAN 5 FT WILL REQUIRE USE OF TRENCH BOX PER CURRENT OSHA GUIDELINES.									
	9	PROPOSED 45 A B C	5º ELBOW - STA 23- - STA 23- - STA 23-	/S (10") AT AP ⊧53 E ⊧60 E ⊧87 F	PROXIMATE STATIO) - STA 23+94 5 - STA 25+63 7 - STA 25+70	ONING	BELC	DW:			
	10	EXISTING LAN ACCESS. A MI BE KEPT AT A	IL PARKIN NIMUM O LL TIMES	IG LOT. CONT F ONE OPEN	RACTOR MUST NO ACCESS TO THE P	ARKIN	G LOT	r MUS	т		
	1	EXISTING PO USED AS STA CONTRACTOR	FENTIAL F GING ARE R	RELEASE SITE EAS OR EQUIF	S (PRS). PRS SITE MENT STORAGE A	S NOT REAS	TO B BY	E			
	(12)	PROPOSED H CONTRACTOR LOCATION, UT REQUIRED,	ORIZONT R: UTILITY FILITY VAI	AL DIRECTION (INFORMATIC RIANCES ARE	NAL DRILL PIT. NO DN IS PENDING FOI LIKELY, COORDIN	te to R This Ation	BORI	E I LANI	L		
	13	PROPOSED C (APPROXIMAT VALVE, RECO HIGH POINT ID DETAIL 2 / C-5 PROPOSED C (APPROXIMAT	OMBINAT TE). SEE L MMENDE DENTIFIEL 6002. OMBINAT TE). SEE	ION / VACUUI DETAIL 2" COM D THAT CONT D / AGREED U ION / VACUUI DETAIL 2" CO	M VALVE STATION MBINATION AIR REL RACTOR INSTALL PON BY LANL AND M VALVE STATION MBINATION AIR RE	20+25 EASE AT AP CONT 23+25 LEASE	/ VAC PARE RACT		I		
	\sim	VALVE, RECC HIGH POINT II DETAIL 2 / C-5	MMENDE DENTIFIE 5002	D THAT CON D / AGREED U	RACTOR INSTALL		PARE RACT	NT OR			
	(15)	WATERLINE A ATOLL FOR C	T MERCU ONSTRUC	IRY RD. SEE I CTION SEQUE	DETAILS 4 / C-5009 NCING	PHAS	E 8 - E	BIKINI			
	(16)	CONTRACTOR	SHALL N	AINTAIN TRU	ICK ACCESS TO SM	1-30 A	T ALL	TIME	5		
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7	TA-IN SUBMIT	FR			BLDG NA	ASE	DATE	1/	19/18	-	
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GENERAL NOTES:
1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.
KEVED NOTES
RETED NOTES:
 STA 10+00.00 - BEGIN NEW CONSTRUCTION. CONNECT TO EXISTING 10" CI WATER LINE. INSTALL 1 - 12"X12" TEE (MECHANICAL JOINT X MECHANICAL JOINT) WITH RESTRAINTS 20' EACH WAY ON MAIN LINE AND 1' ON BRANCH, INV ELEV. 7395.34. INSTALL CONCRETE THRUST BLOCK INSTALL 1-10" GATE VALVE WITH RESTRAINTS.
(2) 10' x 10' HDD PIT
3 STA 11+92.56 - DEFLECT AS REQUIRED. INV ELEV, 7390.36.
(4) 10' x 30' HDD PIT
5 STA 16+58.65 - CONNECT TO EXISTING WATERLINE
6 STA 17+76.38 - CONNECT TO EXISTING WATERLINE
T STA 18+48.13 - DEFLECT AS REQUIRED.
8 STA 18+76.65 - CONNECT TO EXISTING WATERLINE
9 STA 18+90.64 - CONNECT TO EXISTING WATERLINE
(10) STA 19+28.62 - INSTALL (1) 10" Ø 45° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS.
(1) STA 19+39.16 - INSTALL (1) 10" Ø 45° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7376.25.
12 PRS SITE
3 GEOTECH LOCATION SEE TABLE ON SHEET G-0004.
(14) STA. 13+00.00 INSTALL 12" METERING VAULT. SEE TA-59 SITE PLAN DETAIL ON SHEET C-1025.

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ENCLOSURE 2

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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KEYED NOTES:

1) STA 24+17, 19 - CONNECT TO EXISTING WATERLINE,

- 2 STA 24+64,19 CONNECT TO EXISTING WATERLINE.
- STA 24+46.25 INSTALL (1) 12" Ø 90° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS, INV ELEV, 7360.40.
- STA 24+50.93 INSTALL (1) 12" Ø 90° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS.
- 5 STA 24+64.19 CONNECT TO EXISTING 12" CI WATER LINE INSTALL (1) 12"x12" TEE (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7360.11.

6 PRS SITE

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GENERAL NOTES:
1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.
KEYED NOTES:
T STA 10+00.00 - BEGIN NEW CONSTRUCTION, INSTALL CONCRETE THRUST BLOCK, INV ELEV, 7374.68
STA 10+52.64 - INSTALL (1) 12" Ø 22.5° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS, INV ELEV, 7374.44, INSTALL (1) 2" COMBINATION AIR/ VACUUM VALVE.
3 STA 11+33.41 - INSTALL (1) 12" Ø 22.5° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7372.98.
STA 15+74.15 - INSTALL (1) 12" Ø 22.5° BEND AND (1) 10" Ø 11.25° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7331.50.
5 STA 16+91.82 - INSTALL (1) 12" Ø 90° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7330.76.
6 STA 19+07.67 - INSTALL (1) 12" Ø 90" BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS INV ELEV. 7358.09.
T STA 19+08.00 - INSTALL (1) 2" COMBINATION AIR/ VACUUM VALVE. INV ELEV. 7358.97.
8 STA 12+00.00 - DEFLECT AS REQUIRED
9 STA 13+50.00 - DEFLECT AS REQUIRED. INV ELEV. 7347.15
10 STA 18+00.00 - DEFLECT AS REQUIRED
11 STA 20+50.00 - DEFLECT AS REQUIRED
12 STA 18+75.00 - DEFLECT AS REQUIRED. INV ELEV. 7358.09

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ENCLOSURE 2

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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KEYED NOTES:

T STA 21+16.47 - INSTALL (1) 12" Ø 22.5° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7348.05.

- 2 STA 21+50.00 DEFLECT AS REQUIRED
- 3 STA 22+77,43 DEFLECT AS REQUIRED. INV ELEV. 7339 14
- 4 STA 23+50.00 DEFLECT AS REQUIRED INV ELEV 7339.01
- STA 26+95.86 INSTALL (1) 12" Ø 45° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS, INV ELEV, 7346.89. INSTALL CONCRETE THRUST BLOCK. CONNECT TO EXISTING WATERLINE

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GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY

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KEYED NOTES:

STA 10+00.00 - BEGIN NEW CONSTRUCTION. CONNECT TO EXISTING WATER LINE, INV ELEV. 7345.22. INSTALL CONCRETE THRUST BLOCK

- 2 STA 10+07.29 INSTALL (1) 12" Ø 22.5" BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS.
- 3 STA 11+13 44 DEFLECT AS REQUIRED
- STA 13+00.00 DEFLECT AS REQUIRED.
- 5 STA 14+25.00 DEFLECT AS REQUIRED. INV ELEV. 7334.28
- 6 STA 16+00.00 DEFLECT AS REQUIRED

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AL TA-INFR	IGNMENT	3 PLAN AND PROFILE BLDG N	A	DATE	D.1	3RANO 19/2018	2
AL TA-INFR SUBMITTED BRIAN AMBROGI	IGNMENT	3 PLAN AND PROFILE BLDG N/ APPROVED FOR REL MICHAEL WILLIAMS	A	DATE	0.1 1/	3RANO 19/2018	
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		PO Box 1663 Los Alamos, New Mexico 87545 R DONALD VARDMAN	EASE SHEET	DATE	0.1 1/ -1	01	83





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	GE	NER	AL NO	TES						
	1.1	F THIS	SHEET IS	NOT 24"	E X36'' USE GRAPHIC	SCALE ACCO	RDIN	GLY.		
	KE	YED	NOTE	IS:						
	1	STA 2	1+55,26 -		(1) 10" Ø 11,25" BEN	D (MECHANIC	CAL J	OINT X		
	-	MECH	IANICAL J		RESTRAINTS, INV	ELEV. /322.9				- 1
	2	STA 2	2+90 00 -	DEFLEC	I AS REQUIRED					
	3	STA 2 MECH	3+27,95 - IANICAL J	INSTALL OINT) W	(1) 10" Ø 11 25° BEN RESTRAINTS_INV	ND (MECHANI ELEV 7319 0	CAL J 3	OINT X	(
		STA 2	4+50 00 -	DEFLEC	AS REQUIRED					
	0	0	05							
	(5)	STA 2	25+00 00 -	DEFLEC	FAS REQUIRED					
	6	STA 2	7+50 00 -	DEFLEC	AS REQUIRED. IN	IV ELEV 7308	32			
		STA 3	0+05,17 -	INSTALL	(1) 12" x 12" Ø TEE	(MECHANICAI		NT X		
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ENCLOSURE 2

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GENERAL NO	TES:
1. IF THIS SHEET IS N	OT 24"X36" USE GRAPHIC SCALE ACCORDINGLY,
KEYED NOTE	S:
1 STA 10+00 00 - BE WATER LINE, INV	EGIN NEW CONSTRUCTION, CONNECT TO EXISTING ELEV, 7352.36, INSTALL CONCRETE THRUST BLOCK
2 STA 12+00.00 - DI	EFLECT AS REQUIRED. INV ELEV, 7348.53
3 STA 13+50 00 - DI	EFLECT AS REQUIRED
4 STA 15+27 15 - DI	EFLECT AS REQUIRED
5 STA 17+25 00 - DI	EFLECT AS REQUIRED. INV ELEV. 7325.95
6 STA 18+50 00 - DI	EFLECT AS REQUIRED INVELEV 7323.97

T STA 19+30.00 - DEFLECT AS REQUIRED INVELEV 7317.95

NU	DATE	CLASS REV	DC	DES	CRIPTION	DWN	DSGN	снкр	SUB	1
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		P	HASE C -	PAJARITO	ROAD		CHECKE	DE	RAND	
TA-	INFR	ALIG	NMENT	4 PLAN ANI	D PROFILE BLDG	NA	DATE	1/1	19/2018	1
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	A					SHEET	A C	-1	02	O
	LosA	LABORATOR	ļ	P0 Box 1663 _os Alamos, I	Vew Mexico 875	19/1	25	OF	7	3
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D.C.	HATIONAL		DRAWING	NO				1	1	5



GENERAL NOTES:

1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

KEYED NOTES:

STA 20+28.46 - INSTALL (1) 12" x 12" TEE WITH (3) GATE VALVES (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS, INV ELEV, 7316.58 (2) 10' x 15' HDD PIT 3 STA 21+60.04 - DEFLECT AS REQUIRED INV ELEV 7321.50 STA 22+05.05 - INSTALL (1) 12" Ø 45° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS, INV ELEV, 7326.81

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- 5 STA 22+84.70 INSTALL (1) 12" Ø 45° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7329.93
- (6) STA 23+60.04 DEFLECT AS REQUIRED.
- TA 25+43.14 INSTALL (1) 12" Ø 11.25° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS. INV ELEV. 7324.68.
- STA 25+57.36 INSTALL (1) 12" Ø 11.25° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS.
- 9 STA 29+07 36 DEFLECT AS REQUIRED
- (1) STA 30+58.28 INSTALL (1) 12" Ø 11.25° BEND (MECHANICAL JOINT X MECHANICAL JOINT) W/ RESTRAINTS.
- (1) STA 30+68.20 CONNECT TO EXISTING 12" WATER LINE, INV ELEV. 7319.70, INSTALL CONCRETE THRUST BLOCK
- (12) 10' x 30' HDD PIT
- 13 PRS SITE
- 14 PHASE C ALIGNMENT 3
- (15) GEOTECH LOCATION, SEE TABLE ON SHEET G-0004.
- (16) STA 23+60.00 INSTALL (1) 2" COMBINATION AIR/VACUUM VALVE, INV, ELEV 7330.94,

FROM	TO	UTILITY	SEPARATION	PARALLEL/
STATION	STATION	CONFLICT	DISTANCE	PERPENDICULAR
25+57,36	30+58,28	TELEPHONE	1' TO 2_5'	PARALLEL

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SUBMITTED		APPROVED FOR F MICHAEL WILLIAM	ELEASE				
BRIAN AMBROGI			SHEET	AC	-1	02	1
				<i></i>			-
	S PO) Box 1663 s Alamos, New Mexico 875	AT	16	OF	17	
	REVIEWER:	D Box 1663 s Alamos, New Mexico 875 DONALD YARDMAN	A	6 104	OF	175	l



GENERAL NOTES:

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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY

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KEYED NOTES:

STA 10+00.00 - BEGIN NEW CONSTRUCTION. CONNECT TO EXISTING WATER LINE, INV ELEV. 7422.07. INSTALL CONCRETE THRUST BLOCK

- 2 EXISTING HYDRANT TO REMAIN
- 3 STA 12+41.52 CONNECT TO EXISTING WATERLINE,

(4) STA 14+41,47 - CONNECT TO EXISTING WATERLINE.

- 5 STA 16+14 58 CONNECT TO EXISTING WATERLINE.
- 6 STA 16+56 15 CONNECT TO EXISTING WATERLINE.

7 PRS SITE

8 STA 10+50.00 - DEFLECT AS REQUIRED. INV ELEV. 7421.83

9 STA 11+50.00 - DEFLECT AS REQUIRED. INV ELEV. 7426.75

10 STA 14+50.00 - DEFLECT AS REQUIRED INV ELEV. 7426.80.

- 11 STA 15+00.00 DEFLECT AS REQUIRED
- (12) STA 16+00.00 DEFLECT AS REQUIRED. INV ELEV. 7422.41.
- (13) SECURITY FENCE,

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ENCLOSURE 2

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GENERAL NOTES	· · · · · · · · · · · · · · · · · · ·
1. IF THIS SHEET IS NOT 24	- "X36" USE GRAPHIC SCALE ACCORDINGLY
RETED NOTES:	
STA 17+77.38 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 45° BEND (MECHANICAL JOINT X // RESTRAINTS, INV ELEV, 7421.25
2 STA 17+85.03 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 45° BEND (MECHANICAL JOINT X // RESTRAINTS.
3 STA 19+04.43 - CONNEC	CT TO EXISTING WATERLINE
4 STA 19+42.65 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 45° BEND (MECHANICAL JOINT X // RESTRAINTS.
5 STA 19+62 53 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 45° BEND (MECHANICAL JOINT X // RESTRAINTS
6 STA 21+47.68 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 22.5° BEND (MECHANICAL JOINT X // RESTRAINTS.
T STA 21+53.12 - INSTALL MECHANICAL JOINT) W	. (1) 10" Ø 22.5° BEND (MECHANICAL JOINT X ∦ RESTRAINTS.
8 STA 22+18 32 - DEFLEC	T AS REQUIRED. INV ELEV. 7418.79
9 STA 22+73 78 - CONNEC 7421.19. INSTALL CON	CT TO EXISTING 10" WATER LINE, INV ELEV. CRETE THRUST BLOCK
10 PRS SITE	
1 SECURITY FENCE	

FROM	TO	UTILITY	SEPARATION	PARALLEL/
STATION	STATION	CONFLICT	DISTANCE	PERPENDICULAR
17+85,00	22+73.78	SEWER	3.5' TO 9'	PARALLEL

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ENCLOSURE 2

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9	DET	AIL ON SH	EET C-50	03						
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ENCLOSURE 2

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GENERAL NOTES	
1. IF THIS SHEET IS NOT 24	— I"X36" USE GRAPHIC SCALE ACCORDINGLY
KEVED NOTES:	
1 2" FEMALE IRON PIPE - 316 STAINLESS STEEL HARDWARE	THREAD SERVICE SADDLE (LEAD FREE) WITH DOUBLE STRAPS AND 316 STAINLESS STEEL BOLTS, NUTS, AND
2" BRASS CORPORATION BY FEMALE IRON PIPE	ON STOP (LEAD FREE), MALE IRON PIPE THREAD INLET THREAD OUTLET.
3 2" BY CLASS BRASS N	IPPLE (LEAD FREE)
2" BRASS 45° BEND (LE IRON PIPE THREAD.	EAD FREE), FEMALE IRON PIPE THREAD BY FEMALE
5 2" BRASS ADAPTER (LI (COPPER TUBING SIZE	EAD FREE), MALE IRON PIPE THREAD BY PACK JOINT
6 2" COPPER TUBING (T	YPE "K").
7 2" BRONZE BALL VALV	E (LEAD FREE) WITH HANDWHEEL
8 2" STAINLESS STEEL C	COMBINATION AIR RELEASE/ VACUUM VALVE
9 13" BY 24" METER CAN	WITH CAST IRON LID.
10 30" x 30" x 6" CONCRET CONCRETE SHALL BE	TE COLLAR AROUND METER CAN fr≔3,000 POUNDS PER SQUARE INCH AT 28 DAYS
11) 6" THICK CLEAN PEA C	RAVEL BED.
12 2" x 6" COPPER NIPPLE THREAD	E, MALE IRON PIPE THREAD BY MALE IRON PIPE
13 2" BRASS 90" BEND, FE	EMALE IRON PIPE THREAD BY FEMALE IRON THREAD,
14 2" x CLOSE BRASS NIP THREAD.	PLE, MALE IRON PIPE THREAD BY MALE IRON PIPE
15 CONCRETE BLOCK TO	STABILIZE AIR VALVE, 2 REQUIRED.
(16) WHERE WATER MAINS RELEASE/ VACUUM VA	ARE 10" OR LESS IN DIAMETER, A 1" COMBINATION AIR LVE AND 1" TYPE "K" COPPER TUBING MAY BE USED.
17 6" DIMENSION RATIO-1 CONCRETE COLLAR.	8 POLYVINYL CHLORIDE PIPE AND COVER WITH

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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY,

KEYED NOTES:

 ELECTROMAGNETIC FLOW METER, ENDRESS HAUSER MODEL PROMAG W 500, 5W5B OR APPROVED EQUAL, SEE TABLE 1. MINIMUM/MAXIMUM FLOW CAPACITY OF 33 61/13445 GPM. METER SHALL HAVE PTFE LINER, METER-MOUNTED AMPLIFIER, AND VAC POWER SUPPLY. METER SHALL USE "HART" PROTOCOL SEE TABLE FOR SIZING.

6

- AHS1 HEAVY DUTY H-20 RATED SAFE HATCH (ASSEMBLY NO. VSH-H20-A-24-24-S-GS) MANUFACTURED BY EJ, OR APPROVED EQUAL
- 3 DI MJXMJ GATE VALVE, W/ BOX AND RESTRAINTS TYP. SEE TABLE FOR SIZING.
- (4) DI MJXMJ TEE, W/ RESTRAINTS TYP. SEE TABLE FOR SIZING.
- 5 DI MJxMJ 90° BEND, W/ RESTRAINTS TYP. SEE TABLE FOR SIZING.
- (6) DI PIPE SEE TABLE FOR SIZING.
- T PVC C-900 DR-18 PIPE. SEE TABLE FOR SIZING.
- (8) 96" CMP PIPE GUAGE AND MATERIAL, LENGTH AS NEEDED
- 9 PIPE STAND
- (10) MEGALUG MECHANICAL JOINT RESTRAINT, OR APPROVED EQUAL SEE TABLE FOR SIZING.
- 11 TRANSDUCER ASSEMBLY
- (12) 6" x 6" x 12" DEEP GRAVEL DRAIN
- (13) R-19 FOAM BOARD INSULATION SHEET

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10 &	COMP	ANY			ENCOR	<u> </u>	A.A		PC II, Nrs M COM
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GENERAL	NOTES:
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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY

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KEYED NOTES:

- 1 10" PRESSURE REDUCING VALVE.
- 2 AHS1 HEAVY DUTY H-20 RATED SAFE HATCH (ASSEMBLY NO. VSH-H20-A-24-24-S-GS) MANUFACTURED BY EJ, OR APPROVED EQUAL
- 3 10" DI MJXMJ GATE VALVE, W/ BOX AND RESTRAINTS TYP.
- (4) 10" DI MJXMJ TEE, W/ RESTRAINTS TYP,
- 5 10" DI MJxMJ 90° BEND, W/ RESTRAINTS TYP
- 6 10" DI PIPE
- 7 10" PVC C-900 DR-18 PIPE
- (8) 96" CMP PIPE GUAGE AND MATERIAL, LENGTH AS NEEDED
- 9 PIPE STAND
- (10) 10" MEGALUG MECHANICAL JOINT RESTRAINT, OR APPROVED EQUAL
- (11) 10" x 3/4" TAPPING SADDLE
- (12) PRESSURE GAUGE
- (13) 3/4" SPOOL (NPT)
- (14) 3/4" BALL VALVE (NPT)
- (15) 3/4" SAMPLE PORT
- 16 PRESSURE GAUGE ASSEMBLY
- 17 R-19 FOAM BOARD INSULATION SHEET
- 18 BOLLARDS
- (19) 4" PRESSURE REDUCING VALVE
- 20 10" x 4" DI MJxMJxPE TEE, W/ RESTRAINTS TYP
- (21) 4" DI MJ 90° BEND, W/ RESTRAINTS TYP
- 22 4" DI MJ GATE VALVE
- 23 4" DI PIPE

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FPC-DO 18-052

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	GENERAL NO	TES:					
-	1. IF THIS SHEET IS N	OT 24"	" X36" USE GRAPHIC SCALE ACCO	RDIN	GLY.		
C	2. CONSTRUCTION SE CONSTRUCTION AS LANL STR & LANL U	EQUEN S A BAS ITILITIE	ICE PROVIDES FOR GENERAL SE SIS OF BID. CONTRACTOR SHALL ES ON FINAL FITTINGS AND APPU	QUE COC	NCE FO DRDINA NANCE	OR TE WITH S	
18	NEEDED FOR LANL 3. PRESSURE TESTIN	TO MA	AKE COMPLETE CONNECTION	L BE	DEVEL	OPED	
OF	BY CONTRACTOR A TESTING & DISINFE PRIOR TO LANL CO	AND SU ECTION INNECT	JBMITTED TO LANL ES-UI FOR AP 1. TEST RESULTS WILL BE SUBMI TION.	PRO	VAL PR	NL ES-UI	
LITIES W	1 10" x 10" TEE (MJ	S: x MJ)					
	2 10" PVC PIPE 3 10" GATE VALVE						
	4 10" COUPLING						
OOL	5 10" 22.5° BEND (M	MJ x MJ))				
RTHE	6 10" 45° BEND (M.	J x MJ)					
G AND	7 10" PLUG W/ RES		TS				
δA	(10) CONCRETE THR	UST BL	LOCKING				
VICE	1 LOCATION 2						
IEW	12 CUT AND CAP JU	JST DO	WNSTREAM OF HYDRANT #487 (ON 6'	CI LINI	E	
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G	ENERAL NOTES:	
1.	IF THIS SHEET IS NOT 24"X36" US	E GRAPHIC SCALE ACCORDINGLY
2	CONSTRUCTION SEQUENCE PRO CONSTRUCTION AS A BASIS OF E LANL STR & LANL UTILITIES ON FI NEEDED FOR LANL TO MAKE COM	WIDES FOR GENERAL SEQUENCE FOR SID, CONTRACTOR SHALL COORDINATE WITH INAL FITTINGS AND APPURTENANCES MPLETE CONNECTION
3	PRESSURE TESTING PLAN AND D BY CONTRACTOR AND SUBMITTE TESTING & DISINFECTION, TEST PRIOR TO LANL CONNECTION,	DISINFECTION PLAN SHALL BE DEVELOPED ED TO LANL ES-UI FOR APPROVAL PRIOR TO RESULTS WILL BE SUBMITTED TO LANL ES-UI
H	EYED NOTES:	
$\overline{\mathbf{C}}$	1) 10" x 10" TEE (MJ x MJ)	
C	2) 10" PVC PIPE	
\subset	3 10" GATE VALVE	
C	10" COUPLING	
\mathbf{C}	5 10" 45° BEND (MJ x MJ)	
C	6) 10" 90° BEND (MJ x MJ)	
C	7) 6" GATE VALVE	
\subset	8) 6"x6" TEE (MJxMJ)	
C	9 4-1/2' BURY FIRE HYDRANT	
0	0 8" TEMPORARY TEST CAP	
0		
0	12) 10" X 8" TEE (MJ X MJ)	
0	3 CONCRETE THRUST BLOCKING	3
0	14) 6" 90° BEND (MJxMJ)	
C	15) 6" 45° BEND (MJxMJ)	

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FPC-DO 18-052

CONTRACTOR MUST VERIFY WATERLINE SIZE AT CONNECTION POINT. REDUCERS ARE TO BE USED WHEN A WATERLINE IS ENCOUNTERED WITH A DIAMETER LESS THAN 10 INCHES. IF APPLICABLE CONTRACTOR SHOULD BE PREPARED TO INSTALL REDUCERS AT ALL CONNECTION POINTS.

6

- 2. CONTRACTOR MUST COORDINATE ALL TIE-IN POINTS WITH LANL AND FURNISH ALL ADDITIONAL REQUIRED MATERIALS FOR LANL TO INSTALL.
- 3. ALL CUT AND CAPS NOT SHOWN ON CONNECTION DETAILS WILL BE PERFORMED BY LANL.
- 4. THRUST BLOCKS MUST BE PERFORMED IN ACCORDANCE WITH DETAIL 4 / C-5001.

KEYED NOTES:

(1) 10" x 10" TEE (MJ x MJ)

- 2 10" PVC PIPE
- (3A) 10" GATE VALVE (A)
- (3B) 10" GATE VALVE (B)
- 4 10" COUPLING
- 5 10" 45° BEND (MJ x MJ)
- 6 10" x 10" CROSS (MJ x MJ)
- (7) 12" X 12 " TEE
- (8) 12" 10" REDUCER
- (9A) 12" GATE VALVE (A)
- (9B) 12" GATE VALVE (B)
- (10) 12" PVC PIPE
- (11) 12" COUPLING
- (12) 12" 45° BEND (MJ x MJ)

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GENERAL NOTES:

1. CONTRACTOR MUST VERIFY WATERLINE SIZE AT CONNECTION POINT. REDUCERS ARE TO BE USED WHEN A WATERLINE IS ENCOUNTERED WITH A DIAMETER LESS THAN 10 INCHES, IF APPLICABLE CONTRACTOR SHOULD BE PREPARED TO INSTALL REDUCERS AT ALL CONNECTION POINTS.

6

- CONTRACTOR MUST COORDINATE ALL TIE-IN POINTS WITH LANL AND FURNISH ALL ADDITIONAL REQUIRED MATERIALS FOR LANL TO INSTALL.
- 3. ALL CUT AND CAPS NOT SHOWN ON CONNECTION DETAILS WILL BE PERFORMED BY LANL,
- 4. THRUST BLOCKS MUST BE PERFORMED IN ACCORDANCE WITH DETAIL 4 / C-5001.

KEYED NOTES:

(1) 10" x 10" TEE (MJ x MJ)

- 2 10" PVC PIPE
- (3A) 10" GATE VALVE (A)
- (3B) GATE VALVE (B)
- (3C) GATE VALVE (C)
- (4) 10" COUPLING
- (5) 10" 45° BEND (MJ x MJ)
- (6) 10" x 10" CROSS (MJ x MJ)
- (7) SEE FIRE HYDRANT DETAIL FOR INSTALLATION

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	GENERAL NOTES					
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L F Y	2 CONTRACTOR MUST COO FURNISH ALL ADDITIONAL F	RDINATE ALL TIE-IN POINTS WIT REQUIRED MATERIALS FOR LANL	TH LA	NL AN	D	
	3. ALL CUT AND CAPS NOT SH PERFORMED BY LANL.	OWN ON CONNECTION DETAILS	MLL	BE		
	4. THRUST BLOCKS MUST BE / C-5001,	PERFORMED IN ACCORDANCE W	ITH D	ETAIL 4	Ļ	
i	KEYED NOTES:					
	1 10" x 10" TEE (MJ x MJ)					
	2 10" PVC PIPE					
	(3A) 10" GATE VALVE (A)					
	(3B) GATE VALVE (B)					
	4 10" COUPLING					
	5 10" 45° BEND (MJ x MJ))				
	6 SEE FIRE HYDRANT D	ETAIL FOR INSTALLATION				
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EWER: DONALD YARDMAN

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G	ENERAL NO	TES						
1	IF THIS SHEET IS	NOT 24"	X36" USE GRA	PHIC SCALE	ACCORDI	NGLY		
2	CONSTRUCTION CONSTRUCTION LANL STR & LANI	SEQUEN AS A BAS UTILITIE	ICE PROVIDES SIS OF BID, CO ES ON FINAL F	FOR GENER	AL SEQUI SHALL CO APPURTE	ence f Ordin/ Enance	OR ATE WITH ES	
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	12" COUPLING	M.I.x.M.D						
00	100 SY ASPHA	LT REMC	OVAL AND REF		COMPAC [*]	r Subg	RADE	
2	TO 95% RELAT ST-G2010-1 W	TH TWO	ISITY ASPHA 2" LIFTS PLAC	LT SHALL BE CED OVER 8" /	PER LANL	STD D	WG	
C		IRUST B	LUCKING					
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NO	DATE CLASS REV	DC	DES	CRIPTION	DW	N DSGN	CHKD SUB	1
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0	COMPANY			Challer Childry Compo		DRAWA	AEANM.COM	
	SET REDI A	I LEM CEMI	ENT WA	METER	IE RING	DESIGN	C UPSH/	w
	nsf la	• 171هه ي.	PHASE C			CHECKE	B. AMBRO	200
т л		CONN	ECTION DET	AILS BIDA	G NA	DATE	1/19/201	8
SUE	MITTED IAN AMBROGI			APPROVED FOR MICHAEL WILL	R RELEASE			
	A				SHEE	AC	-501	(
1	· Los Alamos	3	P0 Box 1663	Vew Mexico 87	545	42	of 7	7
	MATIONAL LABORATOR	¥	Loo / tantoo, i					ŀ
).C		REVIEW	ER: DONALD YA	RDMAN 201	alitim	- JOA	11/15	

LA-UR-17-31305



GENERAL NOT	_	_
	TES:	
1. IF THIS SHEET IS NO	IOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY,	
2. CONSTRUCTION SE CONSTRUCTION AS LANL STR & LANL U NEEDED FOR LANL	EQUENCE PROVIDES FOR GENERAL SEQUENCE FOR S A BASIS OF BID, CONTRACTOR SHALL COORDINATE WITH JTILITIES ON FINAL FITTINGS AND APPURTENANCES TO MAKE COMPLETE CONNECTION.	
3. PRESSURE TESTIN BY CONTRACTOR A TESTING & DISINFE PRIOR TO LANL CO	IG PLAN AND DISINFECTION PLAN SHALL BE DEVELOPED AND SUBMITTED TO LANL ES-UI FOR APPROVAL PRIOR TO ECTION, TEST RESULTS WILL BE SUBMITTED TO LANL ES-U DNNECTION,	I
KEYED NOTE	S:	
1 12" x 12" TEE (MJ	(LM × L	
2 12" PVC PIPE		
3 12" GATE VALVE	2	
4 12" COUPLING		
5 12" 11.25° BEND ($(MJ \times MJ)$	
6 12" 45° BEND (MJ	(LM × L	
12" 90° BEND (MJ	J × MJ)	
8 12" PLUG W/ RES	STRAINTS	
9 12" WYE (MJ x MJ	(J)	
11.1 SY ASPHALT TO 95% RELATIV ST-G2010-1 WITH	T REMOVAL AND REPLACEMENT. COMPACT SUBGRADE VE DENSITY. ASPHALT SHALL BE PER LANL STD DWG H TWO 2" LIFTS PLACED OVER 6" ABC.	
(1) CONCRETE THR	RUST BLOCKING	
(12) CUT AND CAP		
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NO DATE CLASS REV REV	DC DESCRIPTION DWN DSON CHKO SUG VENCOR VENCOR CHKO SUG AEA PC AEA PC AEA PC AEA PC AEA PC AEA PC	3 API
NO DATE CLASS REV WILSON &COMPANY	DC DESCRIPTION DWN DSON CHKO SU DC DESCRIPTION DWN DSON CHKO SU Abarren, CARACTER LINE DRAWN CHRON	B API
NO DATE CLASS REV MILISON &COMPANY SETTI REPLAC	DC DESCRIPTION DWA DESIN CHKO SUR VENCOR VENCOR VENCOR VENCOR LEMENT WATER LINE EMENT AND METERING DESIGN B. AMBR	B API
NO DATE CLASS REV EXTREMENT &COMPANY SETTI REPLAC	DC DESCRIPTION DWN DSON CHOO SU DC DESCRIPTION DWN DSON CHOO SU DC VENCOR VENCOR VENCOR LEMENT WATER LINE CONFECTION DETAILS	APU AWV OGI D
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NO DATE CLASS REV SCOMPANY SETTI REPLAC TA-INFR SUBMITTED BRIAN AMBROGI DC: LUNGT LOS ALABOOS ATOMAC LABORATORY DC: LUNGT PROJECT ID 103356	DC DESCRIPTION DWN DEGN CHKO SUR DC DESCRIPTION DWN DEGN CHKO SUR DE VEENCOR MILLENE EMENT WATER LINE EMENT WATER LINE EMENT AND METERING PHASE C CONNECTION DETAILS BLDG NA APPROVED FOR RELEASE MICHAEL WILLIAMS BLDG NA DATE 1/19/20 PO Box 1663 Los Alamos, New Mexico 875/51 PO Box 1663 Los Alamos, New Mexico 875/51 A3 of 77 REVIEWER: DONALD YARDMAN C. UPSH DATE 1/19/20 DATE 1/19/20 D	a API a API A API



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G	ENERAL NOTES	
1.	IF THIS SHEET IS NOT 24	"X36" USE GRAPHIC SCALE ACCORDINGLY
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K	EYED NOTES:	
ā	D 12" x 12" TEE (MJ x MJ)	
	2 12" PVC PIPE	
	12" GATE VALVE	
C	12" COUPLING	
C	5 12" 11 25° BEND (MJ x	MJ)
C	12" PLUG W/ RESTRAI	NTS
G	12" EXISTING WATERL	INE TO BE CUT CAPPED AND ABANDONED IN PLACE
	LOCATION 2	
	CONCRETE THRUST E	BLOCKING

NO	DATE	CLASS REV	DC	DES	CRIPTION	DW	N DSGN	снко	SUB
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	R	EPLA	CEME	NT AND) METERI	NG	DESIGN	8.A	MBR
			1	HASE C			CHECKEL	D.B	RAN
TA-I	NFR		CONNE	CTION DET	BLDG	NA	DATE	1/1	9/201
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BRIA	4						11-		-
BRIA	LOSA	LABORATOR	ł	P0 Box 1663 Los Alamos,	New Mexico 875	SEL.	44	OF	7



GENERAL NOT	ES:
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KEYED NOTES	3:
10" x 10" TEE (MJ >	× MJ)
2 10" PVC PIPE	
3 10" GATE VALVE	
4 10" COUPLING	
5 10" 45° BEND (MJ :	x MJ)
6 10" PLUG W/ REST	TRAINTS
7) 10" WYE (MJ × MJ))
(8) LOCATION 2	
9 10" EXISTING WAT	TERLINE TO BE CUT CAPPED AND ABANDONED IN PLACE
(10) CONCRETE THRU	JST BLOCKING
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	DC DESCRIPTION DWN DSGN CHKD SU WEINTERLINE EMENT WATER LINE EMENT AND METERING SONNECTION DETAILS BLDG NA APPROVED FOR RELEASE MICHAEL WILLIAMS STATE PO BOX 1663 LOS Alamos, New Mexico 87547 PO BOX 1663 LOS Alamos, New Mexico 87547 C.500 C



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;E:	GENERAL NOTE	IS:
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/E A DOL ITATE	2. CONSTRUCTION SEQ CONSTRUCTION AS A LANL STR & LANL UTH NEEDED FOR LANL TO	UENCE PROVIDES FOR GENERAL SEQUENCE FOR BASIS OF BID, CONTRACTOR SHALL COORDINATE WITH LITIES ON FINAL FITTINGS AND APPURTENANCES D MAKE COMPLETE CONNECTION.
NG OF	3. PRESSURE TESTING I BY CONTRACTOR AND TESTING & DISINFECT PRIOR TO LANL CONN	PLAN AND DISINFECTION PLAN SHALL BE DEVELOPED D SUBMITTED TO LANL ES-UI FOR APPROVAL PRIOR TO FION, TEST RESULTS WILL BE SUBMITTED TO LANL ES-UI IECTION,
RARY ATER ON	KEYED NOTES:	
LINGS,	10" x 10" TEE (MJ x 1	MJ)
FOR	2 10" PVC PIPE	
TING	3 10" GATE VALVE	
N	4 10" COUPLING	
INTO	5 10" 45° BEND (MJ x	MJ)
ARE	6 10" PLUG W/ RESTR	RAINTS
	7 10" WYE (MJ x MJ)	
AVAIE	8 LOCATION 2	
ting E Will	9 10" EXISTING WATE	RLINE TO BE CUT CAPPED AND ABANDONED IN PLACE
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&COMPA	NW VY	VENCOR	ųc.	AA	AEA PC ELECTRICAL DRC AlbCOLLINGT, NI AEANM, COM	เขตต ระมีเจ
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. LOS AL	BORATORY	Los Alamos, New Monte C		(~	C	21



JITS	DISTRI	BUTION
- CONCEALED RACEWAY) 200	CIRCUIT BREAKER, 200-AMP
- EXPOSED RACEWAY) ₂₀₀	CIRCUIT BREAKER w/ SHUN
 FLEXIBLE RACEWAY UNDERGROUND or EMBEDDED RACEWAY 	₿1200:5	CURRENT TRANSFORMERS
- EXISTING RACEWAY RACEWAY DROP (DOWN)	₫ 100	FUSES, 100-AMP
RACEWAY RISE (UP)	Ŧ	GROUND CONNECTION POIL
CONCEALED ACCESSIBLE JUNCTION BOX EMERGENCY CIRCUIT JUNCTION BOX PULL BOX CIRCUIT IDENTIFIER CIRCUIT NUMBERS PANELBOARD NAME COMMUNICATIONS RACEWAY HOMERUN CABLE TRAY FIRE STOP AT RATED WALLS	☑ ↓ 200 へへへへへ ×F1	METERING DEVICE A AMPERE METER V VOLT METER Q WATT-HOUR METER W WATT METER AS PHASE SELECTOR SW POTENTIAL TRANSFORMER SWITCH, 200 AMP POWER TRANSFORMER
ETS and DEVICES	EQUIPA	AENT
	- C - C - C - C - C - C - C - C - C - C	NOTOD

GROUND FAULT INTERRUPTER TYPE WEATHERPROOF COVER WEATHER RESISTANT DEVICE RECEPTACLE SCHEDULE KEY MOUNTING HEIGHT INCHES AFF TO CENTER IN-USE WEATHERPROOF COVER FLUSH WALL OUTLET SIMPLEX RCP DUPLEX RCP DOUBLE DUPLEX RCP SPLIT WIRED DUPLEX RCP FLUSH FLOOR BOX w/ DUPLEX RCP RECEPTACLE AS KEYED NEMA 4 (FD) SURFACE OUTLET OR JUNCTION BOX FLUSH FLOOR BOX FOR COMMUNICATIONS RECESSED COMBO DUPLEX RCP AND VIDEO CONNECTORS FLUSH FLOOR BOX w/ TWO DUPLEX RCP AND COMM JACKS TELE JACKS DATA JACKS

Q	METERING DEVICE A AMPERE METER V VOLT METER Q WATT-HOUR METER VR VAR METER W WATT METER AS PHASE SELECTOR SWITCH
Å 4:1	POTENTIAL TRANSFORMERS
لا 200	SWITCH, 200 AMP
∧	POWER TRANSFORMER
EQUIP	MENT
Ø	MOTOR
D	DISCONNECT SWITCH
(F)	DISCONNECT SWITCH - FUSED OR CB

CIRCUIT BREAKER, 200-AMP 3-POLE

CIRCUIT BREAKER w/ SHUNT TRIP

GROUND CONNECTION POINT

MOTOR CONTROLLER (STARTER)

LIGHTING CONTACTOR

FIRE/SMOKE DAMPER

SERVICE and DISTRIBUTION

BOARD

DISTRIBUTION SWITCHBOARD

BRANCH CIRCUIT PANELBOARD

CONTROL OR COMMUNICATIONS PANEL TELEPHONE EQUIPMENT OR TERMINAL

VARIABLE FREQUENCY DRIVE

VARIABLE AIR VOLUME UNIT

COMBINATION DISCONNECT AND STARTER

3

×

FSD

VFD

VAV

-

LED LIGHT EMITTING DI AMPERE AC ABOVE COUNTER or LT LTG LIQUID-TIGHT ALTERNATING CURRENT LIGHTING ABOVE FINISH FLOOR MAX MAXIMUM THOUSAND CIRCUI AFF AFG ABOVE FINISH GRADE MCM MAIN DISTRIBUTIO ARC FLASH INTERRUPT MDC AFI AIC AMPS INTERRUPTING MH MIN MINIMUM CAPACITY MAIN LUGS ONLY MLO MTD BFG BELOW FINISH GRADE C CB CCT CLG CONDUIT NORMALLY CLOSE NATION ELECTRIC/ CIRCUIT BREAKER NC NEC CIRCUIT CEILING NEMA NATIONAL ELECTR MANUFACTURER CU DN COPPER NIC NO NTS NOT IN CONTRACT DOWN DWG DRAWING NORMALLY OPEN NOT TO SCALE ELECTRICAL ELE EMT ELECTRICAL METALLIC OC P ON CENTER PHASE, POLE TUBING PULL BOX PANEL BOARD EQP EQUIPMENT PB EXT EXTERIOR FLEX FLEXIBLE CONDUIT PNI PPC POLYESTER POWE FLUORESCENT FIBER OPTIC POLYVINYL CHLOF FLU PVC RCP RECEPTACLE FO SPD SURGE PROTECTIONS FSD FT FIRE-SMOKE DAMPER

ABBREVIATIONS

4

G GND GROUND TEB GAUGE GND ELECTRODE GA GEC TEL CONDUCTOR GND FAULT INTERRUPT ттв GFI GRC GALVANIZED RIGID CONDUIT TV HIGH INTENSITY DISCHARGE TYP HID HOA HP HPS HAND-OFF-AUTO UG HORSEPOWER UL HIGH-PRESSURE SODIUM IN INC INCH v INT INTERIOR IN-USE COVER IUC w JUNCTION BOX JB THOUSAND CIRCULAR MILS KCMIL KILOVOLT KV

FEET

KVA

KW

FVNR FULL-VOLTAGE

NON-REVERSING

LABORATORIES VARIABLE AIR VOL VAV VFD VARIABLE FREQUE WIRE WITH w/o WP WEATHERPROOF TRANSFORMER XE

SQ S/S

NAMING CONVENTION

KILOVOLT-AMPERE

KILOWATT

SYSTEM NUMBER - SERVICE or MAIN S NOT USED FOR SMALL SYSTEMS, CO	SWITCHBOARD NUMBER ONTROLS, or CONTACTOR
EQUIPMENT DESCRIPTION DB DIMMING BALLAST CABINET DP DISTRIBUTION PANEL BOARD DR DIMMER RACK or PANEL DS DISTRIBUTION SW BOARD EB EMERGENCY LTG INVERTER EG STAND-BY ENGINE-GEN LC LTG CONTROL SCABINET MC MOTOR CONTROL CENTER MP MAIN PANEL BOARD	MS MAIN SWITCH BOAF PB PANEL BOARD / LO/ PQ PAD-MTD METERNIN- S PAD-MTD SWITCH PX PAD-MTD TRANSFO CR RELAY CABINET SP SURGE PROTECTIO TS TRANSFER SWITCH XF DRY TYPE TRANSFE
MAIN SWITCHBOARD CIRCUIT NUM	MBER 5, CONTROLS, or CONTAC
VOLTAGE CODE L 480/277 P 208/120 or 240	D/120 - NOT APPLIC
DS2L1	TIFIER



HPC-DO: 18-052

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LIGHTING		GE	INER	AL NC	TES							
MAXIMUM				LOWING			ELECTRIC/	AI WO	ORK IN	ICLU	DED I	N
THOUSAND CIRCULAR MILS		~	THE CO	NTRACT L	NLESS NO	DTED OTHER	RWISE					
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OLS, or CONTACTORS		Ne						_				-
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PANEL BOARD / LOAD CNTR		E-5	5000 D	ETAILS - E	2 CABINE	т						
PAD-MTD METERING		E-5	5001 D	ETAILS - E	2A CABIN	ET						
PAD-MTD TRANSFORMER		E-8	5002 D	ETAILS - E	4 CABINE	т						
SURGE PROTECTION		E-5	5003 D	ETAILS								
DRY TYPE TRANSFORMER		E-6	6000 D	IAGRAMS	- METERI	NG - E2 CAB	INET					
		E-6	5001 D	IAGRAMS	- METERI	NG - EZA CA	BINET					_
NTROLS, or CONTACTORS		E-t	5002 D	AGRAMS	- METERH	AND CROUI						
		E-0	5003 D		- POWER	AND GROUN	4DilaG					
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- D WORKING CLEARANCE: PROVIDE WORKING CLEARANCE AS REQUIRED BY NEC ARTICLE 110
- E DEDICATED SPACE: PROVIDE DEDICATED SPACE FOR ELECTRICAL EQUIPMENT AS REQUIRED BY NEC ARTICLE 110

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KEYED NOTES:

- PROVIDE #2/0 BARE STRANDED CU GND ELECTRODE CONDUCTOR 30" MIN BELOW FINISH GRADE
- (2) GND BUS NEAR BOTTOM OF CABINET

- 2 GND BUS NEAR BOTTOM OF CABINET
 3 PROVIDE #6 BARE SOLID CU GEC
 4 PAD REINFORCING STEEL
 5 PROVIDE EXOTHERMIC WELD BOND TO GROUNDING ELECTRODE
 6 PROVIDE EXOTHERMIC WELD BOND TO PAD REINFORCING STEEL
 7 PROVIDE 1°C STUB-UP FOR GEC INTO CABINET
 7 PROVIDE EXOTHERMIC WELD BOND TO SUPPORT STEEL
 9 PAD BLOCK-OUT FOR CONDUIT
 10 PROVIDE HD NEMA 3R UL SE FUSED SWITCH W/ SOLID NEUTRAL,
 PAD-UOCK PROVISIONS, AND 2 LPN-RK-20SPI FUSES
 11 PROVIDE 6 SOLID CU GEC AND 34*D X 101 COPPER CLAD STEEL GI (1) PROVIDE #6 SOLID CU GEC AND 3/4*D x 10*L COPPER CLAD STEEL GND ROD - DRIVE ROD INTO GROUND - EXOTHERMIC WELD GEC TO TOP OF ROD

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ENCLOSURE 2

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KEYED NOTES:

1)#6 STRANDED CU (60A) BETWEEN CHARGER AND BATTERIES

- 2 TO SERVICE BATT1, CG-01, CC-01, OR PS-01, CONNECT BATT2 -CONNECTOR CAN ALSO BE USED FOR PORTABLE BACKUP POWER SUPPLY FROM 24 Vdc SOURCE DURING AN EXTENDED UTILITY POWER OUTAGE - DO NOT USE TO CHARGE BATT1
- 3 CONNECT CONDUCTOR SHIELDS PER THE MANUFACTURER'S INSTALLATION INSTRUCTIONS
- (4) TRANSIENT PROTECTION w/ GROUND POINT NOT SHOWN
- 5 DO NOT BOND N-G AT CABINET
- 6 WIRE HARNESS, PRE-SCALAR BOARD CONNECTOR, BATTERY TEMP SENSOR, AND BATTERY TEMP WIRE FURNISHED W/ EQUIPMENT



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GENERAL NOTES



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SITE	METER ID	DEVICE ID	RTU PORT	ETHERNET SWITCH PORT	DESCRIPTION
		CR-01 CR-02 SPD-01 NS-01 TT-01	DI-01 DI-02 DI-03 DI-04 AI-01		CABINET INTRUSION STATUS UTILITY POWER STATUS SURGE PROTECTION DEVICE STATUS NETWORK SWITCH STATUS CABINET TEMPERATURE °F
LANSCE SM-142 TA-59 S SITE TA-09 ANNIV TANK	WM-61-01 WM-03-01 WM-59-01 WM-06-01 WM-09-01 WM-73-01	RT-01		IP-01	FLOW METER TCP/IP COMMUNICATION FLOW GPM PRESSURE PSI TOTAL GAL (MILLION) STATUS
		PLC-01 BM-01A		IP-05	LOGIC CONTROLLER TCP/IP COMMUNICATIO BATTERY MONITOR COMM BOX TCP/IP COMMUNICATION BATTERY CHARGE %

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MATERIAL SCHEDULE

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FUNCTION	KEY	MANUFACTURER	MODEL NO.	DESCRIPTION	QUAN	
VV-01			la contra c			NOTES
	BAT-01			BATTERY	4	2
YY-02 YY-03 YY-04	BM-01	SCHNEIDER	865-1080-01 and 865-1058	BATTERY MONITOR AND COMM BOX (BM-01A), 24 Vdc BATTERY BANK, BATTERY TEMPERATURE SENSOR, SERIAL COMM TO OTHER SYSTEM COMPONENTS, DIN RAIL MOUNT, ETHERNET COMMUNICATIONS, WEB PAGE SERVER, USB 2.0 PORT	1	
TT-01	CG-01			BATTERY CHARGER	1	2
	CR-01	SCHNEIDER	8501-XDO40V53	CONTROL RELAY, 24 Vdc COIL, 2NO/2NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1	
FY-01 PY-01 FQY-01	CR-02	SCHNEIDER	8501-XO20V03	CONTROL RELAY, 240 Vac COIL, 1NO/1NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1	
JY-01	E2-01	PENTAIR (HOFFMAN)	A723018SSFSN4	ENCLOSURE, NEMA 4X, TYPE 302 S/S, 72"H x 30"W x 18"D, SINGLE DOOR HINGED LEFT, 3-POINT LATCH #AL36DR, PADLOCK HANDLE, R-4 INSULATION TOP SIDES BACK & DOOR, 12 GA WHITE PPC STEEL INTERIOR MOUNTING PANEL #A72P30F1, S/S DOOR STOP #ADSTOPKSS6, CUSTOM BOTTOM CONDUIT CUT-OUT, S/S GUIDE AND BLANK-OFF PLATES, WELDED S/S CHANNEL STRUT BOTTOM RAILS, S/S HARDWARE	1	
TT-02 YY-06	E2-02	PENTAIR	DAH2001A	ELECTRIC HEATER, 200W, 120Vac, AL HOUSING, THERMOSTATIC CONTROL 0-100 °F, SET AT 40°F	1	
	E2-03	PENTAIR	TFP41UL12	COOLING FAN PACKAGE, 120Vac, 55 CFM, 17 W, COMPOSITE HOUSING, PLENUM, GUARD, AND GRILLE, DISPOSABLE FILTER	1	
	E2-04	PENTAIR	TEP4UL12	EXHAUST PACKAGE, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER	1	
	E2-05	PENTAIR	LED24V15	LED LIGHT BAR, ADJ ANGLE, 24 Vdc, 470 LUMEN MIN, DAISY-CHAIN CABLES #LGCABLE24 (2), #LGCABLE72 (1), #LED24CORD (1), #LDSWITCH72 (1)	2	
	E2-06	PENTAIR	ALFSWD	DOOR SWITCH, DOOR ACTIVATED	1	
	E2-07	PENTAIR	ALFSWM	LIGHT SWITCH, MANUAL	1	
	E2-08	PENTAIR	ATEMNO	FAN THERMOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 75°F	1	
	LG-01			LTE CELLULAR GATEWAY	1	2
	NS-01			ETHERNET NETWORK SWITCH	1	2
	PLC-01			PROGRAMMABLE LOGIC CONTROLLER	1	2
	PS-01			POWER SUPPLY	1	2
	PT-01			PRESSURE TRANSMITTER, 4-20 mA, 24 Vdc	-	1
	RT-01			FLOW METER, ELECTRO-MAGNETIC, REMOTE DIGITAL SIGNAL PROCESSOR, 24 Vdc	*	1
	SB-01	McMASTER-CARR	19135A24	SHELF BRACKETS	2	
	SPD-01	SCI INEIDER (Sq-D)	6671-TVS1HWA80X	SURGE PROTECTION DEVICE, 120/240 Vac 1 PHASE, 80 KA PEAK, SINE WAVE TRACKING, -54 dB EMI/RFI FILTERING, 200 KA SCCR, DRY ALARM CONTACTS	1	
	TT-01			TEMPERATURE TRANSMITTER	1	2

4

GENERAL NOTES: NOT ALL ITEMS OF MATERIAL ARE INCLUDED IN THIS SCHEDULE ALL ITEMS ARE TO BE PROVIDED (FURNISHED AND INSTALLED) CONDUIT SIZES ARE FOR EMT - WIRE SIZES ARE FOR THHN/THWN CU AN = AS NEEDED xx = SEQUENTIAL I.D. NUMBER STARTING AT 01

NUMBERED NOTES: 1 REFER TO SPEC 40 7113 2 REFER TO SPEC 27 5410 3 FURNISHED BY THE GOVERNMENT - RECEIVE, INSTALL, CONNECT, AND INTEGRATE



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I/O SCHEDULE

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SITE	METER ID	DEVICE ID	RTU PORT	ETHERNET SWITCH PORT	DESCRIPTION	FUNCTION
		CR-01	DI-01		CABINET INTRUSION STATUS	YY-01
		CR-02	DI-02		UTILITY POWER STATUS	YY-02
		SPD-01	DI-03		SURGE PROTECTION DEVICE STATUS	YY-03
		NS-01	DI-04		NETWORK SWITCH STATUS	YY-04
		TT-01	AI-01		CABINET TEMPERATURE °F	ττ-01
MERCURY	WM-58-01	RT-01		IP-01	FLOW METER TCP/IP COMMUNICATION FLOW GPM PRESSURE PSI TOTAL GAL (MILLION) STATUS	FY-01 PY-01 FQY-01 YY-05
	WM-58-02	RT-02		IP-02	FLOW METER TCP/IP COMMUNICATION FLOW GPM PRESSURE PSI TOTAL GAL (MILLION) STATUS	FY-02 PY-02 FQY-02 YY-06
		PLC-01		IP-05	LOGIC CONTROLLER TCP/IP COMMUNICATION	
		BM-01A		IP-06	BATTERY MONITOR COMM BOX TCP/IP COMMUNICATION BATTERY CHARGE % BATTERY TEMP *F STATUS	JY-01 TT-02 YY-07

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MATERIAL SCHEDULE

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KEY	MANUFACTURER	MODEL NO.	DESCRIPTION	QUAN	
		1			NOTE
BAT-01			BATTERY	4	2
BM-01	SCHNEIDER	865-1080-01 and 865-1058	BATTERY MONITOR AND COMM BOX (BM-01A), 24 Vdc BATTERY BANK, BATTERY TEMPERATURE SENSOR, SERIAL COMM TO OTHER SYSTEM COMPONENTS, DIN RAIL MOUNT, ETHERNET COMMUNICATIONS, WEB PAGE SERVER, USB 2.0 PORT	1	
CG-01			BATTERY CHARGER	1	2
CR-01	SCHNEIDER	8501-XDO40V53	CONTROL RELAY, 24 Vdc COIL, 2NO/2NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1	
CR-02	SCHNEIDER	8501-XO20V03	CONTROL RELAY, 240 Vac COIL, 1NO/1NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1	
E2-01	PENTAIR (HOFFMAN)	A723018SSFSN4	ENCLOSURE, NEMA 4X, TYPE 302 S/S, 72"H x 30"W x 18"D, SINGLE DOOR HINGED LEFT, 3-POINT LATCH #AL36DR, PADLOCK HANDLE, R-4 INSULATION TOP SIDES BACK & DOOR, 12 GA WHITE PPC STEEL INTERIOR MOUNTING PANEL #A72P30F1, S/S DOOR STOP #ADSTOPKSS6, CUSTOM BOTTOM CONDUIT CUT-OUT, S/S GUIDE AND BLANK-OFF PLATES, WELDED S/S CHANNEL STRUT BOTTOM RAILS, S/S HARDWARE	1	
E2-02	PENTAIR	DAH2001A	ELECTRIC HEATER, 200W, 120Vac, AL HOUSING, THERMOSTATIC CONTROL 0-100 °F, SET AT 40°F	1	
E2-03	PENTAIR	TFP41UL12	COOLING FAN PACKAGE, 120Vac, 55 CFM, 17 W, COMPOSITE HOUSING, PLENUM, GUARD, AND GRILLE, DISPOSABLE FILTER	1	
E2-04	PENTAIR	TEP4UL12	EXHAUST PACKAGE, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER	1	
E2-05	PENTAIR	LED24V15	LED LIGHT BAR, ADJ ANGLE, 24 Vdc, 470 LUMEN MIN, DAISY-CHAIN CABLES #LGCABLE24 (2), #LGCABLE72 (1), #LED24CORD (1), #LDSWITCH72 (1)	2	
E2-06	PENTAIR	ALFSWD	DOOR SWITCH, DOOR ACTIVATED	1	Í.
E2-07	PENTAIR	ALFSWM	LIGHT SWITCH, MANUAL	1	
E2-08	PENTAIR	ATEMNO	FAN THERMOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 75°F	1	
LG-01			LTE CELLULAR GATEWAY	1	2
NS-01			ETHERNET NETWORK SWITCH	1	2
PLC-01			PROGRAMMABLE LOGIC CONTROLLER	1	2
PS-01			POWER SUPPLY	1	2
PT-01			PRESSURE TRANSMITTER, 4-20 mA, 24 Vdc	× .	1
RT-01			FLOW METER, ELECTRO-MAGNETIC, REMOTE DIGITAL SIGNAL PROCESSOR, 24 Vdc	•	1
RT-02			FLOW METER, ELECTRO-MAGNETIC, REMOTE DIGITAL SIGNAL PROCESSOR, 24 Vdc	•	1
SB-01	McMASTER-CARR	19135A24	SHELF BRACKETS	2	
SPD-01	SCHNEIDER (Sq-D)	6671-TVS1HWA80X	SURGE PROTECTION DEVICE, 120/240 Vac 1 PHASE, 80 KA PEAK, SINE WAVE TRACKING, -54 dB EMI/RFI FILTERING, 200 KA SCCR, DRY ALARM CONTACTS	1	
				4	2

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GENERAL NOTES: NOT ALL ITEMS OF MATERIAL ARE INCLUDED IN THIS SCHEDULE ALL ITEMS ARE TO BE PROVIDED (FURNISHED AND INSTALLED) CONDUIT SIZES ARE FOR EMT - WIRE SIZES ARE FOR THHN/THWN CU AN = AS NEEDED XX = SEQUENTIAL I.D. NUMBER STARTING AT 01

NUMBERED NOTES: 1 REFER TO SPEC 40 7113 2 REFER TO SPEC 27 5410 3 FURNISHED BY THE GOVERNMENT - RECEIVE, INSTALL, CONNECT, AND INTEGRATE



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IO STEE NETER OP/OCE POINT FUNCTION SOUTH COSCIPITION COSCIPITION COSCIPITION COSCIENT		1				2	2		3		/	4	
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D OR-01 Di-01 CABNET INTRUSION STATUS YY-01 BATCH AntTERY ANTTERY BATCH BATC		SITE	METER IC	DEVICE	RTU PORT	ETHERNET SWITCH PORT	DESCRIPTION	FUNCTION	KEY	MANUFACTURER	MODEL NO.	DESCRIPTION	QUAN
B BATCH BAT				CR-01	DI-01		CABINET INTRUSION STATUS	YY-01					1
D Unital F-UNCES INTOS				00.00	DI 02			× 02	BAT-01			BATTERY	6
C NS-01 DL04 NETWORK SWITCH STATUS YY-04 Old Schlebock B85-1638 OTHER SYSTEM COMPONENTS, DIN RAU, MOUNT, EL HEAD RELICE 1 TI-01 AL-01 CABINET TEMPERATURE 'F TI-01 CG-01 C B87-1638 OTHER SYSTEM COMPONENTS, DIN RAU, MOUNT, EL HEAD RELIC 1 WM-50-01 RT-01 AL-01 CABINET TEMPERATURE 'F TI-01 CG-01 C B87-1638 COMMUNICATION SWITCH STATUS 1 WM-50-01 RT-01 IP-01 FELOW METER TCP/IP COMMUNICATION FTOTAL (MILLON) Prof.1 GR-01 Schnelder 8651-X020VUR COMTECT RELY, 24 We CONTACT RATING 1 WM-50-02 RT-02 IP-02 FELOW METER TCP/IP COMMUNICATION FP F0/22 FF/02 FF/02 Schnelder 8651-X020VUR COMTECT RELY, 24 We CONTACT RATING 1 WM-50-02 RT-02 IP-02 IP-02 FF/02 Schnelder Schnelder 8651-X020VUR COMERCEL ST, 350 XE MAS SCHOON, 250 XE MAS SCHOON, 25	D			SPD-01	DI-02		SURGE PROTECTION DEVICE STA	TUS YY-03	BM-01	SCHNEIDER	865-1080-01 and	BATTERY MONITOR AND COMM BOX (BM-01A), 24 Vdc BATTERY BANK, BATTERY TEMPERATURE SENSOR, SERIAL COMM TO	1
C C CABINET TEMPERATURE F T-01 GG01 C BATTERY CHARGER 1 VMA-50-1 RT-01 A-01 PLOW METER TOP/IP COMMUNICATION PLOW GPM Pr-01 PP-01 PP-01 STATUS Pr-01 PP-01 PP-01 PP-01 STATUS Pr-01 PP-01 PP-01 PP-01 STATUS Pr-01 PP-01 PP-01 PP-01 STATUS Pr-01 PP-01 PP-01 PP-01 STATUS Pr-01 PP-				NS-01	DI-04		NETWORK SWITCH STATUS	YY-04	DIVI-01	Schweiber	865-1058	OTHER SYSTEM COMPONENTS, DIN RAIL MOUNT, ETHERNET COMMUNICATIONS TCP/IP, WEB PAGE SERVER, USB 2.0 PORT	
C No. No. Output High Residuation Produin Figure Column Control Control Produin Figure Column Control Figure Column Control Figure Column Control Produin Figure Column Control Figure Column Figure Column Control Figure Column Figure Column Control Figure Column Figure Colu				TT-01	AL-01		CABINET TEMPERATURE *F	TT-01	CG-01			BATTERY CHARGER	1
C WM-50-01 RT-01 IP-01 PRESSURE PSI TOTAL GAL (MILLION) STATUS PY-01 FOV 05F CR-02 SCHNEIDER 8501-X020V08 CONTROL HELAY, 28 Vm COLL, MOVINC CONTACTS 1 VM-50-02 RT-02 IP-02 PRESSURE PSI FOV 05FM PY-02 FOV 05FM PY-03 FOV 05FM PY-04 FOV 05FM PY-04 FOV 05FM PY-04 FOV 05FM PY-04 FOV 05FM							FLOW METER TCP/IP COMMUNICA	TION EX-01	CR-01	SCHNEIDER	8501-XDO40V53	CONTROL RELAY, 24 Vdc COIL, 2NO/2NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1
Image: Constraint of the			WM-50-01	RT-01		IP-01	PRESSURE PSI TOTAL GAL (MILLION)	PY-01 FQY-01	CR-02	SCHNEIDER	8501-XO20V08	CONTROL RELAY, 208 Vac COIL, 1NO/1NC CONTACTS (CONVERTIBLE), 5A 125 Vdc CONTACT RATING	1
C NM-50-03 RT-03 IP-03 IP-04	-	RULOB	WM-50-02	RT-02		IP-02	FLOW METER TCP/IP COMMUNICA FLOW GPM PRESSURE PSI TOTAL GAL (MILLION) STATUS	TION FY-02 PY-02 FQY-02 YY-06	E4-01	PENTAIR (HOFFMAN)	A723618SSFSN4	ENCLOSURE, NEMA 4X, TYPE 302 S/S, 72"H x 36"W x 18"D, SING DOOR HINGED LEFT, 3-POINT LATCH #AL36DR, PADLOCK HAND R-4 INSULATION TOP SIDES BACK & DOOR, 12 GA WHITE PPC STEEL INTERIOR MOUNTING PANEL #A72P36F1, S/S DOOR STO #ADSTOPKSS6, CUSTOM BOTTOM CONDUIT CUT-OUT, S/S GUII AND BLANK-OFF PLATES, WELDED S/S CHANNEL STRUT BOTTOM	LE, PLE, P 1 DE DM
C WM-55-01 RT-04 IP-04 FLOW METER TCP/IP COMMUNICATION FLOW GPM PRESSURE PSI TOTAL GAL (MILLION) FY-04 PY-04 PY-04 STATUS FY-04 PY-04 PY-04 STATUS FY-04 PY-04 PY-04 STATUS FY-04 PY-04 PY-04 STATUS FY-04 PY-04 PY-04 STATUS FY-04 PY-04 PY-04 STATUS FY-04 PENTAIR TEP4UL12 COOLING FAN PACKAGE, 120Vac, 17 W, 55 CFM, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER 1 BM-01A IP-04 IP-04 IP-04 IP-05 LOGIC CONTROLLER TCP/IP COMMUNICATION STATUS FQY-04 YY-08 FQY-04 YY-08 FQY-04 PENTAIR TEP4UL12 COOLING FAN PACKAGE, 120Vac, 17 W, 55 CFM, COMPOSITE GRILLE, DISPOSABLE FILTER 1 BM-01A IP-06 IP-06 DOIG CONTROLLER TCP/IP COMMUNICATION BATTERY CHARGE % BATTERY TEMP "F STATUS IP-06 PENTAIR LED24V15 CABLES #LGOALE22 (2), #LGCABLE22			WM-50-03	RT-03		IP-03	FLOW METER TCP/IP COMMUNICA FLOW GPM PRESSURE PSI	TION FY-03 PY-03	E4-02	PENTAIR	DAH2001A	ELECTRIC HEATER, 200W, 120Vac, AL HOUSING, THERMOSTATI CONTROL 0-100 °F, SET AT 40°F	C 1
C WM-55-01 RT-04 IP-04 PRESSURE PSI TOTAL GAL (MILLION) STATUS PY-04 PQ-04 TOTAL GAL (MILLION) STATUS PY-04 PQ-04 TOTAL GAL (MILLION) STATUS PY-04 PQ-04 PQ-04 PQ-04 PQ-04 PENTAIR TEP4UL12 EXHAUST PACKAGE, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER 1 PLC-01 IP-05 LOGIC CONTROLLER TCP/IP COMMUNICATION BATTERY MONITOR COMM BOX TCP/IP COMMUNICATION BATTERY CHARGE % BATTERY TEMP °F STATUS PU-04 PENTAIR TEP4UL12 EXHAUST PACKAGE, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER 1 E4-05 PENTAIR LED24V15 LED LIGHT BAR, ADJ ANGLE, 24 Vdc, 470 LUMEN MIN, DAISY-CHAIN CABLES #LGCABLE24 (2), #								TION	E4-03	PENTAIR	TFP41UL12	COOLING FAN PACKAGE, 120Vac, 17 W, 55 CFM, COMPOSITE HOUSING, PLENUM, GUARD, AND GRILLE, DISPOSABLE FILTER	1
C PLC-01 IP-05 LOGIC CONTROLLER TCP/IP COMMUNICATION BATTERY MONITOR COMM BOX TCP/IP COMMUNICATION BATTERY CHARGE % BATTERY TEMP °F STATUS YY-08 YY-08 PENTAIR LED LIGHT BAR, ADJ ANGLE, 24 Vdc, 470 LUMEN MIN, DAISY-CHAIN CABLES #LGCABLE24 (2), #LGCABLE24 (2), #LED24V15 ABLES #LGCABLE24 (2), #LGCABLE24 (2), #LED24CORD (1), #LDSWITCH72 (1) 4 BM-01A IP-06 BATTERY MONITOR COMM BOX TCP/IP COMMUNICATION BATTERY CHARGE % BATTERY TEMP °F STATUS JY-01 TT-02 YY-09 JY-01 TT-02 YY-09 ALFSWD DOOR SWITCH, DOOR ACTIVATED 1 E4-06 PENTAIR ALFSWD DOOR SWITCH, DOOR ACTIVATED 1 E4-07 PENTAIR ALFSWD LIGHT SWITCH, MANUAL 1 E4-08 PENTAIR ALFSWD LIGHT SWITCH, MANUAL 1 E4-08 PENTAIR ATEMNO FAN THERWOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 1 1			WM-55-01	RT-04		IP-04	FLOW METER FLOW IN COMMUNICATION	FY-04 PY-04 FOX 04	E4-04	PENTAIR	TEP4UL12	EXHAUST PACKAGE, COMPOSITE HOUSING, PLENUM, AND GRILLE, DISPOSABLE FILTER	1
BM-01A BATTERY MONITOR COMM BOX TCP/IP JY-01 E4-06 PENTAIR ALFSWD DOOR SWITCH, DOOR ACTIVATED 1 BM-01A BATTERY CHARGE % JY-01 TT-02 YY-09 E4-06 PENTAIR ALFSWD LIGHT SWITCH, MANUAL 1 BH-01A BATTERY TEMP °F STATUS YY-09 YY-09 E4-08 PENTAIR ALFSWD LIGHT SWITCH, MANUAL 1	c			PLC-01		IP-05	STATUS		E4-05	PENTAIR	LED24V15	LED LIGHT BAR, ADJ ANGLE, 24 Vdc, 470 LUMEN MIN, DAISY-CH CABLES #LGCABLE24 (2), #LGCABLE72 (1), #LED24CORD (1), #LDSWITCH72 (1)	AIN 4
BM-01A IP-06 COMMUNICATION BATTERY CHARGE % BATTERY TEMP °F STATUS JY-01 TT-02 YY-09 J4-07 PENTAIR ALFSWM LIGHT SWITCH, MANUAL 1 E4-07 PENTAIR ALFSWM LIGHT SWITCH, MANUAL 1 LC 01 E4-08 PENTAIR ATEMNO FAN THERMOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 1							BATTERY MONITOR COMM BOX TO	CP/IP	E4-06	PENTAIR	ALFSWD	DOOR SWITCH, DOOR ACTIVATED	1
BM-UTA IP-00 DATTERY TEMP °F BATTERY TEMP °F STATUS DTA TO YY-09 IP-00 DTA TO YY-09 DTA TO YY-09 DTA E4-08 PENTAIR ATEMNO FAN THERMOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 75°F 1				DIA GAA		10.00		17.01	E4-07	PENTAIR	ALFSWM	LIGHT SWITCH, MANUAL	1
				DM-UIA		1100	BATTERY TEMP °F STATUS	TT-02 YY-09	E4-08	PENTAIR	ATEMNO	FAN THERMOSTAT, ADJUSTABLE, CLOSE-ON-RISE (NO), SET AT 75°F	1
		. Vii						11 *	10.01				1

NS-01

PLC-01

PS-01 PT-xx

RT-xx

SB-01

SPD-01

TT-01

GENERAL NOTES: NOT ALL ITEMS OF MATERIAL ARE INCLUDED IN THIS SCHEDULE ALL ITEMS ARE TO BE PROVIDED (FURNISHED AND INSTALLED) CONDUIT SIZES ARE FOR EMT - WIRE SIZES ARE FOR THHN/THWN CU AN = AS NEEDED XX = SEQUENTIAL I.D. NUMBER STARTING AT 01

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SCHNEIDER

NUMBERED NOTES: 1 REFER TO SPEC 40 7113 2 REFER TO SPEC 27 5410 3 FURNISHED BY THE GOVERNMENT - RECEIVE, INSTALL, CONNECT, AND INTEGRATE

19135A24

ETHERNET NETWORK SWITCH

TEMPERATURE TRANSMITTER

POWER SUPPLY

SHELF BRACKETS

PROGRAMMABLE LOGIC CONTROLLER

PRESSURE TRANSMITTER, 4-20 mA, 24 Vdc

6671-TVS1HWA80X SURGE PROTECTION DEVICE, 120/240 Vac 1 PHASE, 80 KA PEAK, SINE WAVE TRACKING, -54 dB EMI/RFI FILTERING, 200 KA SCCR, DRY ALARM CONTACTS

FLOW METER, ELECTRO-MAGNETIC, REMOTE DIGITAL SIGNAL PROCESSOR, 24 Vdc



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1,;;	TRAFFIC SIGNS, J DEVICE DAMAGI REQUIR CONSTR	C CONTRO ARROW PA S. THEY W ED, REMO ED, RESE RUCTION,	DL DEVIC ANELS, F /ILL BE F VED, WH T IF NEC AND REM	ES INCLUDE PORTABLE F URNISHED, I IEN TEMPOR CESSARY D MOVED ENTI	E, BUT ARE NOT LIN LASHING BEACONS INSTALLED, MAINTA RARILY NOT IN USE URING THE PROGR RELY WHEN THE P	NITED T S AND (AINED, RETU RESS O ROJEC	O BAR CHANN REPLA RNED F T IS C	RICA ELIZI ACED, WHEN OMPL	DES, NG , IF N	
2	WORK (CONTRO OFFICIA	ON THE PR OL PLAN D	ROJECT	WILL NOT BE ARE IN PLAC	STARTED UNTIL A	LL REC	QUIREE HE AWA) TRA ARDIN	FFIC IG	
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4.	BASED (ON SIGHT ONS OF SI	DISTAN	CE AND OTH	ER CONSIDERATIO	NS, TH	ie fina Ardin	IG OF	FICIA	AL.
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 ALL SIGN MATERIAL WILL BE SOUND AND DURABLE TO THE DEGREE NECCESSARY FOR MAINTAINING EFFECTIVE AND NEAT APPEARING TR CONTROLS, AND: 										
	a SiGN OTHI	I PANELS I ER SUITAE	MAY BE I	FABRICATED ERIAL	FROM PLYWOOD,	STEEL	., ALUN	INUN	I, OR	
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 d. PORTABLE OR TEMPORARY MOUNTING WILL NOT BE CONSTRUCTED OR WEIGHTED BY ANY METHOD OR MATERIAL THAT MAKES IT HAZARDOUS TO TRAFFIC. 										
I RAFFIC: CERTAIN POST SIZES AND SHAPES REQUIRE A "BREAKAWAY" DEVICE. OTHER POST DESIGNS OR SYSTEMS REQUIRE THE SUBMITTAL OF AN FHWA LETTER OF ACCEPTANCE TO THE AWARDING OFFICIAL PRIOR TO USE.										
8.	SIGNS M BOTTOM PAVEME SUBCOI CONFO CONSTI SIGNED SUBCOI	MOUNTED MOF THE ENT ELEV/ AN AND FO NTRACTO RMING TO RUCTION (MOATED B NTRACTO	ON BAR SIGNS W ATION R'S CER SECTIO OF ROAE Y THE TO R, PRIOF	RICADES, M. ILL NOT BE IG REVISION TIFIED TRAF N 156.08 OF OS AND BRID CS; REVIEWE TO FORWA	AY BE AT LOWER H LESS THAN ONE F(S SHALL BE PREP, FIC CONTROL SUP THE STANDARD S) OGES ON FEDERAL DO/SIONED/DATED/ RDING TO THE AW	ARED E ERVISO PECIFIO HIGHV (BY TH (ARDIN)	S, BUT BOVE 1 DR (TC CATION VAY PR E G OFFI	S) SFC SI SFC CIAL	R CTS;	
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C57500-DWG-INFR-TC-1000 LA-UR-17-31305

WER DONALD YARDMAN

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KEYED NOTES:

1 PHASE A - WATER LINE WORK
2 PHASE B - WATER LINE WORK
3 PHASE C - WATER LINE WORK
PHASE D - WATER LINE WORK

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1. IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.

KEYED NOTES

- SUBCONTRACTOR TO MAINTAIN ACCESS DURING CONSTRUCTION
- 2 DIRECTIONAL DRILL LOCATION. IF PIT IS WITH IN 16-FT OF DRIVING LANE, TEMPORARY CONCRETE WALL BARRIER WITH IMPACT ATTENUATORS SHALL BE USED TO PROTECT THE PIT.
- 3 OPEN TRENCH SEGMENT.
- DIRECTIONAL DRILL SEGMENT.

LEGEND

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- C TRAFFIC CONTROL VERTICAL PANELS
- -P-PEDESTRIAN BARRICADE

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2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.

KEYED NOTES

1 OPEN TRENCH SEGMENT

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- TRAFFIC DIRECTION
- O TRAFFIC CONTROL VERTICAL PANELS
- ------ TEMPORARY STEEL BARRICADE
- -P-PEDESTRIAN BARRICADE

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- 2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.
- SUBCONTRACTOR SHALL MINIMIZE PARKING LOT STALL CLOSURES, REROUTE TRAFFIC IF DIRECTIONAL DRILLING PITS END UP IN PARKING LOT DRIVING LANES.

KEYED NOTES

- DIRECTIONAL DRILL LOCATION. IF PIT IS WITH IN 16-FT OF DRIVING LANE, TEMPORARY CONCRETE WALL BARRIER WITH IMPACT ATTENUATORS SHALL BE USED TO PROTECT THE PIT.
- 2 DIRECTION DRILL SEGMENT.
- 3 OPEN TRENCH SEGMENT.
- PROVIDE TEMPORARY WALL BARRIER FOR PITS IN PARKING AREA

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- TRAFFIC CONTROL VERTICAL PANELS
- ----P--- PEDESTRIAN BARRICADE

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- 2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.
- SUBCONTRACTOR SHALL MINIMIZE PARKING LOT STALL CLOSURES. REROUTE TRAFFIC IF DIRECTIONAL DRILLING PITS END UP IN PARKING LOT DRIVING LANES.

KEYED NOTES

- DIRECTIONAL DRILL LOCATION. IF PIT IS WITH IN 16-FT OF DRIVING LANE, TEMPORARY CONCRETE WALL BARRIER WITH IMPACT ATTENUATORS SHALL BE USED TO PROTECT THE PIT.
- 2 DIRECTION DRILL SEGMENT.
- PROVIDE TEMPORARY WALL BARRIER FOR PITS IN THE PARKING AREA.
- 4 OPEN TRENCH SEGMENT.

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- TRAFFIC DIRECTION
- TRAFFIC CONTROL VERTICAL PANELS
- -PEDESTRIAN BARRICADE

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KEYED NOTES	
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2 ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION,

KEYED NOTES

- 1 SUBCONTRACTOR TO MAINTAIN ACCESS DURING CONSTRUCTION.
- DIRECTIONAL DRILL LOCATION. IF PIT IS WITH IN 18-FT OF DRIVING LANE, TEMPORARY CONCRETE WALL BARRIER WITH IMPACT ATTENUATORS SHALL BE USED TO PROTECT THE PIT.
- 3 DIRECTION DRILL SEGMENT
- (4) OPEN TRENCH SEGMENT

LEGEND

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA

TEMPORARY CONCRETE WALL BARRIER

WORK ZONE IMPACT ATTENUATOR

- TRAFFIC DIRECTION
- TRAFFIC CONTROL VERTICAL PANELS þ
- *---* TEMPORARY STEEL BARRICADE
- -PEDESTRIAN BARRICADE

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2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.

KEYED NOTES

- SUBCONTRACTOR TO MAINTAIN ACCESS DURING CONSTRUCTION.
- 2 OPEN TRENCH SEGMENT
- 3 SUBCONTRACTOR SHALL SPLIT WORK UP IN ORDER TO KEEP PARKING AND PEDESTRIAN ACCESS AVAILABLE TO THE BUILDINGS.

LEGEND

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- TRAFFIC CONTROL VERTICAL PANELS
- -P-PEDESTRIAN BARRICADE

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- 2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION.

KEYED NOTES

- (1) OPEN TRENCH SEGMENT.
- 2 TRAFFIC SIGNALS SHALL FLASH RED. COORDINATE SIGNAL ADJUSTMENT WITH LANL TRAFFIC ENGINEER

LEGEND

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
- TYPE III BARRICADE
- WORK ZONE AREA
- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
- TRAFFIC DIRECTION
- þ TRAFFIC CONTROL VERTICAL PANELS
- *----* TEMPORARY STEEL BARRICADE

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GENERAL NOTES:

1 IF THIS SHEET IS NOT 24"X36" USE GRAPHIC SCALE ACCORDINGLY.

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- 2. ALL STATIONING IS BASED OFF OF THE CENTERLINE OF WATERLINE CONSTRUCTION,
- 3. TEMPORARY STEEL BARRICADE TO BE PROVIDED BY LANL,

KEYED NOTES

SUBCONTRACTOR TO MAINTAIN ACCESS DURING CONSTRUCTION.
 OPEN TRENCH SEGMENT.

LEGEND

- TRAFFIC CONTROL SIGN
- TRAFFIC CONTROL DRUM
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1	SUBCONTRACTOR TO MAINTAIN ACCESS DURING CONSTRUCTION
2	DIRECTIONAL DRILL LOCATION, IF PIT IS WITH IN 16-FT OF DRIVING LANI TEMPORARY CONCRETE WALL BARRIER WITH IMPACT ATTENUATORS SHALL BE USED TO PROTECT THE PIT.
3	DIRECTION DRILL SEGMENT
4	OPEN TRENCH SEGMENT.
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- 3. STEEL BARRICADE TO BE PROVIDED BY LANL.

KEYED NOTES

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- 2 DIRECTION DRILL SEGMENT
- 3 OPEN TRENCH SEGMENT,

LEGEND

- TRAFFIC CONTROL SIGN
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- TYPE III BARRICADE
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- TEMPORARY CONCRETE WALL BARRIER
- WORK ZONE IMPACT ATTENUATOR
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ENCLOSURE 3

100% Settlement Water Line Improvement and Metering Upgrade Project Technical Specifications -1/19/2018

EPC-DO: 17-052

LA-UR-17-31305

JAN 3 1 2018

Date:

Settlement Water Line Replacement and Metering

Project ID No. 103356

Specifications

TA-99

NMED Review Package

Revision C

January 19, 2018



Wilson & Company, Inc., Engineers & Architects 4900 Lang Ave, Suite 100 Albuquerque, NM 87109

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Settlement Water Line Replacement and Metering

Project ID No. 103356

Date	Revision	Description	Prepared By:	Approved By:
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Specifications

For

Settlement Water Line Replacement and Metering

Los Alamos National Laboratory

Project ID No. 103356

NMED Review Package

Revision C

January 19, 2018

Prepared By: Wilson & Company, Inc., Engineers & Architects 4900 Lang Ave, Suite 100 Albuquerque, NM 87109

SUBMITTED Brian Ambrogi, PE Wilson & Company, Inc. Engineers & Architects APPROVED Aaron Hobson LANL PE

CLASSIFICATION XXXX XXXXXXX ADC

Sup**Errotosal re**ct**3**nical Specification List 100% Submittal

Replacement and Metering

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01 2500	В	Substitution Procedures EM01	LANIL Master Spec				
01 2300	B	Submittal Procedures, EM02, EM03	LANL Master Spec				
01 3545	В	Water Discharge Requirements	LANL Master Spec				
01 3045	В	Quality Requirements	LANL Master Spec				
01 4000	B	Definitions	LANL Master Spec				
01 4210	B	Offsite Welding and Joining Requirements	LANL Master Spec				
01 4444	В	Onsite Welding and Joining Requirements	LANL Master Spec				
01 4455	A	Temporary Controls and Compliance Requirements	LANL Master Spec				
01 5705	В	Product Requirements	LANL Master Spec				
01 7700	В	Closeout Procedures	LANL Master Spec				
01 7823	В	Operation and Maintenance Data	LANL Master Spec				
01 7839	В	Project Record Documents	LANL Master Spec				
017035		CONCRETE	LANE Master Spee				
03 3001	В	Reinforced Concrete	I ANI Master Spec				
03 3053	A	Miscellaneous Cast-in-Place Concrete	LANL Master Spec				
03 6000	В	Grouting	LANL Master Spec				
03 6001	A	Grouting of Water Mains	WCI Spec				
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22 0529	В	Hangers and Supports for Plumbing Piping and Equipment	I ANI Master Spec				
ELECTRICAL							
26 0050	В	Basic Electrical Materials and Methods	LANL Master Spec				
26 0519	В	Low Voltage Electrical Power Conductors and Cables	LANL Master Spec				
26 0526	В	Grounding and Bonding for Electrical Systems	LANL Master Spec				
26 0529	В	Hangers and Supports for Electrical Systems	LANL Master Spec				
26 0533	В	Raceway and Boxes for Electrical Systems	LANL Master Spec				
26 0553	В	Identification for Electrical Systems	LANL Master Spec				
26 0813	В	Electrical Acceptance Testing	LANL Master Spec				
26 2726	В	Wiring Devices	LANL Master Spec				
26 2813	В	Fuses	LANL Master Spec				
26 2818	В	Enclosed Switches	LANL Master Spec				
26 4300	В	Surge Protective Devices	LANL Master Spec				
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27 5410	В	Instrumentation	LANL Master Spec				
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31 2000	В	Earth Moving	LANL Master Spec				
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32 1216	В	Asphalt Paving	LANL Master Spec				
32 9219	В	Seeding	LANL Master Spec				
32 9223	В	Sodding	LANL Master Spec				
		UTILITIES					
33 1000	В	Water Utilities	LANL Master Spec				
33 1001	A	Fusible Polyvinylchloride (PVC) Pipe and Installation for Pressure Systems with Horizontal Directional Drill (HDD) Instructions	WCI Spec				
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Sup**Errotosal re**ct**3**nical Specification List 100% Submittal

PROCESS INTERCONNECTIONS

Project: LANUASettRenert31/805r Line

Replacement and Metering

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Electromagnetic Flow Measuring System

Endress-Hauser

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Specifications and general provisions of the Subcontract, including contractual Exhibits, related attachments, and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions for products, fabrication, or installation methods.
 - 1. Substitutions shall only be considered prior to bidding and according to the terms outlined in the Subcontract Documents. Formal acceptance of proposed substitutions shall be distributed to bidders prior to the bid date.
 - 2. Substitution requests submitted after the bid date will only be considered when circumstances do not allow products or methods to be met as defined in the Subcontract documents.
- B. Related Requirements:
 - 1. Section 01 3300 Submittal Procedures
 - 2. Section 01 6000 Product Requirements

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Subcontract Documents and proposed by Subcontractor.
 - 1. Substitutions for Cause: Changes proposed by Subcontractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Subcontractor or LANL that are not required in order to meet other Project requirements but may offer advantage to Subcontractor or LANL. Substitutions for convenience shall be considered prior to bidding only.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

- 1. Substitution Request Form: Use LANL's Substitution Request Form, FM01, available in Word below 01 2500 at http://engstandards.lanl.gov/specs.shtml#01.
- 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by LANL and separate Subcontractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of A/E of Record and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES or applicable code organization or similar third party.
 - j. Detailed comparison of Subcontractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Subcontract Time. If specified product or method of construction cannot be provided within the Subcontract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Subcontract Sum.

- I. Subcontractor's certification that proposed substitution complies with requirements in the Subcontract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Subcontractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. A/E of Record's Action: If necessary, A/E of Record will request additional information or documentation for evaluation within seven 7days of receipt of a request for substitution. A/E of Record will notify Subcontractor through LANL STR of acceptance or rejection of proposed substitution within fifteen 15 days of receipt of request, or seven 7 days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Design Revision Notice (DRN), Field Change Notice (FCN), or Field Change Request (FCR) for changes in the Work.
 - b. Use product specified if A/E of Record does not issue a decision on use of a proposed substitution within time allocated.
- 4. LANL's acceptance or denial to substitution requests shall be documented by addendum.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: A/E of Record will consider Subcontractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, A/E of Record will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- b. Requested substitution provides sustainable design characteristics that specified product provided.
- c. Substitution request is fully documented and properly submitted.
- d. Requested substitution will not adversely affect Subcontractor's construction schedule.
- e. Requested substitution has received necessary approvals of authorities having jurisdiction.
- f. Requested substitution is compatible with other portions of the Work.
- g. Requested substitution has been coordinated with other portions of the Work.
- h. Requested substitution provides specified warranty.
- i. If requested substitution involves more than one subcontractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all subcontractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: A/E of Record will consider requests for substitution if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of A/E of Record.
 - 1. Conditions: LANL STR and/or A/E of Record will consider Subcontractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, A/E of Record will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers LANL a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities LANL must assume. LANL's additional responsibilities may include compensation to A/E of Record for redesign and evaluation services, increased cost of other construction by LANL, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Subcontract Documents.
 - c. Requested substitution is consistent with the Subcontract Documents and will produce indicated results.

- d. Requested substitution provides sustainable design characteristics that specified product provided.
- e. Substitution request is fully documented and properly submitted.
- f. Requested substitution will not adversely affect Subcontractor's construction schedule.
- g. Requested substitution has received necessary approvals of authorities having jurisdiction.
- h. Requested substitution is compatible with other portions of the Work.
- i. Requested substitution has been coordinated with other portions of the Work.
- j. Requested substitution provides specified warranty.
- k. If requested substitution involves more than one subtiersubcontractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all subtier Subcontractors involved.

PART 3 - EXECUTION (Not Used)

END OF MAIN SECTION; FORM FOLLOWS

FORM 01: SUBSTITUTION REQUEST (SUB)

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 2500 Rev. 3, dated May 18, 2016.

Section 1 Completed by Subcontractor					
Project:					
Project Number:		Date:			
From:		·			
Spec Section/Rev:	Article/Paragraph:	Page:			
Specification Title:					
Item Description:	Including manufacture/model/type/part numbers				
Proposed substitution affects a Section 01 3300 submittal? No Yes; Explain which:					
Proposed Substitution:	Including manufacture/model/type/part numbers				
Manufacturer:	Address:				
History: 🗌 New Prod	luct 1-4 years old 5-10 years old More than 10 years	old 🗌 Unknown			
 Point-by-point comparative data attached Differences between proposed substitution and specified product: 					
Reason for not providing specified items: Cause Convenience Explain:					
Proposed substitution affects other parts of work: No Yes; Explain:					
Previous successful use of substitution:					
Project:					

Date Installed:		AE:			
Address:			Owner:		
Dollar savings to LANL for accepting substitution:		\$			
Subcontract time changes: No Yes Add Deduct days.					
Supporting Data Attached: Drawings Product Data Samples Tests Reports Other (specify)					

The Undersigned certifies that, except as noted:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service or source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the work as necessary for accepted substitution will be complete in all respects.

Submitted by:	
Signed by:	
Firm:	
Address:	
Telephone:	
Attachments:	
Additional Comments: Subcontractor Sub-Tier Supplier Manufacturer	

Upon completion of the above, forward to LANL Project entity identified to receive submittals in Section 01 3300, Submittal Procedures.

Section 2 – Design Agency Action

Substitution <u>approved</u> – Make submittals accordance with Specification 01 2500 Substitution Procedures and 01 3300 Submittal Procedures
Substitution <u>approved as noted</u> – Make submittals accordance with Specification 01 2500 Substitution Procedures and 01 3300 Submittal Procedures
 Substitution <u>rejected</u> – Use specified materials. Substitution request received too late, so <u>rejected</u>. Use specified materials.
Note to Design Agency on Non-Structural Systems and Components, and Non-Building Structures: For architectural, mechanical or electrical system or component, or non-building structure, the component/structure should also be reviewed by the design structural engineer for anchorage and support. If and when approved, the design structural engineer shall make any necessary anchorage and support revisions to the construction specifications and drawings associated with the component/structure.

Signed for Design Agency by: _____ Date: _____

Section 3 – LANL Concurrence with Design Agency (External Design-Build Only)

When project is design-build by an outside firm, LANL SME must concur with design-agency action; SME may sign directly or LANL Project Engineer may sign for LANL upon SME concurrence (N/A otherwise).

Final Acceptance for LANL by:	Date:	
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SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Transmittal of submittals
- B. Submittal procedures
- C. Definition of submittal types for construction
- D. Use of electronic CAD and BIM files of Project Drawings
- E. Delegated design submittals and procedures
- F. Submittals for contract closeout
- G. Submittal list (log) Attachment A
- H. Forms for transmittal and review

1.2 RELATED SECTIONS

- A. Section 01 4000 Quality Requirements
- B. Section 01 7700 Closeout Procedures
- C. Section 01 7823 Operation and Maintenance Data
- D. Section 01 7839 Project Record Documents

1.3 DEFINITIONS

- A. A/E: The architect-engineer of record.
- B. Action Submittals: Written and graphic information and physical samples that require the A/E's responsive action. Action submittals are indicated in individual Specification Sections as such.
- C. Informational Submittals: Written or graphic information and physical samples that do not require the A/E responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are indicated in individual Specification Sections as such.
- D. Sustainable Design Submittals: Written and graphic information and physical samples that require the A/E responsive action. Sustainable design submittals are indicated in individual Specification Sections as such.
- E. Close-out Submittals: Written and graphic information and extra stock materials that require A/E responsive action. Close-out submittals are indicated in individual Specification Sections as such.
- F. Delegated Design Submittals: Product's and systems complying with specific performance and design criteria prepared by a design professional. Delegated

design submittals require A/E responsive action. Delegated design submittals are indicated in individual Specification Sections as such.

G. LANL Concurrent Review: Those submittals identified in Attachment A as "LANL Concurrent Review" or otherwise indicated in individual Specification Sections as requiring review by LANL SMEs. "Consecutive review" is similar but means LANL SME review after AE review.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by A/E and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subtier Subcontractors, the schedule of values, and Construction Subcontractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Construction Subcontractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format:
 - a. Use LANL Construction Submittal Log (Att A)
 - b. Obtain electronic submittal log from the LANL Construction STR (e.g., at the pre-construction conference).

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Transmittal of Submittals:
 - 1. Provide submittals as indicated in the specific specification sections.
 - 2. Use a LANL Submittal Transmittal Form FM01 to transmit submittals at the times specified in the Log.
 - a. Obtain electronic version of Submittal Transmittal Form FM01 at the preconstruction conference for use during construction or at <u>http://engstandards.lanl.gov/specs.shtml#01</u>
- B. A/E Digital Data Files: Electronic digital files of the Construction Subcontract Drawings will be provided by A/E for Construction Subcontractor's use in preparing submittals.

- 1. A/E will furnish Construction Subcontractor one set of digital data drawing files of the Contract Drawings for use in preparing Submittals, Shop Drawings, Delegated Design Submittals, and Project record drawings.
 - a. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD Civil3D 2013 version or newer.
 - b. Construction Subcontractor shall execute a data licensing agreement in the form of Agreement form acceptable to LANL and A/E.
- 2. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
 - a. Use of files is solely at receiver's risk. A/E 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 Construction Subcontract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Construction Subcontract Documents, notify A/E of discrepancy and use information in hard-copy Drawings and Specifications.
 - b. CAD files do not necessarily represent the latest Construction Subcontract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
 - c. User is responsible for removing information not normally provided on shop drawings and removing references to Construction Subcontract Documents. Shop Drawings submitted with information associated with other trades or with references to Construction Subcontract Documents will not be reviewed and will be immediately returned.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal. In general, submitting earlier than required is always allowed/preferable.
 - 3. Submit close-out submittals required by the same Specification Section as separate package under separate transmittal as indicated on approved submittal schedule.
 - 4. Submit delegated design submittals required by same Specification Section as under the same transmittal.

- 5. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. A/E reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on A/E's receipt of submittal. No extension of the Subcontract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including submittals.
 - 1. Product data, samples, design data, test reports, qualification data and certifications: Allow five (5) working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. A/E will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
 - 2. Shop drawings, coordination drawings, sustainable design and delegated design submittals: allow 10 working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. A/E will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
 - 3. Close-out submittals: Allow 10 working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. A/E will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
 - 4. LANL Concurrent Review: Where the Subcontract Documents indicate that submittals may be transmitted simultaneously to A/E and to LANL SMEs, allow 10 working days for review of each submittal. Submittal will be returned to A/E, before being returned to Construction Subcontractor.
 - 5. Intermediate Review: If intermediate submittal is necessary, process it in same manner as specific submittal type.
 - 6. Resubmittal Review: Allow 10 working days for review of each resubmittal.
 - 7. The Construction Subcontractor shall allow a minimum of five working days after completion of the submittal review for return of submittals.
- E. Submittal Review
 - 1. After review of the submittal package the "Status Code" will be chosen and result returned to the Construction Subcontractor. A/E will document submittal review comments on a Submittal Review Record form FM03 or electronic equivalent (e.g., DRS). Retain submittal review comments with the submittal documents.
 - 2. LANL SMEs will document concurrent submittal review comments on the LANL Submittal Review Record form FM03 or electronic equivalent (e.g.,

DRS). Retain concurrent submittal review comments with the submittal documents.

- 3. Delegated Design: The Construction Subcontractor shall complete the Delegated Design Review Initiation section of the FM02 form and submit the form with the Delegated Design Review documents to the LANL STR. A/E and LANL SMEs will document Delegated Design review comments on the form. Retain delegated design submittal review comments with the submittal documents. LANL Delegated Design Review Record form FM02 template is located in the LANL Master Specifications General Requirements Index at http://engstandards.lanl.gov/specs.shtml#01.
- F. LANL will utilize the following "Status Codes" to indicate the status of submittals resulting from the review, and the action required of the Subcontractor.
 - 1. Final Unrestricted Release: Where the submittal is statused "**Reviewed-Work may proceed**," the Work covered by the submittal may proceed provided it complies with the Subcontract Documents. Final acceptance will depend on that compliance.
 - 2. Final-but-Restricted Release: Where the submittal is marked "**Reviewed-Revise and resubmit. Work may proceed**," the Work covered by the submittal may proceed provided it complies both with AE/LANL notations and corrections on the submittal and the Subcontract Documents. Final acceptance will depend on that compliance.
 - 3. Resubmit: Where the submittal is marked "**Reviewed. Revise and resubmit. Work may not proceed**, do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to AE/LANL notations and corrections.
 - 4. Rejected: Where the submittal is marked "**Reject**," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
 - 5. Other Action: If the submittal is primarily for information purposes, record purposes, special processing, or other Subcontractor activity, the submittal will be returned marked "**Permission to proceed not required**."
- G. Physical (non-electronic) Submittals: Paper submittals are strongly discouraged, so physical submittals should be limited to items such as samples and mockups. Submit the LANL Submittal Transmittal Form FM01 electronically and follow by delivery of physical submittal to LANL Records Management. Place a permanent label or title block on each submittal item for identification with same identifying information as the LANL Submittal Transmittal form FM01.
 - 1. Submittal number shall be composed of "SBT", a hyphen, the LANL construction subcontract number, a hyphen, the spec section number using an underscore vice the space, another hyphen, and the submittal's sequential number from the log. Example: SBT-258018-01_4444.
 - 2. Additional Copies: Unless additional copies are required for final submittal, and unless A/E observes noncompliance with provisions in the

Construction Subcontract Documents, initial submittal may serve as final submittal.

- 3. Transmittal for Physical Submittals: Assemble each submittal individually and appropriately for transmittal and handling. A/E will return without review submittals received from sources other than Construction Subcontractor.
- H. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittals of a single Submittal Log item and Submittal Transmittal Form FM01 with links enabling navigation to each item. Other methods (e.g., bundling of like submittals or all submittals for a Spec section) require the approval of LANL STR.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. Submittal number shall be composed of "SBT", a hyphen, the LANL construction subcontract number, a hyphen, the spec section number using an underscore vice the space, another hyphen, and the submittal's sequential number from the log. Example: SBT-258018-01_4444.
 - 3. Transmittal Form for Electronic Submittals: Use LANL Submittal Transmittal Form FM01. PDF the form and combine with submittal pdf into a single pdf file.
 - 4. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate specification section.
 - c. Manufacturer name.
 - d. Product name.
 - e. <Insert required information>.
- I. Options: Identify options requiring selection by A/E.
- J. Deviations from offsite fabrication Contract Requirements: Submit Supplier Deviation Disposition Request (SDDR) Form 2178.
- K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.

- 3. Resubmit submittals until they are marked with approval notation from A/E's status code.
- L. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- M. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from A/E status code.
- PART 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - Submit electronic submittals via email as PDF electronic files to the LANL SI-DC (project-dcrm@lanl.gov unless another email is provided). Copy (cc) the STR unless they have indicated they do not want to be copied. When over 20MB, use transfer.lanl.gov.
 - a. LANL will retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit each submittal unless otherwise indicated.
 - 3. Informational Submittals: Submit of each submittal unless otherwise indicated. Project will not return copies.
 - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Calculations (CA): Prepare design calculations to document analytical determinations to reflect the basis for selection of systems and components. Room numbers, equipment nomenclature, fixture numbers, zone numbers or any other designations must be consistent with those indicated on the drawings or specifications. Calculations must be checked, reviewed, sealed when required and dated by the designer and checker, and complete in all respects.
- C. Welding Certificates (CT): Prepare written certification that welding procedures and personnel comply with requirements in the Construction Subcontract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- D. Installer Certificates (CT): Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Construction Subcontract Documents and, where required, is authorized by manufacturer for this specific Project.
- E. Manufacturer Certificates (CT): Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Construction Subcontract Documents. Include evidence of manufacturing experience where required.
- F. Product Certificates (CT): Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Construction Subcontract Documents.
- G. Material Certificates (CT): Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Construction Subcontract Documents.
- H. Design Data (DD): Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- I. Installation Instructions (II): Provide manufacturer's approved instructions for installation, step-by-step if necessary, showing the field installation of parts, components, equipment, and other similar items.
- J. Maintenance Data (OM): Comply with requirements specified in Section 01 7823, *Operation and Maintenance Data.*
- K. Closeout Submittals and Maintenance Material (OM) Submittals: Comply with requirements specified in Section 01 7700, *Closeout Procedures.*
- L. Product Data (PD): Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
- f. Application of testing agency labels and seals.
- g. Notation of coordination requirements.
- h. Availability and delivery time information.
- 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - b. Five paper copies of Product Data unless otherwise indicated. A/E will return one copy.
- M. Product Schedule (PS): As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Construction Subcontract Documents or assigned by Construction Subcontractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- N. Qualification Data (QD): Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- O. Project Record Documents (RD): Comply with requirements specified in Section 01 7839 Project Record Documents.
- P. Samples/Colors (SC): Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
- 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
- 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
- 4. Disposition: Maintain sets of approved Samples at Project site, available for quality control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as LANL's property, are the property of Construction Subcontractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. A/E will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three 3 sets of Samples. A/E will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

- i. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- ii. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three, 3, sets of paired units that show approximate limits of variations.
- Q. Shop Drawings (SD): Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Construction Subcontract Documents or standard printed data unless submittal based on A/E's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Construction Subcontract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - 4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
 - b. Refer to Section 01 3100 *Project Management and Coordination* for requirements for coordination drawings.
- R. Spare Parts and Maintenance Materials (SP): Submit spare parts, extra materials and maintenance materials in quantities, sizes, finishes and colors as identified in each specific specification. Parts and materials to be in manufacturer's original packaging with original labeling. Identify location where parts or materials are installed within facility.

- S. Test and Inspection Reports and Schedule of Tests and Inspections (TR) Submittals: Comply with requirements specified in Section 01 4000, *Quality Requirements*.
- T. Material Test Reports (TR): Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Construction Subcontract Documents.
- U. Product Test Reports (TR): Submit written reports indicating that current product produced by manufacturer complies with requirements in the Construction Subcontract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- V. Research Reports (TR): Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- W. Preconstruction Test Reports (TR): Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Construction Subcontract Documents.
- X. Compatibility Test Reports (TR): Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- Y. Field Test Reports (TR): Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Construction Subcontract Documents.
- Z. Warranty (WA): Submit written and executed documentation of warranties as specified in applicable specification sections. Refer to Section 01 7823, *Operation and Maintenance Data and* Section 01 7700, *Closeout Procedures*.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Construction

Subcontractor by the Construction Subcontract Documents, provide products and systems complying with specific performance and design criteria indicated.

- 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to A/E.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file signed and sealed by the responsible design professional registered in the State of New Mexico, for each product and system specifically assigned to Construction Subcontractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Construction Subcontract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Incorporate delegated design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 EXECUTION

3.1. CONSTRUCTION SUBCONTRACTOR'S REVIEW

- A. Construction Subcontractor Review: Certify that submittal has been reviewed, checked, and approved for compliance with the Construction Subcontract Documents in first section of the LANL Submittal Transmittal Form FM01. Provide any comments on the form.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 7700 *Closeout Procedures*.
- 3.2. A/E'S ACTION
 - A. Action Submittals: A/E will review each submittal, make marks to indicate corrections or revisions required, and return it. A/E will indicate status (action) code on LANL Submittal Review Form FM03 or electronic equivalent (e.g., DRS). Provide any comments on the form.
 - B. Informational Submittals: A/E will review each submittal and will not return it, or will return it if it does not comply with requirements. A/E will forward each submittal to appropriate party.
 - C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from A/E.
 - D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
 - E. Submittals not required by the Construction Subcontract Documents may be returned by the A/E without action.

3.3. DELEGATED DESIGN REVIEW

- A. Action Submittals: Design Agency for Delegated Design shall submit design documents to A/E and LANL SME(s) for concurrent review. Provide completed Delegated Design Review Record (DDRR, FM02) form with Delegated Design submittal documents.
- B. A/E will review the Delegated Design submittal and provide applicable comments on the DDRR and return it to the Design Agency.
- C. LANL SME(s) will review the Delegated Design submittal and provide applicable comments on the DDRR and return it to the Design Agency.
- D. The Design Agency for Delegated Design is responsible for incorporating DDRR comments in the Delegated Design documents prior to resubmitting the design if required and/or issuing the Delegated Design documents for construction.
- E. Partial Delegated Design submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from A/E.
- F. Incomplete Delegated Design submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

END OF MAIN SECTION; ATTACHMENT AND FORMS FOLLOW

ATTACHMENT A: CONSTRUCTION SUBMITTAL LOG

FORM 01: SUBMITTAL TRANSMITAL FORM

FORM 02: DELEGATED DESIGN REVIEW FORM

FORM 03: SUBMITTAL REVIEW FORM

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 01 3300 Rev. 5, dated June 27, 2016.

Subcontract Number:			S	STR Name:			
Project ID Number: Project Title with Tec				al A	Area-Building:		
LANL Self-perform Date Self-perform			ıbmitte	ed:		Review Due Date:	
Construction Subcontractor							
Spec Section and Title:			Rev.	 Submittal Sequential Number fror Submittal Description: 		uential Number from Log and cription:	
REVIEW TYPE							
🗌 Initia	Submittal of New	Document					
🗌 Re-S	ubmittal of Previou	s Document					
(Rev. 1,	2, etc.):						
	ACTION SUBMITT	ALS (Respons	ive act	tio	n required by E	OR)	
		t 🗌 dd 🗌 II	🗌 PD)] PS 🗌 SC 🔲 🗄	SD 🗌 TR 🗌 OTHER	
ы So D	INFORMATIONAL	SUBMITTALS	(Respo	ons	sive action NO	required by EOR)	
TYF boxe	CT DD QD TR WA OTHER						
AL cable	SUSTAINABLE DESIGN SUBMITTALS						
IITT applic	🗆 СТ 🗌 LD 🗌	PD 🗌 TR 🗌] OTHE	ER			
JBN eck.	CLOSE-OUT SUBMITTALS						
ته کا	OM C RD SP WA OTHER						
	DELEGATED DESIGN SUBMITTALS						
		;t 🗌 dd 🗌 II	🗌 PD)] PS 🗌 SC 🔲 🗄	SD 🗌 TR 🗌 OTHER	
	Submittals shall be el	ectronic (pdf) and	d sent in	n by	email unless the	Specification Section or LANL	
		CONT	RACI	ТО	R (LANL)		
LANL ST	R: If LANL's DRS elec	tronic review syst	em (DR	RS)	will not be used fo	r submittal routing, then STR is	
responsit Engineer-	le for initiating routing (to-STR-to-Sub and to l	(e.g., to Project ⊨ Project Records,	ngineer all using	r wh g Af	o routes to Desigr P-350-405-FM02 o	n Agency, then back through Project or successor).	
	Date Received:			0		·	
	Statused By:						
	Date:						
	Comments:						

	St	atus	s Code:			
		1	Reviewed- Work may proceed			
2 Reviewed-Revise and resubmit. Work n indicated comments.		2	Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.			
		3	Reviewed. Revise and resubmit. Work may not proceed.			
		4	Reject. Submittal does not meet requirements. Resubmit.			
		5	Permission to proceed not required.			
	Su	ıbm	it comments to:			
ATT	АСНМІ	ENT	<u>S</u>			
	Submi	ttal	Documents			
	(Reviewed Submittals to be attached electronically (PDF) to the FM03 Submittal Review Form)					
	Physical Submittals Samples/Colors/Mockups (attached or delivered)					
	Delegated Design Review Record (01 3300-FM02)					
	Submittal Review Form (01 3300-FM03)					
] Other					
1						

DDRR No.: DDRR -**1.0 DELEGATED DESIGN REVIEW INITIATION** 1.2 STR Name, Z No., Organization, Phone No.: 1.1 Subcontract No: 1.3 Project ID: 1.4 Project Title with Technical Area-Building: LANL Self-perform 1.6 Date Submitted: 1.5 1.7 Date Due: Construction Subcontractor 1.9 Submittal Description/Spec Section: 1.8 Submittal No.: 1.10 Submittal Type: CA CD CT DD II PD PS SC SD TR OTHER 1.11 Constructor: (Construction Subcontractor or LANL Self-perform) Company Name: Street Address: City, State, Zip Code: Phone: 1.12 Constructor Point of Contact: 1.13 Delegated Design Agency: (Firm that developed the Delegated Design Documents) Company Name: Street Address: City, State, Zip Code: Phone: 1.14 Delegated Design Agency Point of Contact: 1.15 Project Engineer Name, Z Number, Organization, Phone No.: 1.16 Reviewer Name, Z. No., Discipline, Organization:

Page 1 of 2

DDRR No.: DDRR -

Page 2 of 2

2.0 DELEGATED DESIGN REVIEW PROCESSING

These comments represent feedback that may or may not address the full scope of design accuracy. It is incumbent upon the Design Agency/ Construction Subcontractor to ensure that all contract provisions and specifications are met by the design or disposition of non-conformance is made to the satisfaction of LANL.

2.1 No.	2.2	2.3		2.4		2.6	2.7	2.9	2.11
	Drawing, Spec,	Comment	Comment		Action	Disposition	Reviewer's	Reviewer's	
	or Page Number			atego R	ry C	(+ or -)		initiai	Initial for "C"
					Ŭ				Comments
2.5 Reviewed By:(Signature, Z Number, Organization, Date)									
2.8 Comments Resolved By: (Signature, Z Number, Organization, Date)									
2.10 Comment Resolutions Accepted.: (Signature, Z Number, Organization, Date)									

1.1 Subcont	ntract No: 1.2 STR Name, Z No., Organization, Phone No.:								
1.3 Project	oject ID: 1.4 Project Title with Technical Area-Building:								
1.5 🗌 LAN	L Self-perform struction Subcontractor	mitted:	1.7 Date	e Due:					
1.8 Submitte	8 Submittal No.: 1.9 Submittal Description/Spec Section:								
1.10 Submit	1.10 Submittal Type: Action Submittal Informational Submittal Submittal Closeout Submittal CA CD CT DD II LD OM PD PS QD SC SD SP TR WA								
2.1 Constru Company Nan Street Address City, State, Zip Phone:	2.1 Constructor: Company Name: Street Address: City, State, Zip Code: Phone:								
2.2 Constru	ctor Point of Contact:								
2.3 A/E of F	Record: Name, Z Numbe	er, Organization, Pl	hone No.:						
2.4 🗌 Co	ncurrent LANL review [Design Agency	only review						
2.5 Complete for LANL Reviewers only Cost Code : Prog. Code : Cost Acct: Work Pkg:									
2.5 Complete	FIOR LANL Reviewers only		Frog. Code .	COST ACCT:	WORK	ng.			
2.5 complete	ideration of LANL cond	current review cor	mments received afte	r review dea	dline is discre	etionary.			
Consi	ideration of LANL cond 3.1 Rev	<i>current review cor</i> iewer (Name, Org, Pho	mments received afte	r review dea	dline is discre 3.2 Date	ationary. 3.3 Status Code			
Cons	ideration of LANL cond 3.1 Rev	<i>current review cor</i> iewer (Name, Org, Pho	mments received afte	r review deal	dline is discre	ationary. 3.3 Status Code			
2.5 Complete Const 3.4 Comment	ideration of LANL cond 3.1 Rev	<i>current review cor</i> iewer (Name, Org, Pho	mments received afte	r review dea	dline is discre	ationary. 3.3 Status Code			
2.5 Complete Const 3.4 Comment No. 1	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Pho	mments received afte	r review dea	dline is discre	ationary. 3.3 Status Code			
2.3 Complete Const 3.4 Comment No. 1 2	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Pho	mments received afte	r review deal	dline is discre	ationary. 3.3 Status Code			
2.3 Complete Const 3.4 Comment No. 1 2 3	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Ph	mments received afte	r review deal	dline is discre	ationary. 3.3 Status Code			
2.5 Complete Const Comment No. 1 2 3 4	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Ph	mments received afte	r review deal	dline is discre	ationary. 3.3 Status Code			
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2.5 Complete Const No. 1 2 3 4 5 6	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Pho	mments received afte	r review deal	dline is discre	ationary. 3.3 Status Code			
2.5 Complete Const Comment No. 1 2 3 4 5 6 7	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Ph	mments received afte	r review deal	dline is discre	3.3 Status Code			
2.5 Complete Const Comment No. 1 2 3 4 5 6 7 8	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Ph	mments received after	r review dead	dline is discre	ationary. 3.3 Status Code			
2.5 Complete Const Comment No. 1 2 3 4 5 6 7 8 9	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Pho	mments received after	r review dead	dline is discre	ationary. 3.3 Status Code			
2.5 complete Consi Consi Comment No. 1 2 3 4 5 6 7 8 9 10	ideration of LANL cond 3.1 Rev	iewer (Name, Org, Pho	mments received afte	r review dead	dline is discre 3.2 Date	ationary. 3.3 Status Code			
2.5 complete Consi Consi Consi 1 2 3 4 5 6 7 8 9 10 Insert .	ideration of LANL cond 3.1 Rev	eurrent review cor iewer (Name, Org, Pho	Organization:	r review dead	dline is discre 3.2 Date	ationary. 3.3 Status Code			

Submittal Review Form Instructions (Edit Instructions) Delete these instructions before submitting for review/comment

Completed by the PE

Field	Entry Information			
1.1	Subcontract number			
1.2	Subcontract Technical Representative information.			
1.3	Project ID			
1.4	Project title and Location (TA-XX-XXXX)			
1.5	Indicate if being constructed by LANL or a Subcontractor			
1.6	Submittal Date – Date the submittal package received by the DCC/RM POC or PE			
1.7	Review Due Date – Date reviewers are expected to return comments (typically 5 working-days)			
1.8	Submittal Number – as listed in Exhibit I or the Engineering Submittal Summary			
1.9	Submittal Description – as listed in Exhibit I or the Engineering Submittal Summary			
1.10	Submittal Type(s) – list all applicable to the documents included in the submittal package as listed in Exhibit I			

Field	Entry Information
2.1	Constructor
2.2	Constructor Point of Contact
2.3	A/E of Record POC
2.4	Indicate whether concurrent (see 01 3300 for discussion)
2.5	Complete when LANL reviewers need charge codes and not provided by ESR

Completed by the Design Agency Reviewer

Field	Entry Information				
3.1	Reviewer Name, Organization, Phone #, Date, and Status Code				
3.2	Date review completed and documented; should be the same as the date returned to the PE.				
3.3	 Status Code – Enter the number and description that defines next step actions 1. Final Unrestricted Release: Where the submittal is statused "Reviewed- Work may proceed," the Work covered by the submittal may proceed provided it complies with the Subcontract Documents. Final acceptance will depend on that compliance. 				
	 Final-but-Restricted Release: Where the submittal is marked "Reviewed- Revise and resubmit. Work may proceed," the Work covered by the submittal may proceed provided it complies both with AE/LANL notations and 				

Field	Entry Information
	corrections on the submittal and the Subcontract Documents. Final acceptance will depend on that compliance.
	3. Resubmit: Where the submittal is marked " Reviewed. Revise and resubmit. Work may not proceed , do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to AE/LANL notations and corrections.
	4. Rejected: Where the submittal is marked "Reject," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
	 Other Action: If the submittal is primarily for information purposes, record purposes, special processing, or other Subcontractor activity, the submittal will be returned marked "Permission to proceed not required."
3.4	Reviewer Comments: Document individual comments including reference to specific documents to which the comment applies; reference to design requirements, code, or regulation; and the specific issue to be addressed. Insert "No Comment" when appropriate.
3.5	Signature: Reviewer – sign, insert organization, and date when review is complete. PDF the document and return electronically to the PE.

EPC-DO: 18-052

SECTION 01 3545

WATER DISCHARGE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements for all LANL and Subcontractor personnel when there is a planned or accidental discharge of water, including those not covered by a NPDES permit, Ground Water Discharge Plan, or approved Notice of Intent (NOI).
- 1.2 RELATED SECTIONS
 - A. Section 33 1300, Disinfecting of Water Utility Distribution

1.3 DEFINITIONS

- A. Discharge: Release of water to environment or sanitary sewer system due to an accidental spill or planned construction activity, e.g., flushing, piping disinfection, chemical water treatment of piping systems, hydrostatic piping tests, etc.
- B. Best Management Practices (BMPs): Schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control facility site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. Physical practices to control facility site runoff can be, but are not limited to silt fences, graveled construction area entry/exit points, dikes, berms, wattles, ground covers, reduced discharge rates, armoring, or other such methods emplaced to eliminate erosion or transport by water of soil or other contaminants.
- PART 2 PRODUCTS

Not used.

- PART 3 EXECUTION
- 3.1 SUBCONTRACTOR REQUIREMENTS (LANL, WHEN LANL IS PERFORMING WORK)
 - A. Discharges to Environment:
 - 1. Discharges shall not cause or have the reasonable potential to cause or contribute to a violation of a water quality standard.

- 2. Employ BMPs to prevent erosion from discharge of water.
- 3. Chlorinated water used for disinfection shall be dechlorinated with a neutralizing agent per Section 22 0816 prior to discharge. If discharge is not to a watercourse (e.g., flat ground), then total chlorine concentration shall be reduced to less than 1 ppm (part per million) -- *typically the same as that in the Safe Drinking Water Act.*
- 4. Discharges to a watercourse shall have a total chlorine concentration not greater than 0.011 mg/L (11 parts per billion). (*This value is based on 1999 changes in the New Mexico stream standards that dropped chlorine limit from 1 ppm to 11 ppb).*
- 5. For discharges of less than 5000 gallons, notify LANL Subcontract Technical Representative (STR) at least 5 working days before the planned discharge.
- 6. For discharges of 5000 gallons or more, notify LANL STR at least 30 working days before the planned discharge.
- B. Discharges to Sanitary Sewer:
 - 1. Notify LANL STR prior to any discharge.
 - 2. Volumes greater than 1000 gallons shall not be discharged into the sanitary sewer systems without special approval by Sanitary Wastewater Operations Manager (665-7855) obtained via LANL STR.
 - 3. Properly characterize discharges through the Waste Stream Profile (found in the Waste Compliance and Tracking System (WCATS) process and meet the TA-46 Wastewater Treatment Plant Waste Acceptance Criteria (WAC), refer to LANL Procedure <u>P930-1</u> especially Attachment 16.
 - a. WAC limits for total chlorine concentration are 3 mg/L (3 ppm). Dechlorinate water used for disinfection in excess of 20 gallons with neutralizing agent per Section 22 0816 prior to discharge.
- C. Notify LANL STR immediately in the event of any accidental or unplanned discharge.
- 3.2 LANL REQUIREMENTS (E.G., STR)
 - A. Discharges to the Environment:
 - 1. Keep a written record of each discharge by project.
 - For planned discharges of less than 5000 gallons, notify LANL Environmental Compliance Programs Group (ENV-CP) five working days prior to the discharge. Following ENV-CP approval, complete and return attached form "Notice of Intent to Discharge/General Discharge Record" to ENV-CP, (e.g., Jacob Meadows <u>imeadows@lanl.gov</u>). Discharges will

be documented by ENV-CP and submitted to NMED in LANL's Quarterly Discharge Report.

- 3. For planned discharges of 5000 gallons or more, notify LANL ENV-CP Group at least [30 working days] in advance of the planned discharge. ENV-CP will review the proposed discharge to determine if submittal of an NOI is required. If required, ENV-CP will develop and submit the NOI to NMED (NMED has up to 30 working days to respond). ENV-CP will coordinate, if necessary, a review for potential impacts to critical habitat and Threatened and Endangered Species.
- B. Discharges to the Sanitary Sewer:
 - 1. Assist Subcontractor with characterizing discharges using Waste Stream Profile process and meeting the TA-46 Wastewater Treatment Plant Waste Acceptance Criteria (WAC) described in 3.1.B.3 above.
 - 2. Notify Sanitary Wastewater Operations Manager (665-7855) at least 5 working days in advance for approval of planned discharge into sanitary waste water system.
- C. Notify the LANL ENV-CP Group immediately in the event of any accidental or unplanned discharge.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 3545, Rev. 7, dated February 27, 2015.

NOTICE OF INTENT TO DISCHARGE

GENERAL DISCHARGE RECORD

LOCATION: TA:		BLDG:	
FIRE HYDRANT / PIPE / SEC CONTAIMENT / MANHOLE #	CONDARY t:		
USER GROUP:		CONTACT PERSON:	
PHONE:		PAGER:	
PERSON CONDUCTING SEC DRAINAGE ACTIVITY:	CONDARY CC	ONTAINMENT	
DATE and TIME of DISCHAR	RGE:		/
DURATION of DISCHARGE:			1
ENV-CP CONTACT:	Jacob Mead jmeadows@	dows, cell 231-0460 ⊉lanl.gov	fx: 665-9344,
	GE:		
VOLUME of DISCHARGE:			
CANYON AFFECTED:			
SAMPLES TAKEN:	YES:	NO:	
COMMENTS:			
REVIEWED BY:			DATE:
	ENV-C)P	

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for construction quality assurance and quality control driven, in part, by Engineering Standards Manual Chapter 16-IBC Program (International Building Code). http://engstandards.lanl.gov/ESM_Chapters.shtml#esm16
- B. Testing and inspecting services contracted by the Subcontractor are required to verify compliance with Drawings and Specification and for production of standard products and the Special Inspection required by the IBC. LANL will perform oversight inspections of these services. None of these LANL QA services relieve the Subcontractor of responsibility for compliance with the Subcontract Documents.
 - 1. Requirements for Subcontractor to provide quality-assurance and -control services may be supplemented by provisions of other sections.
 - 2. Other Sections may contain QA activities specific to those work results.
 - 3. Subcontractor is responsible to assure that any activities sub-contracted to lower-tier Subcontractors or agencies are contractually "passed-down" and Subcontractor shall assure that their sub-tier entities follow these requirements.

1.2 DEFINITIONS

- A. Subcontractor: The entity performing fabrication or physical construction activity; normally the general contractor (a subcontractor to DOE), but when LANL is self-performing the Work, LANL takes this role.
- B. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. IBC: International Building Code, published by ICC
- D. ICC: International Code Council, publisher of IBC and parent of ICC-ES.
- E. Installer/Applicator/Erector: Sub-tier subcontractor or another entity engaged by Subcontractor as an employee, or lower-tier subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations
- F. LANL Building Official (LBO): LANL's Authority for the Building Program as detailed in the Engineering Standards Manual Chapter 16-IBC Program.
- G. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics

- H. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- I. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
- J. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- K. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- L. Product Testing: Tests and inspections to establish product performance and compliance with industry standards that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to the LBO.
- M. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction complies with requirements.
- N. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include subcontract enforcement activities performed by LANL Subcontract Tech Rep (STR).
- O. Source Quality-Control Testing: Tests and inspections that are performed at the source; i.e., plant, mill, factory, or shop.
- P. SSI: Statement of Special Inspections. An inspection plan exclusively for the requirements of IBC Chapter 17, per ESM Ch 16 IBC-IP Att H template.
- Q. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- R. TIP: Test and inspection plan for Subcontractor's work based on the Specifications and Drawings and developed by Project (normally design professional in responsible charge) per ESM Ch 16 IBC-IP Att I template.

1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to LANL for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation

may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. Specified numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to LANL for a decision before proceeding.

1.4 ACTION SUBMITTALS

- A. Qualification Data: Name and address of Testing Agencies to be utilized on the project. The testing agencies will be reviewed to verify that they have been approved by the LBO in accordance with Section 1.5 A.6.
- B. Submit design/research reports/test data supporting the use of alternate materials/methods of construction not specifically prescribed by the IBC such as rebar couplers, rebar splices and post-installed anchors. Such alternate materials/methods of construction must be approved by the LBO. ICC Evaluation Services ES reports covering the testing of materials within the parameters of the materials intended use can be construed to have LBO approval.
- C. Test and Inspection Plan: Include with overall project construction schedule or submit separate schedule within **30** days prior to commencement of the Work. This can be built upon the Project (normally design agency) initiated Test and inspection plan (TIP) and Statement of Special Inspections (SSI) if present (electronic files available). For TIP, add any remaining tests and inspections required by specifications and standards or other intended inspections in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description, type, and periodicity of test and inspection
 - 3. Applicable standards.
 - 4. Test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - Entity responsible for performing tests and inspections (e.g., LANL Inspector, LBO-approved Special Inspector, or Structural Engineer-of-Record)
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

LANL will review and may add additional inspections and hold points.

Subcontractor's TIP may be produced and maintained separately from design agency's TIP with written permission of the LANL Chief Inspector.

D. Coordination by Subcontractor: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of

delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

- 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 2. Distribute schedule to LANL, AE, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
- E. Reports: Prepare and submit certified written Test and Inspection reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting, if relevant.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Subcontract requirements.
 - 12. Name and signature of responsible inspector.
 - 13. Recommendations on retesting and re-inspecting.
- F. Licenses and Certificates: For LANL's records, submit copies of licenses, certifications, correspondence, records, and similar documents used to establish compliance with standards and regulations that pertain to performance of the Work.
- G. For IBC work, each subcontractor and subtier responsible for the fabrication or erection of a main wind- or seismic-force-resisting system, designated seismic system, or a wind- or seismic-resisting component listed in the Statement of Special Inspections must submit a Statement of Responsibility per ESM Chapter 16 Section IP Att H to LANL as a submittal prior to the commencement of work.

1.5 QUALITY ASSURANCE

- A. Qualification requirements specified below establish the minimum qualification levels for the skills or organizations listed; individual Specification sections specify additional requirements.
 - 1. Installer: A firm or individual with 5 years experience in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
 - 2. Manufacturer: A firm with 5 years experience in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
 - 3. Fabricator: A firm with 5 years experience in producing products similar to those indicated for this Project and with a record of successful inservice performance, as well as sufficient production capacity to produce required units.
 - 4. Steel Fabricator Qualifications: Firms performing structural fabrication subject to IBC Chapter 17 shall be pre-approved by the LBO. In cases where the desired fabricators are not LBO-approved, or with LBO permission, Subcontractor shall arrange for the IBC-related activities to be inspected during fabrication in the shop by an LBO-approved special inspector. As an alternative, LANL may provide Special Inspectors inshop at Subcontractor's expense. Note: Special Inspection or shop approval not required for burning and cutting of mild steel (e.g., ASTM A36)If other design professionals are indicated in Specification Sections, insert qualifications here.
 - 5. Professional Engineer: An engineer registered to practice in New Mexico and experienced and registered as providing engineering services of the discipline and kind indicated. Engineering services are defined as those performed for installation of systems, assembly, or product design that is similar to those indicated for this Project in material, design, and extent.
 - 6. Testing Agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and approved by the LBO per Eng Standards Manual Chapter 16 Section IBC-TIA. LANL approved testing subcontractor shall be selected
- B. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Subcontractor responsibilities include the following:

Provide test specimens representative of proposed products and construction.

Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

Provide configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.

Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups, do not reuse products on Project.

- 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to LANL with copy to Subcontractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Subcontract Documents.
- C. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated.
 - 2. Notify LANL **7** days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain LANL's approval of mockups before starting work, fabrication, or construction. Allow **7** days for initial review and each re-review of each mockup.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups when directed, unless otherwise indicated.
- D. Subcontractor Procedures: The following must be approved by LANL before related work begins:
 - 1. Receipt inspection procedures
 - 2. Quality Assurance Manual
 - 3. Quality Control Manual/ Shop Fabrication Procedures
 - 4. Material Control Procedures

5. Nonconformance procedures

1.6 QUALITY CONTROL

- A. LANL Responsibilities: Where quality-control services are indicated as LANL's responsibility, LANL will engage a qualified testing agency to perform these services.
 - 1. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Subcontract Documents will be charged to Subcontractor, and the Subcontract Sum will be adjusted by Change Order.
- B. Subcontractor Responsibilities: Tests and inspections in TIP, SSI, and elsewhere in Specifications and Drawings that are not explicitly assigned to LANL are Subcontractor's responsibility. Unless otherwise indicated, provide quality-control services specified.
 - 1. Engage a qualified, LBO-approved, testing agency to perform qualitycontrol services.
 - 2. Subcontractor shall not employ the same entity engaged by LANL, unless agreed to in writing by LANL.
 - 3. Subcontractor shall pass quality requirements down to lower-tier subcontractors and shall enforce such requirements.
 - 4. Notify LANL STR at least **24** hours in advance of time when Work that requires testing or inspecting will be performed, unless otherwise indicated in individual Sections.
 - 5. Provide access to approved designs. The Subcontractor is responsible for providing inspectors with access to approved design.
 - 6. Submit a certified written report, in duplicate, of each quality-control service.
 - 7. Testing and inspecting requested by Subcontractor and not required by the Subcontract Documents are at Subcontractor's expense.
 - 8. Submit additional copies of each written report to LANL, when so directed.
 - 9. Manufacturer's Field Services: Where indicated, engage a factoryauthorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in submittal procedures Section 01 3300.
- C. Retesting/Re-inspecting: Provide, at Subcontractor's expense, quality-control services for retesting and re-inspecting, for replacement construction Work resulting from work that failed to comply with the Subcontract Documents.
- D. Testing Agency Responsibilities (services retained by Subcontractor): Cooperate with AE and Subcontractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

- 1. Notify AE and Subcontractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
- 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
- 3. Submit a certified written report of each test, inspection, and similar quality-control service through Subcontractor.
- 4. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
- 5. Do not release, revoke, alter, or increase the Subcontract Document requirements or approve or accept any portion of the Work.
- 6. Do not perform any duties of Subcontractor.
- E. Associated Services (actions and efforts of Subcontractor): Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide auxiliary services as requested. Notify agency in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.

1.7 SPECIAL INSPECTIONS AND TESTS

- A. Special Inspections will be conducted by LANL or LANL-approved agency where indicated in individual Specification Sections and in accordance with the SSI.
- B. Onsite Special Inspectors are provided by LANL at LANL expense.
- C. For offsite fabrication work where Subcontractor does not choose a LANL (LBO)approved fabricator, special inspection by LANL or LANL-approved agency is at Subcontractor's expense.
- D. Regardless of location, third-party testing and NDE is at Subcontractor's expense.
- E. Structural steel fabricators whose work includes seismic-force-resisting structures (SFRS) or demand-critical welds are subject to project-specific IBC reviews and approvals for processes, procedures, qualifications and materials prior to start and may require shop inspections by LANL- approved IBC Inspectors prior to, during, or post fabrication.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- 3.1 Work shall only be accomplished to LANL-approved, controlled design (Specifications, Drawings, and amendments to same such as Field Change Notices and Requests, Supplier Deviation Requests, etc.), of which a copy of latest must be maintained on the work site by Subcontractor.
 - A. This design, along with the Subcontract and applicable codes and standards included in the subcontract, specifications, and drawings shall be complied with and must be contractually "passed-down" to any sub-tier fabricators, testing agencies, or others subcontracted or assigned by the Subcontractor.
 - B. Work shall comply with the design processes and work processes described in the LANL Quality Assurance Program (QAP) document or the LANL QA-PQ approved Subcontractor QAP document.
- 3.2 ACCEPTABLE TESTING AGENCIES
 - A. Approved IBC listing at <u>http://engstandards.lanl.gov/ESM_Chapters.shtml#esm16</u>
 - B. LBO approval does not negate Subcontractors' responsibility to assure that fabricators, testing, and NDE agencies perform correctly.

3.3 REPAIR AND PROTECTION

- A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Subcontractor's responsibility, regardless of the assignment of responsibility for quality-control services.
- D. Subcontractors must comply with all LANL standard procedures and processes as specified in the Subcontract including safety, quality (such as hold tags), environmental, and other signs, tags, warnings, etc. For building work, Subcontractors shall comply with the applicable requirements of the IBC (and IEBC, as applicable) as amended by LANL in Engineering Standards Manual Chapter 16 including Appendices A and B. Where the LANL Standards including this chapter invoke the IBC, interpret to mean this LANL version of the Building Code.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 4000 Rev. 6, dated May 27, 2014.

EPC-DO: 18-052

SECTION 01 4216

DEFINITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General definitions for the Specifications and other Subcontract Documents including the Drawings.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Subcontract, including General and Special Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

Note: Basic Subcontract definitions are included in the Construction Subcontract Form of Agreement (or General Conditions, Special Conditions, etc.).

- A. A/E or Engineer of Record, or Design Professional in Responsible Charge: Architect and/or Engineer in responsible charge of the design and preparation of the bid/construction documents.
- B. Approved: When used to convey A/E of Record's action on Construction Subcontractor's submittals, applications, and requests, approved is limited to AE of Record's duties and responsibilities as stated in the Construction Subcontract.
- C. Certificate of Conformance (or Conformity): Document certified by a competent authority that the supplied goods or services meets the required specifications. Certificate of Compliance is similar but attests that the supplier of goods or services meets the specifications.
- D. Certified Material Test Reports (CMTR); Mill Traceability Report (composition); and Material Test Report (mechanical properties): All must have actual test results. CMTRs shall be certified by a nationally-accredited lab (notary not required).
- E. Construction Subcontractor: The successful third party or the Offeror. A subcontractor to the LANL Managing and Operating Contractor, LANS; the individual or legal entity that has entered into the construction agreement with LANL for the delivery of goods or services necessary for the performance of the Construction Contract. Constructor, if used, shall be taken to mean Construction Subcontractor. (Note: from April 2008 forward, "Construction Subcontractor" was generally used in LANL Master Specifications in lieu of Contractor or Constructor.) Also, when LANL chooses to self-perform work, Construction Subcontractor shall mean LANL self-perform entity (further discussed by Section 01 1117 when present).
- F. Contractor: The LANL site managing and operating contractor to NNSA Los Alamos National Security, LLC (LANS). Contractor also means Subcontract

Administrator, the individual authorized to act on the behalf of LANL. (Note: LANL Master Specifications prior to April 2008 may use the term "Contractor" to mean the Construction Subcontractor.)

- G. Contractor Furnished and Installed Equipment: Contractor will furnish and install equipment identified in Contract Documents as "by Contractor", and will coordinate work with the Construction Subcontractor.
- H. Contractor Performed Work; Contractor will perform work identified in Contract Documents "by Contractor", and will coordinate work with the Construction Subcontractor.
- I. Directed: A command or instruction from Contractor. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- J. Furnish: Supply and deliver to Project site, readying for unloading, unpacking, assembly, installation, and similar operations.
- K. Government Furnished Equipment (GFE): Term used in Subcontract Documents to refer to Contractor furnished property, products or in general to describe any Contractor furnished equipment for installation by the Construction Subcontractor in the work or used in its performance..
- L. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- M. Install: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, testing, protecting, cleaning, and similar operations.
- N. Installer: An installer is the Construction Subcontractor or another entity engaged by the Construction Subcontractor, either as an employee, lower tier construction subcontractor or subcontractor to a lower tier construction subcontractor, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- O. Los Alamos National Security, LLC (LANS): A limited liability company that manages and operates LANL under contract with the Department of Energy (DOE)/National Nuclear Security Administration (NNSA).
- P. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- Q. Provide: Furnish and install, complete and ready for the intended use.
- R. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

- S. Subcontract Technical Representative (STR): The LANL STR has technical and performance oversight of the Construction Subcontractor's Scope of Work, including but not limited to engineering, procurement, safety, quality, schedule, and coordinated execution of the Work that is carried out by the Construction Subcontractor. The STR has no authority to direct commercial or technical changes to the subcontract.
- T. Testing Agency: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification Section 01 4216 Rev. 0, dated May 23, 2017.

EPC-DO: 18-052

SECTION 01 4444 OFFSITE WELDING & JOINING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for offsite welding and joining as required by other sections of the Specification (e.g., items or assemblies fabricated specifically for LANL). This Section is not applicable to manufactured commercial items ("off-the-shelf") where welding requirements are not subject to LANL approval, nor does it apply to mechanical joints (e.g., threaded, bolted or clamped).
- B. Pressure-retaining, code-stamped items shall only be welded on by organizations with the applicable ASME or National Board Certificate(s) of Authorization. Certificate holders are organizations that have been authorized by the ASME or The National Board to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code or The National Board.
- C. Onsite welding shall be in accordance with LANL Welding Program (ESM Chapter 13), Section 01 4455 for onsite welding, and applicable codes.
- D. The LANL Welding Program and General Welding Standards (GWSs) referenced are available here: <u>http://engstandards.lanl.gov/ESM_Chapters.shtml#esm13</u>

1.2 SUBMITTALS

- A. The following documents shall be submitted and approved by LANL WPA prior to the start of welding:
 - 1. Welding/Brazing/Bonding Procedure Specifications with the associated Procedure Qualification Records (PQRs)
 - 2. Welder/Brazer/Bonder Performance Qualification Records
 - 3. Weld Filler Material Control Procedure
 - 4. Filler Material Certified Material Test Reports
 - 5. Heat Treatment Procedures (where applicable)
 - 6. Inspector qualification records
 - 7. Inspection Procedures
- B. Engineering drawings shall specify all fillet weld sizes and partial penetration weld sizes.

- C. Shop drawings shall show weld symbols and requirements to define the work and enable design review and inspection this shall include fillet weld sizes and partial penetration weld sizes.
- D. Applications that are not similar in materials or processes to a specified Code or Standard shall define and produce the following:
 - 1. Design basis; i.e., mechanical properties, part geometry, acceptance criteria.
 - 2. A method to verify that the welding procedure can produce acceptable welds
 - 3. A method to demonstrate that the welder has the skill to produce sound welds in accordance with the specified welding procedure (reference LANL GWS 1-02, *Administrative Control of Welding and Brazing*, *para* 5.3.*B*)
 - 4. Identify methods and perform inspections, required to judge welds against predetermined acceptance criteria.
 - 5. Provide documentation that these objectives have been defined and identified.
- 1.3 QUALIFIED PROCEDURES Welding shall be performed in accordance with properly qualified and approved welding procedure specifications (WPS) that have been qualified in accordance with applicable codes and standards:
 - A. AWS/ANSI Standard Welding Procedure Specifications and documented prequalified welding procedures may be used as allowed by applicable codes and standards.
 - B. WPSs used on structures, systems and components (SSC) which are designated ML-1, ML-2, safety class, or safety significant shall be approved by LANL Welding Program Administrator prior to welding.
- 1.4 JOINING (solvent bonding, adhesive, and electro-fusion joints): When required by consensus codes and standards (e.g., ASME B31.3 & 49 CFR Part 192), joining shall be done by qualified personnel following approved procedures.
- 1.5 CERTIFIED PERSONNEL Welding and brazing shall be performed by certified welders and brazers who have demonstrated their welding brazing qualifications by test.
- 1.6 CONTROL OF CONSUMABLES Consumable welding materials shall be properly procured, received, stored, controlled, and issued to ensure weld quality and prevent use by unqualified personnel (reference LANL GWS 1-03).
 - A. For structures, systems and components (SSC) which are designated ML-1, ML-2, safety class or safety significant welding consumables shall be provided with Certified Material Test Reports (CMTRs) traceable by heat/lot # to the point of use.

- CMTRs shall meet the requirements of LANL Welding Program <u>1-03</u>, <u>Welding & Brazing Material Procurement & Control</u>. Attachment 5, *Filler Material Procurement, Table 1, Sch.I, Required Tests*. Filler material inspection records shall be submitted and accepted prior to start of affected work.
- 1.7 WELDING INSPECTION shall be performed by qualified personnel in accordance with applicable consensus codes and standards, and as specified in design drawings and/or specifications in the absence of applicable codes and standards.
 - A. Inspector Qualification/Certification When inspectors are required to be qualified/certified by the referenced code & standard, submit qualification/certification records for
 - 1. Visual Inspectors (for welding & bonding)
 - 2. NDE Inspectors
 - B. Welding Inspections required by consensus codes and standards or design shall be documented. Welding Inspection Reports shall identify at least the following:
 - 1. Method, Type and extent of Inspection or test
 - 2. Acceptance/rejection as based on the criteria specified by the design documents
 - 3. Code or Standard used for acceptance and class, category, or service
 - 4. Record attributes inspected and severity
 - 5. Identification and location of welds inspected
 - 6. MT&E Identification and date of calibration expiration for measuring and test equipment used
 - 7. Name, & Date & signature of person who performed the inspection
 - 8. Inspector's qualification level
 - C. Inspection Procedures When inspection procedures are required by the referenced code & standard submit inspection procedures
 - 1. NDE Procedure Qualification Records When inspection procedures are required to be qualified by the referenced code & standard submit procedure qualification records
 - D. Inspection results, including weld maps, shall be documented and provided within one day after completion of associated inspection work.
 - E. When applicable codes and standards specify two levels of inspection, the qualification of the owners inspector and inspections will be done by LANL as

specified in ESM, Chapter 13, Volume 1, GWS 1-02 Para. 5.9 see: http://engstandards.lanl.gov/esm/welding/vol1/GWS%201-02 Procedure-R6.pdf

- F. LANL reserves the right of access to all welding locations and to have its own qualified inspectors and personnel present during all welding activities.
 - 1. At least five working days notice is required prior to inspection & testing activities planned by the fabricator so that LANL can arrange for its staff's participation.
 - 2. Hold Points may be identified in the construction/fabrication schedule to allow for LANL's inspection activities.
- 1.8 SUBCONTRACTED WELDING
 - A. Subcontracted welding activities shall have all specifications and drawing and their applicable requirements flowed down to any sub tier subcontractors who perform those activities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 4444 Rev. 1, dated October 15, 2015.
SECTION 01 4455 ONSITE WELDING & JOINING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for welding and joining on the LANL site as required by other sections of the Specification, consensus codes and standards, and/or engineering design.
- B. Pressure-retaining code-stamped items shall only be welded on by organizations with the applicable ASME or National Board Certificate(s) of Authorization. Certificate holders are organizations that have been authorized by the ASME and or the or The National Board to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code and or the or The National Board.
- C. Offsite welding shall be in accordance with design documents, applicable codes & standards, and Section 01 4444 on offsite welding.
- 1.2 "WELDING CHECKLIST" A "Welding Checklist" shall be completed prior to onsite welding to assure that the specific requirements for welding activities have been identified and addressed. The "Welding Checklist" can be found at: http://www.lanl.gov/orgs/eng/engstandards/ESM_Ch13.shtml#checklist
- 1.3 DESIGN Design of welded structures, systems and components (SSC) shall meet the requirements of LANL ESM and as a minimum identify applicable codes and standards including requirements of graded application. For welding activities that would normally fall outside the defined scope of specified national consensus codes and standards for fabrication and welding, such codes and standards shall be adopted and used to the extent possible.
 - A. Engineering drawings shall specify all fillet weld sizes and partial penetration weld sizes.
 - B. Shop drawings shall show weld symbols and requirements to define the work and enable design review and inspection this shall include fillet weld sizes and partial penetration weld sizes.
 - C. Applications that are not similar in materials or processes to a specified code or standard shall define and produce the following:
 - 1. Design basis; i.e., mechanical properties, part geometry, acceptance criteria.
 - 2. A method to verify that the welding procedure can produce acceptable welds
 - 3. A method to demonstrate that the welder has the skill to produce sound welds in accordance with the specified welding procedure (reference GWS 1-02, *Administrative Control of Welding and Brazing, para 5.3.B*)
 - 4. Identify methods and perform inspections, required to judge welds against predetermined acceptance criteria.
 - 5. Provide documentation that these objectives have been defined and identified.

- 1.4 QUALIFIED PROCEDURES Welding and brazing shall be performed in accordance with LANL approved welding/brazing procedure specifications (WPS/BPS) that have been qualified in accordance with applicable codes and standards or design criteria:
 - A. LANL-approved welding/brazing procedure specifications are located at: http://engstandards.lanl.gov/ESM_Ch13_specs.shtml
 - B. AWS/ANSI Standard Welding Procedure Specifications and written Prequalified Welding Procedure Specifications as allowed by applicable codes and standards may also be used if approved by the LANL Welding Program Administrator.
- 1.5 JOINING (solvent bonding, adhesive, and electro-fusion joints): When required by consensus codes and standards (e.g., ASME B31.3 & 49 CFR Part 192), joining shall be done by LANL qualified personnel following LANL approved procedures.
 - A. Electro-fusion of fusible Poly-Vinyl Chloride Pipe for potable water use shall be completed in accordance with Section 33 1001. Provisions of this section shall also apply.
- 1.6 CERTIFIED PERSONNEL Welding and brazing shall be performed by welders and brazers who have demonstrated their welding/brazing skill by test at LANL and are LANL-certified.
 - A. Current listing located at <u>http://eswebserver.lanl.gov/welding/engstandard.aspx</u>
- 1.7 PROCUREMENT & CONTROL OF CONSUMABLES Subcontractors are responsible to supply filler material meeting the requirements defined in GWS 1-03 and attachments unless filler material is to be government-furnished by contract. On a case-by-case basis as authorized by the responsible subcontractors STR, LANL-stocked filler material may be issued. If LANL stock materials are issued to a subcontractor then the cost of those filler materials will be charged to the LANL project. The subcontract STR should require compensation from the subcontractor for the cost of filler materials. LANL will disburse daily quantities to those with proper paperwork (see 5.5 below); they will also issue bulk quantities to those maintaining <u>WPA-approved satellite and issue stations</u>. A list of stocked filler material is <u>here</u>.
 - A. The procedure for procurement, storage, issue and control of consumables is found in ESM, Chapter 13 Welding & Joining, Volume 1, General Welding Standard (<u>GWS) 1-03</u>.
 Filler material shall be procured with Certified Material Test Reports (CMTRs) traceable by heat/lot #.
 - 1. CMTRs shall meet the requirements of LANL Welding Program GWS 1-03 Attachment 5, <u>Filler Material Procurement</u>, *Table 1, Sch. I, Required Test.*
 - 2. Structures, systems and components (SSC) which are designated ML-1, ML-2, safety class, or safety significant shall have CMTRs for welding consumables that are traceable by heat/lot # to the weld in which they were consumed.
 - B. Filler materials shall be issued from approved locations by authorized personnel to qualified welders.
 - 1. <u>Authorized filler material issue stations</u>.
- 1.8 WELDING INSPECTION shall be performed by qualified personnel in accordance with applicable consensus codes and standards and as specified in the design documents.
 - A. Inspector Qualification/Certification Welding inspectors are required to be approved by a LANL Level III to perform visual and NDE inspection/examinations. LANL-approved

inspectors can be found at:

http://eswebserver.lanl.gov/welding/Inspector.aspx?RST=Y&FROM=ENG&A=0

- B. Welding Inspections required by consensus codes and standards or design shall be documented. Welding inspection reports shall identify at least the following:
 - 1. Method, type, and extent of Inspection or test
 - 2. Acceptance/rejection as based on the criteria specified by the design documents
 - 3. Code or standard used for acceptance and class, category, or service
 - 4. Record attributes inspected and severity
 - 5. Identification and location of welds inspected
 - 6. MT&E Identification and date of calibration expiration for measuring and test equipment used
 - 7. Name, & date & signature of person who performed the inspection
 - 8. Inspector's qualification level
- C. Inspection Procedures When inspection procedures are required by the referenced code & standards procedures shall be reviewed and approved by a LANL Level III inspector in the applicable inspection method
 - 1. NDE Procedure Qualification Records When inspection procedures are required to be qualified by the referenced code & standard procedure qualification records will be reviewed and approved by a LANL Level III inspector in the applicable inspection method.
- D. Inspection results, including weld maps, shall be documented and provided to the project managers within one day after completion of associated inspection work.
- E. When applicable codes and standards specify two levels of inspection, the qualification of the owners inspector and inspections will be done by LANL as specified in ESM, Chapter 13, Volume 1, GWS 1-02 Para. 5.9 see: http://engstandards.lanl.gov/ESM_Ch13.shtml#ch13_vol1
- F. LANL reserves the right of access to all welding locations and to have its own qualified inspectors and personnel present during all welding activities.
 - 1. At least five-working-days notice is required prior to inspection & testing activities planned by the fabricator so that LANL can arrange for its staff's participation.
 - 2. Hold Points may be identified in the construction/fabrication schedule to allow for LANL's inspection activities.

1.9 SUBCONTRACTED WELDING

- A. Subcontracted welding activities shall have all specifications and drawings and their applicable requirements flowed down to any sub-tier who is to perform those welding activities.
- B. Requirements for subcontracted welding shall be identified in subcontract documents as outlined in GWS 1-09, *Control of Subcontracted Welding*.

1.10 RECORDS

A. The following documents shall be collected and maintained in the project files:

- 1. Welding/brazing/bonding procedure specifications used
- 2. Welder/brazer/bonder performance qualification records
- 3. Weld Material Requests (yellow copy)
- 4. CMTRs of filler material traceable to weld in which consumed for ML-1, ML-2, safety class, and safety significant SSC
- 5. Heat treatment charts or records
- 6. Inspection reports
- 7. Inspector qualification records
- 8. Inspection procedures

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 5705

TEMPORARY CONTROLS AND COMPLIANCE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Erosion and Sediment Control
- B. Storm Water Management
- C. Site Stabilization
- D. Spill Control and Response
- E. Debris Control
- F. Air Quality
- G. Dust Suppression
- H. Rodent Control
- I. Environmental Restoration Sites
- J. Hazardous Waste
- K. Traffic Control
- L. Water Discharge
- M. Grading, Excavating and Trenching
- N. Washout, Potholing, Directional Drilling

1.2 ACTION SUBMITTALS

- A. Submit the following in accordance with project submittal procedures.
 - 1. For projects operating under a National Pollutant Discharge Elimination System (NPDES) Construction General Permit:
 - a. Submit all requested information for the Storm Water Pollution Prevention (SWPP) Plan within 14 days after award of the contract. Submit information in sufficient format and detail as may

be required by LANL for completion of the SWPP Plan, including the calculations required by the New Mexico Environmental Department (NMED) Surface Water Quality Bureau (SWQB) state certification of the NPDES Construction General Permit. The completed SWPPP Plan shall be certified by both LANL and a responsible corporate officer of the Subcontractor prior to the Notice of Intent (NOI) submittal.

- b. Submit the NOI to the United States Environmental Protection Agency (EPA) at least 14 days prior to start of any construction activities.
 - Any earth-disturbing or pollutant generating activities shall not begin until at least 14 days after the EPA has acknowledged receipt of the complete NOI on their website at <u>http://ofmpub.epa.gov/CGPSearch/faces/CGPPublicSearch.js</u> <u>px?_afrLoop=12492164959615666&_afrWindowMode=0&_adf</u> <u>.ctrl-state=k9gsu0fxb_4</u> and has identified the permit status as "Active".
 - Submit such additional information to and otherwise cooperate and work with LANL to maintain/modify the SWPP Plan throughout the duration of this contract.
- c. Following a review and approval by LANL, submit a Notice of Termination (NOT) to the EPA within 30 days after final stabilization of the site. Transfer of the site before final stabilization may be negotiated through LANL prior to termination of the Subcontract.
- 2. New Mexico Environment Department Notice of Intent (NMED NOI)
 - a. The LANL Subcontract Technical Representative (STR) will contact the LANL Environmental Compliance Programs Group (ENV-CP) at 667-0666 prior to the Subcontractor using fertilizer, hydraulically applied mulches, dust suppression additives, soil stabilizers, washouts, potholing fluids, directional drilling fluids, and other substances that are applied to the ground. ENV-CP will determine whether the substances will require a Notice of Intent (NOI) to Discharge be submitted to the New Mexico Environment Department (NMED). Provide information as necessary to obtain the NMED NOI.
- 3. Traffic Control Plan
 - a. Submit a temporary traffic control plan and subsequent proposed changes to the plan to the LANL STR who will coordinate with the LANL Traffic Engineer for review and approval.

PART 2 PRODUCTS

Not Used

- PART 3 EXECUTION
- 3.1 EROSION AND SEDIMENT CONTROL
 - A. Properly install Best Management Practices (BMPs) as shown on the drawings or identified in the SWPP Plan, prior to any earth disturbing activity.
 - B. Install perimeter sediment controls around disturbed areas and all soil stockpiles and implement controls as necessary to minimize sediment track-out onto streets, sidewalks, and other paved areas.
 - C. Maintain BMPs in accordance with SWPP Plan, manufacturer's recommendations, and the LANL Storm Water Best Management Practices Manual.
 - D. When practical, implement permanent BMPs during the construction phase to meet the objectives of temporary sediment and erosion controls.
 - E. Disturb only the minimum amount of soil necessary and preserve native topsoil on site unless infeasible. Give special attention to protecting established vegetation.

3.2 STORM WATER MANAGEMENT

- A. Provide methods to control surface water as identified in the Drawings or SWPP Plan to prevent damage to the Project, the site, and in adjoining areas.
- B. Use permanent storm water management controls (such as detention ponds, riprap, rock check dams, etc.) during the construction in place of temporary storm water management controls whenever practical.
- C. Ensure temporary and permanent storm water management controls are properly installed per Drawings and the SWPP Plan. Maintain controls per Drawings, the SWPP Plan, and manufacturer's installation recommendations.

3.3 SITE STABILIZATION

A. Stabilize all disturbed areas with permanent stabilization measures. Do not leave any disturbed areas as barren soil. Final stabilization shall be accepted by LANL Utilities and Institutional Facilities (U&I) and ENV-CP. The LANL STR will contact LANL U&I storm water system engineer and ENV-CP at 667-0666 to schedule the final walk down and acceptance.

- B. For seeded areas, establish an evenly distributed native perennial vegetative cover with no large bare areas and an average density of 70% of the native background vegetative cover for the area. Refer to Section 32 9219 Seeding. Begin stabilizing disturbed areas immediately after construction activities have finally or temporarily ended in the area.
- C. If permanent stabilization is impracticable due to seasonal conditions then temporary stabilization measures shall be utilized.
- D. Do not apply fertilizer, hydraulically applied mulches, or soil stabilizers in watercourses.
- 3.4 SPILL CONTROL AND RESPONSE
 - A. In the event of a spill, immediately notify the LANL STR who will contact LANL Emergency Operations (EO). The Subcontractor is responsible for remediation of any spill.
 - B. Store all fuels, lubricants, chemicals, material stockpiles, construction materials, waste material, and other potential pollutants in a designated area on-site. Provide controls including secondary containment, covering, or leak-proof containers to prevent discharges of pollutant and to minimize contact with storm water. When aboveground petroleum storage capacity is greater than 1,320 gallons (including all equipment and containers 55 gallons or larger), notify the LANL STR who will contact ENV-CP at 667-0666 to initiate the development of a Spill Prevention Control and Countermeasure (SPCC) Plan.
 - C. When an aboveground petroleum storage tank (AST) is being constructed with a storage capacity greater than 1,320 gallons and less than 55,000 gallons, submit information in sufficient format and detail as required by LANL for completion of the tank registration, and State notification. The AST system must be registered with New Mexico Environment Department Petroleum Storage Tank Bureau NMED-PTSB prior to being placed in service. Personnel who install AST systems must be certified by the NMED-PTSB.
 - D. The LANL STR will contact ENV-CP (667-0666) at least 60 days prior to performing repairs or modifications to existing AST systems. If the repair or modification is an emergency repair, notify ENV-CP as soon as possible following the repair. Personnel who modify or repair AST systems must be certified by the NMED-PTSB.
 - E. Installation of underground petroleum storage tanks at LANL is not permitted.
- 3.5 DEBRIS CONTROL & SOILS MANAGEMENT
 - A. Use good housekeeping practices to keep sites free of construction debris and trash. Provide containers for deposit of debris and trash.

- B. Cover all roll-off bins to prevent storm water contact with its contents and accumulation of storm water in the bin. Notify STR for guidance on discharge requirements if storm water accumulates in a roll-off bin.
- C. Metal shavings, cuttings, grinding residue or other small metal particles shall be placed in leak-proof containers in a manner as to prevent storm water contact with its contents.
- D. Do not drive or move any vehicle on any public road unless the vehicle is constructed, loaded, secured or covered in a manner that will prevent any of its load from dropping, sifting, leaking, or otherwise escaping (except when purposefully cleaning, maintaining, or sanding for traction).
- E. Securely fasten all load covers to vehicles prior to driving on public roads so that the covering does not come loose or become a hazard to others.
- F. Do not bury construction waste, sanitary waste, or trash on-site.
- G. Do not move soil or other material between Technical Areas (TAs) without first obtaining written approval from the receiving TA. Material must be clean of all contaminates before movement; all transferred soil must be characterized.
- H. Segregate all materials prior to sending material to the LANL Material Recycle Facility (MRF). The LANL STR will contact ENV-CP to obtain instruction on required sampling and documentation procedures. Material shall be clean of all contaminates.

3.6 AIR QUALITY

- A. The LANL STR will contact the LANL Ecology & Air Quality Group (ENV-ES) prior to the Subcontractor operating portable and stationary fuel burning equipment (e.g., generators, rock crushers, asphalt plants). Drivable equipment does not require notification of ENV-ES.
- B. The LANL STR will contact ENV-ES if the Subcontractor stores over 500 pounds of chemicals at the site.

3.7 DUST SUPPRESSION

- A. When applying potable water for dust control, ensure compliance with Section 01 3545, *Water Discharge Requirements*.
- B. Do not add additives to potable water for dust control until receiving approval. Notify the LANL STR who will contact ENV-CP. Comply with all conditions specified by ENV-CP and the applicable federal and state agencies. Apply all liquids in a manner that does not result in runoff.
- C. Do not apply dust suppression additives or other substances in watercourses.

3.8 PEST CONTROL

- A. Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials
- B. Do not use any pesticide (rodenticide) or herbicides without the written approval of LANL.
- 3.9 ENVIRONMENTAL RESTORATION SITE
 - A. No storm water runoff or soil disturbance shall be allowed across a Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs) that are identified in the contract documents.
 - B. Existing BMPs, including vegetative cover, located at a SWMU or AOC shall not be disturbed without coordination with LANL ADEP: Environmental Programs personnel.
 - C. An SWMU or AOC cannot be disturbed without LANL ADEP approval and oversight. The LANL STR will contact ADEP. Any worker conducting work within the boundary of a SWMU or AOC must be made aware, by the LANL STR, of the potential contaminants present in soils and other materials at the site and the potential hazards associated with those contaminants.
 - D. Any soil or other material removed from a SWMU or AOC boundary and not returned to the point of excavation must be managed, characterized, and disposed of by the Subcontractor in accordance with all applicable LANL waste management requirements including approved Waste Profile forms, waste accumulation areas, etc. If the project causes additional runoff to cross the site, install appropriate sediment & erosion controls prior to construction activities. Best Management Practices must be in place for all projects prior to the start of any soil disturbing activities to prevent potential contaminant migration.

3.10 HAZARDOUS AND MIXED WASTE

- A. Store, treat, and/or dispose of hazardous or mixed wastes in accordance with applicable laws and regulations, and LANL requirements.
- B. Register satellite accumulation areas or less than 90 days storage areas with LANL ENV-CP Group prior to storing, handling, treating, or disposing of hazardous or mixed waste.
- C. Contact the ENV-CP Group for more information on the management of hazardous or mixed waste, New Mexico special waste (such as petroleum

contaminated soil, spills, chemical products, asbestos waste, infectious waste, etc.), PCBs, construction and demolition debris, and other types of solid waste.

3.11 TRAFFIC CONTROL

- A. A temporary traffic control plan shall be prepared by a registered Professional Engineer (PE) who is certified as a Professional Traffic Operations Engineer (PTOE). The detail shall be appropriate to the complexity of the work project and submit to the LANL Traffic Engineer for review and approval. The LANL Traffic Engineer shall approve any proposed changes in the temporary traffic control plan.
- B. The temporary traffic control plan shall start in the planning phase and continue through the design, construction, and restoration phases. The temporary traffic control plans and devices shall follow the principles set forth in the MUTCD, latest addition. Temporary traffic control plans may deviate from the typical applications described in the MUTCD based upon engineering judgment, to allow for conditions and requirements of a particular site.
- C. The temporary Traffic Control Plan shall address the safety of pedestrians and bicycles by providing an alternate, safe route.
- D. Traffic control devices shall be properly maintained during the project, including periodic cleaning and replacement of damaged devices. Inspection and maintenance of traffic control devices shall be in accordance with NMDOT Standard Specifications for Highway and Bridge Construction Section 618 Traffic Control Management and performed by personnel certified through ATSSA, ACNM, or IMSA.

3.12 WATER DISCHARGE

- A. Follow Section 01 3545, Water Discharge Requirements.
- 3.13 GRADING, EXCAVATING, AND TRENCHING
 - A. Follow Section 31 2000, for *Earth Moving* requirements.
- 3.14 WASHOUT, POTHOLING, DIRECTIONAL DRILLING
 - A. Do not discharge substances to the ground until an NOI has been obtained. Once a substance is approved by NMED, follow all conditions of the NOI. Discharges must be documented to the LANL Water Quality Group.
 - B. Washout shall pertain to any generation of wastewater from the washout and/or cleanout of concrete, stucco, paint, form release oil, curing compounds, or other related construction materials.

- C. Washout will be performed within a leak-proof container or leak-proof pit designed so that no overflows can occur due to inadequate sizing or precipitation. Properly dispose of all hardened excess materials. Washout areas cannot be placed in or on SWMU or AOC areas, watercourses, Treatment Storage Disposal Facilities, or storm water drainages.
- D. Liquids from potholing activities must be placed within a defined area within the project site limits surrounded by a Triangular Silt Dike[™], compacted earth berm, or other appropriate control, until the liquids evaporate. Properly dispose of solids. Do not discharge polypropylene glycol, propylene glycol, ethylene glycol, or any other anti-freeze substance without contacting LANL to ensure all environmental requirements have been met. Potholing material may not be removed from the site.
- E. Directional-drilling mud must be placed within a lined retention pond until the liquids evaporate or properly disposed of. Mud from drilling operations involving a SWMU or AOC must first be evaluated for contaminates before disposal occurs. Contact ENV-CP at 667-0666 for additional guidance.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 5705, Rev. 5, dated February 25, 2015.

SECTION 01 6000 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.

1.2 PRODUCTS

- A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Subcontract Documents.
- B. Provide interchangeable components of the same manufacture for components being replaced.
- 1.3 TRANSPORTATION AND HANDLING
 - A. Transport and handle Products in accordance with manufacturer's instructions.
 - B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
 - C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive Products in weather tight, climate controlled enclosures in accordance with the manufacturer's requirements.
- D. For exterior storage of fabricated Products, place on sloped supports above ground.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover Products subject to deterioration with impervious sheet covering. Protect Products from dust, liquids, debris and any deleterious matter, once it is installed and until operational start-up. Provide ventilation to prevent condensation and

degradation of Products.

- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.
- J. Manually rotate shafts of rotating equipment (fans, pumps, cooling towers, etc.) weekly from time of arrival to start-up.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification Section 01 6000 Rev. 2, dated May 31, 2017.

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- 1.2 RELATED SECTIONS
 - A. Drawings and general provisions of the Subcontract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
 - B. Section 01 3300, Submittal Procedures, for construction submittal process and procedures.
 - C. Section 01 7823, Operation and Maintenance Data, for operation and maintenance manual requirements.

1.3 REFERENCES

- A. ASTM E 1971 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
- B. Green Seal GS 37 Cleaning Products for Industrial and Institutional Use
- C. National Air Duct Cleaners Association (NADCA) ACR 2013 Standard for Assessment, Cleaning & Restoration of HVAC Systems.
- D. USDA BioPreferred program.

1.4 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Construction Subcontractor's list of Incomplete Items (Punch List): Initial submittal at Substantial Completion.

C. Certified list of Incomplete Items: Final submittal at Final Completion

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: N/A; LANL will provide certificate of occupancy.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Construction Subcontractor's List of Incomplete Items (Punch List): Prepare and submit a list of items to be completed and corrected (Construction Subcontractor's punch list), on form provided by the LANL Construction STR.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificate of Occupancy: LANL Project Engineer will obtain certificate of occupancy from LANL Building Official allowing LANL unrestricted use of the work, or portions thereof in the case of partial beneficial occupancy, and access to services and utilities.
 - 2. Closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, and similar final record information.
 - 3. Closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certificates, and similar documents.
 - 4. Maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by LANL Construction STR. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related specification Section. Obtain LANL Construction STR signature for receipt of submittals.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise LANL Construction STR of pending insurance changeover requirements.
 - 2. Complete startup and testing of systems and equipment.
 - 3. Instruct LANL personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in other sections.

- 4. Participate with LANL in conducting inspection and walkthrough with local emergency responders.
- 5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- 6. Complete final cleaning requirements, including touchup painting.
- 7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request to the LANL Construction STR for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection. On receipt of request, LANL Construction STR will either proceed with inspection or notify Construction Subcontractor of unfulfilled requirements. LANL will prepare the certificate of Substantial Completion after inspection or will notify Construction Subcontractor of items, either on Construction Subcontractor's list or additional items identified by LANL Construction STR that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, submit the following:
 - 1. Final Application for Payment according to Exhibit B, Special Conditions.
 - 2. Certified List of Incomplete Items: Certified copy of LANL's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by LANL Construction STR. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Notice of Termination for termination of the NPDES SWPPP permit.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, LANL Construction STR will either proceed with inspection or notify Construction Subcontractor of unfulfilled requirements. Prepare a final Certificate for Payment after inspection or notify LANL Construction STR of construction that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 CLOSEOUT SUBMITTALS- LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Construction Subcontractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order.
 - 2. Document incomplete items on the LANL Subcontractor turnover punch list form provided by the LANL Construction STR.
 - 3. Submit list of incomplete items in the following format:
 - a. PDF electronic file. LANL Construction STR will return annotated file.
 - b. Three paper copies. LANL Construction STR will return two copies.

1.10 CLOSEOUT SUBMITTALS- PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit LANL's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the work that completed and occupied or used by LANL during construction period by separate agreement with Construction Subcontractor.
- C. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, looseleaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project Name, and name of Construction Subcontractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation of each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Provide cleaners that bear either a Green Seal Certification Label and/or a U.S. EPA Design for the Environment (DfE) label.
 - 2. Comply with GS 37 for general purpose cleaning and bathroom cleaning.
 - 3. Biobased content Provide in accordance with USDA BioPreferred Program:
 - a. General Purpose Household Cleaners: Products designed to clean multiple common household surfaces. This designated item does not include products that are formulated for use as disinfectants. Task-specific cleaning products, such as spot and stain removers, upholstery cleaners, bathroom cleaners, glass cleaners, etc., are not included in this item. Provide minimum 39% biobased content.
 - b. Industrial Cleaners: Products, including solvents, used to remove parts, products, tools, machinery, equipment, vessels, floors, walls, and other production-related work areas. Task-specific cleaners used in industrial settings, such as parts wash solutions, are not included in this definition. Provide minimum 41% biobased content.
 - c. Multipurpose Cleaners: Products used to clean dirt, grease, and grime from a variety of items in both industrial and domestic settings. This designated item does not include products that are formulated for use as disinfectants. Provide minimum 56% biobased content.
 - d. Glass Cleaners: Cleaning products designed specifically for use in cleaning glass surfaces, such as windows, mirrors, car windows, and computer monitors. Provide minimum 49% biobased content.
 - e. Adhesive and Mastic Removers: Solvent products formulated for use in removing asbestos, carpet, and tile mastics as well as adhesive materials, including glue, tape, and gum, from various surface types. Provide minimum 58% biobased content.
 - f. Carpet and Upholstery Cleaners

- General Purpose: Cleaning products formulated specifically for use in cleaning carpets and upholstery, through a dry or wet process, found in locations such as houses, cars, and workplaces. Carpet and upholstery cleaners formulated for use in cleaning large areas such as the carpet in an entire room or the upholstery on an entire piece of furniture. Provide minimum 54% biobased content.
- 2) Spot removers: Cleaning products formulated specifically for use in cleaning carpets and upholstery, through a dry or wet process, found in locations such as houses, cars, and workplaces. Carpet and upholstery cleaners formulated for use in removing spots or stains in a small confined area. Provide minimum 7% biobased content.
- 4. Use natural cleaning materials where feasible. Natural cleaning materials include:
 - a. Abrasive cleaners: Substitute ¹/₂ lemon dipped in borax.
 - b. Ammonia: Substitute vinegar, salt and water mixture, or baking soda and water.
 - c. Disinfectants: Substitute ½ cup borax in gallon water.
 - d. Drain cleaners: Substitute ¼ cup baking soda and ¼ cup vinegar in boiling water.
 - e. Upholstery cleaners: Substitute dry cornstarch.

PART 3 EXECUTION

3.1. 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, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

3.2. FINAL CLEANING

A. General: Perform final cleaning in accordance with ASTM E 1971.

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finished and dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove labels that are not permanent.
 - h. Leave project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 *Construction Waste Management and Disposal.*

3.3. REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Touch-up and otherwise repair and restore marred or exposed finishes and surfaces. Replaces finishes and surfaces that already show evidence of repair or restoration.

- a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
- 2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

END OF SECTION

THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification is based on LANL Master Section Specification 01 7700 Rev. 3, dated June 23, 2017.

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1. SECTION INCLUDES

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2. RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section 01 3300, Submittal Procedures for submitting copies of submittals tor operation and maintenance manuals.
- C. Section 01 7839, Project Record Documents for compliance with newly prepared record drawings.
- 1.3. DEFINITIONS
 - A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
 - B. Subsystem: A portion of a system with characteristics similar to a system.

1.4. CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. A/E of Record will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarity and update review manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:

- 1. PDF electronic file: Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to A/E of Record.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- 2. Three paper copies of final submittal. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. A/E of Record will return one copy.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. A/E of Record will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. A/E of Record will return copy with comments.
 - Correct or revise each manual to comply with A/E of Records' comments. Submit copies of each corrected manual within 15 days of receipt of A/E of Records comments and prior to commencing demonstration and training.

PART 2 PRODUCTS

2.1 SUSTAINABLE DESIGN REQUIREMENTS

- A. Inspection Requirements: Describe inspection schedule and procedures necessary to promote durability of materials, components, and systems. Include the following:
 - 1. Exterior: Inspection of exterior indicating points of potential concern for assessment of the following:
 - a. Possible water ingress.
 - b. UV degradation/damage
 - c. Leaks, e.g. oil, coolant, refrigerants, etc.
 - d. Damage or modifications to equipment enclosures
 - e. Loose fasteners, door hardware, covers, etc.
 - f. Blocking of ventilation openings
 - 2. Equipment: Seasonal inspection of equipment.
- B. Environmental Requirements:
 - 1. Identify environmentally preferable materials and systems incorporated into the Project. Include: product model; manufacturer's name, address, phone, and website; and local technical representative, if any.

- a. Verify that plastic products, including plastic components in assemblies, to be incorporated into the Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
 - Products made from compositions containing a single filler, reinforcing or other modifying material in a concentration of more than one percent by mass shall be marked with the abbreviated term for the polymer, followed by a dash, then the abbreviated term or symbol for the additive, with its percentage by mass, arranged as shown in the example and set off with brackets. For example, a polypropylene containing 30 mass percentage of mineral powder use would be labeled: >PFMD30<
- b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and the approved Integrated Pest Management (IPM) plan.
 - 1) Include potential environmental impacts of recommended maintenance procedures and materials.
 - 2) Include potential indoor air quality impacts of the recommended maintenance procedures and materials.
 - 3) Where the proposed maintenance procedures incorporate composting of plastics, assess the potential effect of each type of plastic to be included on the composting process in accordance with ASTM D6002.
- c. Material Safety Data Sheets: Include MSDSs as specified in individual Specification Sections.
- 2. Develop environmental management programs for the facility as follows:
 - a. Waste management program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures.
 - IAQ management program: Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of VOCs (volatile organic compounds) in indoor air in accordance with ASTM D6345.
 - c. Water management program: Develop a water monitoring program for surface and ground water on the Project site in accordance with ASTM D5851 and consistent with the water management program utilized during construction operations.

2.2 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

- 1. List of documents.
- 2. List of systems.
- 3. List of equipment.
- 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.3 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of LANL.
 - 4. Date of submittal.
 - 5. Name and contact information for Construction Subcontractor.
 - 6. Name and contact information for Construction Subcontractor Manager.
 - 7. Name and contact information for A/E of Record.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the A/E of Record that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

- 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Construction Subcontractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.

- 4. Equipment function.
- 5. Operating characteristics.
- 6. Limiting conditions.
- 7. Performance curves.
- 8. Engineering data and tests.
- 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric, electronic, pneumatic and/or hydraulic systems or other systems where shut down and start/re-start sequence is important.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.

- 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection and test procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended or required to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.

- 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- 5. Aligning, adjusting, and checking instructions.
- 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.1. MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by LANL's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by LANL's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each

sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 01 7839 *Project Record Documents*.
- G. Comply with Section 01 7700 *Closeout Procedures* for schedule for submitting operation and maintenance documentation.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 7823 R0, dated March 23, 2015.

EPC-DO: 18-052

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Section includes administrative and procedural requirements for project record documents including the following:
 - 1. Record Documents.
 - 2. Record Specifications.
 - 3. Record Calculations.
 - 4. Record Product Data.
 - 5. Miscellaneous record submittals.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section 01 7700 Closeout Procedures for general closeout procedures.
- C. Section 01 7823 Operation and Maintenance Data for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Submit set(s) of marked-up record Drawings to LANL Construction Subcontract Technical Representative (STR) as follows:
 - a. Initial Submittal:
 - 1. One paper-copy set(s) of marked-up record prints.
 - 2. PDF electronic files of scanned record prints and one of file prints.
 - 3. Record digital data files and one set of plots.
 - 4. A/E of Record will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

- b. Final Submittal:
 - 1. Submit one paper-copy set of marked-up record prints.
 - 2. Submit PDF electronic files of scanned record prints and one set of prints.
 - 3. Submit record digital data files and one set of record digital data file plots.
 - 4. Print and/or plot each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Record Calculation Submittals: Submit one paper copy and annotated PDF electronic files of projects calculations developed or revised during construction.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous recordkeeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.
- F. Reports: Submit written report at scheduled construction meeting indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints with red colored pencil or pen to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

- b. Accurately record information in an acceptable drawing technique.
- c. Record data as soon as possible after obtaining it.
- d. Record and check the markup before enclosing concealed installations.
- 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Field Change Notice.
 - k. Changes made following LANL's written orders.
 - I. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - o. Field test records.
 - p. Inspection certificates.
 - q. Manufacturer's certificates.
 - r. Specified installer/tradesman certificates.
 - s. Storm Water Pollution Prevention Plan.
 - t. Delegated Design Submittals
 - u. Locations of contaminated areas and/or hazardous materials (asbestos, lead, beryllium, chemicals, spills, etc.) identified during construction and are to remain in place.

- Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Field Change Notices numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for certificate of Substantial Completion, review marked-up record prints with LANL Construction STR and A/E of Record. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 - 2. Format:DWG Version AutoCAD Microsoft Window's operating system.
 - 3. Format: Notated PDF electronic file with comment function enabled.
 - 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 5. Refer instances of uncertainty to A/E of Record for resolution.
 - 6. A/E of Record will furnish Construction Subcontractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3300 *Submittal Procedures* for requirements related to use of A/E of Record's digital data files.
 - b. A/E of Record will provide date file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where AE of Record determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult LANL STR for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the LANL project ID number and sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name
 - b. Date
 - c. Designation "PROJECT RECORD DRAWINGS"
 - d. Name of A/E of Record
 - e. Name of Construction Subcontractor

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related change orders and record drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to Information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record specifications, and record drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.
- 2.4 CALCULATIONS RECORD SUBMITTALS
 - A. Assemble calculation records in connection with actual performance of the Work. Bind or file calculation records and identify each, ready for continued use and reference.
 - B. Format: Submit calculation record submittals as PDF electronic file.
 - 1. Include calculation record submittals directory organized by Specification Section number and title, electronically linked to each item of calculation record submittal.

2.5 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 EXECUTION

3.1. RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record

documents for LANL STR and A/E of Record's reference during normal working hours.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 01 7839 Rev. 3, dated March 23, 2015.

EPC-DO: 18-052

SECTION 03 3001

REINFORCED CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formwork, shoring, bracing, and anchorage.
- B. Reinforcement and accessories.
- C. Cast-in-place, normal weight, non-prestressed concrete.
- D. Construction, isolation, and contraction joint devices associated with concrete work.
- 1.2 DEFINITIONS and ACRONYMS (as used herein)
 - A. Cementitious Material: Portland cement by itself, or Portland cement in combination with fly ash (or other raw or calcined natural pozzolans, silica fume, and slag cement).
 - B. Reinforced Concrete: Structural concrete reinforced with no less than the minimum amounts of reinforcement specified in ACI 318 (with the exception of Chapter 14).
 - C. Plain Concrete: Structural concrete with no reinforcement, or with no more than the minimum amount specified in ACI 318 for plain concrete.
 - D. Engineer-of-record (EOR) / Architect-Engineer: The responsible engineer for the overall design of the work.
 - E. LANL Subcontract Technical Representative: STR.
 - F. In accordance with: IAW
 - G. Certificate of Conformance (C of C): A document signed or otherwise authenticated by an authorized individual certifying the degree to which items or services meet specified requirements.
 - H. Certified Material Test Report (CMTR). A written and signed document that is approved by a qualified party and contains data and information that attests to the actual properties of an item and the actual results of all required tests.
 - I. National Institute of Standards and Testing: NIST.
 - J. Reinforcement: Non-prestressed bars and wires; structural steel, pipe and tubing for composite columns; and headed shear studs and stud assemblies.

1.3 REFERENCES

A. References noted in this Section form a part of the Section to the extent applicable. The publications are referred to in the text by the basic designation

only. The related publishing organizations are stipulated in Section 01 4200, References.

B. Work, products, and materials shall conform to ACI 301 and other specific referenced publications and standards except where otherwise specified herein.

1.4 SUBMITTALS

 A. Documents required to be submitted to LANL are included in the appended Submittal Table as they apply (including time frames for submission, unless the STR authorizes changes to a time frame(s)).
 NOTE: All submittals require EOR review and approval. For design-build subcontracts, this approval must occur prior to submission to LANL.

1.5 QUALITY ASSURANCE

- A. Unless stated otherwise herein, the Work shall comply with the following documents: the version of ACI 301 referenced by the applicable edition of ACI 318 that the project/job is required to comply with; and the latest versions of CRSI Placing Reinforcing Bars, and DOE Order 414.1D. If a conflict occurs between this Section and any of these documents, notify the LANL STR.
- B. The Work shall be subject to inspection at all times by the Owner and Owner's Independent Testing Agency for the purpose of determining that the Work is properly executed IAW this Section. Failure to detect defective workmanship or material during any interim inspection shall not constitute acceptance of workmanship and materials.
- C. Acquire cement, aggregate, and fly ash to be used in the proposed Work from same source as used to develop the final mixture proportions. The subcontractor must provide LANL a C of C confirming the source of all concrete materials (except for admixtures), that test results confirm conformance to applicable specifications, and confirming that all concrete materials (including admixtures) used to develop mixture proportions correspond to those to be used in the proposed Work.
- D. If different concrete mixtures are to be used for different portions of the proposed Work, each mixture shall comply with the indicated mixture requirements for it. The subcontractor must provide LANL a C of C confirming this.
- E. Hot and Cold Weather Concreting, and Curing Concrete. Work on project shall conform to all requirements of ACI 305.1, 306.1, and 308.1.
 - 1. The subcontractor shall use ACI 305R when concreting during hot weather, or 306R during cold weather, to develop the required hot / cold weather plan. See Para. 3.8 for details of these plans and their development.
- F. Testing Agency Qualifications: Testing agencies that perform concrete related testing shall be nationally accredited IAW ASTM C1077 and testing agencies that perform reinforcing steel testing shall meet ASTM E329. For field and laboratory testing agencies and testing personnel request approval by the LANL Building Official, or designee, IAW the provisions of the IBC and the LANL Engineering Standards Manual Chapter 16.

G. The reinforcement fabricator shall maintain Heat Number Traceability for all reinforcement to assure heat numbers for the reinforcement are traceable to the reinforcement delivered. These heat numbers (or lot numbers if they correlate to the heat numbers on the CMTR documentation) must be identified on the tags attached to the reinforcement bundles and traceable to the associated CMTR(s). Once the tags on the reinforcement bundles are confirmed to match the associated CMTRs by the appropriate receiving inspection; the bundles may be broken and the reinforcement located as required.

NOTE: Unless authorized by LANL, use of foreign reinforcement is prohibited.

NOTE: If /when a request to weld reinforcing bars has been approved by the EOR and LANL, a welding procedure must be used that has been similarly approved. Welding shall conform to ACI 301 para. 3.2.2.2, AWS D.1.4, and Section 01 4455, Onsite Welding and Joining Requirements. Reinforcing bars cannot be used for filler metal, gap filler, lightning grounding, or other uses that involve welding. For other than ASTM A 706 reinforcing bar, a CMTR of the reinforcing bar material properties that demonstrate compliance with AWS D1.4 is required.

- H. The batch plant must be certified (and maintain current certification) under the NRMCA (National Ready Mix Concrete Association) process.
- I. Devices used for acceptance or testing, including all levels of sub-tiers, must be calibrated within recognized tolerances specified by the EOR and calibrated to NIST or other recognized national standards. The devices must be suitably marked for traceability to the calibration documentation with recalibration due dates marked on each device. The users must maintain a usage log and identify any "as-found/as-received" out of tolerance devices to the appropriate LANL STR within 3 working days along with where and how the device(s) was used.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Cementitious materials and aggregates shall be stored to prevent deterioration or contamination.
- B. Material that has deteriorated or has been contaminated shall not be used in concrete.
- C. Do not deliver concrete until vapor barrier, forms (including confirmation of approved calculations for formwork when required), reinforcement, embedded items, chamfer strips, and any other prerequisites specified in the job specific "Test and Inspection Plan" are in place and ready for concrete placement. Job site storage of materials shall be IAW ACI 301 (e.g., paragraphs 3.1.2, 5.1.3, 6.1.4, etc.). Ensure materials can be accurately identified after bundles are broken and tags removed.
- D. Inspection/Documentation Verification Hold Point: Product and raw material inspection shall be performed at time of delivery to site receiving area and prior to off-loading and incorporation into the Work. Verify conformance with specified requirements and project environmental, safety and health (ES&H) and radiological requirements through inspection of material, shipping documentation, material safety data sheets (MSDS) documentation, data sheets, test documentation and other shipping manifest information. Material not passing inspection shall be marked and prevented from entering the site or placed in an

off-site quarantine area until the inspection and verification process is satisfactorily completed.

1. Reinforcement: Store reinforcement of different sizes and shapes in separate piles on racks raised above the ground (to avoid excessive rusting). Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed. Painting on reinforcement must be approved in writing by the engineer-of-record.

PART 2 PRODUCTS AND MATERIALS

2.1 GENERAL

A. All concrete Work, projects and materials shall conform to applicable provisions of ACI 301 except as otherwise specified herein.

2.2 FORM MATERIALS AND ACCESSORIES

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints
 - 1. Plywood, metal, or other approved panel materials.
 - a. Metal form surfaces shall not contain irregularities, dents, or sags.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with APA PS 1, and as follows:
 - i. High-density overlay, Class 1 or better.
 - ii. Medium density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - iii. Structural 1, B-B or better; mill oiled and edge sealed.
 - iv. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 - c. AHA A135.4, hardboard for smooth form lining.
 - 2. Prefabricated forms.
 - a. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
 - b. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
 - c. Pan Type: Glass fiber of size and profile required.
 - d. Tubular Column Type: Round, spirally wound, laminated fiber material, surface treated with release agent, non-reusable, of sizes required.

- e. Void Forms: Moisture-resistant, treated-paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inch thick.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiberreinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- D. Form-Release Agent: Colorless mineral oil which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- E. Corners: Chamfered, wood strip type; ³/₄ x ³/₄ in. size.
- F. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- G. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.3 REINFORCEMENT AND ACCESSORIES

- A. Reinforcing Steel: ASTM A 615, grade 60 deformed bars and stirrups; and ties.
- B. Accessory materials, such as proprietary mechanical splices (e.g., rebar couplers, Form Savers, Cadwelds, etc.) must be supported by ICC-Evaluation Service reports indicating full compliance with the applicable code of record for the project.
- C. Welded Steel Wire Fabric: ASTM A1064 Plain type in flat sheets
- D. Chairs, Bolsters, Bar Supports, Spacers: Size and shape for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture. Special chairs, bolsters, bar supports, spacers adjacent to weather exposed concrete surfaces to be plastic coated steel type; size and shape as required.

NOTE: concrete "dobie" blocks used to hold up and position reinforcement must have documentation to show that their strength in compression is at least the compressive strength (in pounds per square inch, or psi) of the concrete used in the placement.

E. Tie Wire: Minimum 16 gage annealed type.

- 2.4 CONCRETE MATERIALS
 - A. Cement: ASTM C 150, Type I or Type II.
 - B. Fine and Coarse Aggregates: Conform to ASTM C 33.
 - C. Water: ASTM C 1602.
 - D. Fly Ash: Conform to ASTM C 618, type F. Fly ash, 20% to 30% of combined weight of fly ash and cement shall be used for the LANL standard concrete mix. For alternate acceptable means of reducing Alkali-Silica Reaction (ASR), see Para. 2.7.B.
- 2.5 ADMIXTURES
 - A. Air Entrainment: Conform to ASTM C260.
 - B. Water reduction and Setting Time Modification: Conform to ASTM C494.
- 2.6 ACCESSORIES
 - A. Bonding Agent: Polymer resin emulsion.
 - B. Vapor Barrier: 6 mil clear polyethylene film of type recommended for below grade application.
 - C. Non-Shrink Grout: Refer to Section 03 6000, Grout.
 - D. Isolation/ Expansion Joint Filler: ASTM D 1751; asphalt impregnated fiberboard or felt.
- 2.7 CONCRETE MIX
 - A. Standard Mix Design
 - The standard mix design for LANL shall contain from 20% to 30% by weight of total cementitious material Type F fly ash conforming to ASTM C 618 for mitigating the deleterious effects of ASR in concrete that is common with the siliceous nature of aggregates found in Northern New Mexico.

NOTE: Pre-approved LATM mixes in Para. 2.7.H comply with this 'standard.'

B. Alternative Mix Designs

Alternate means for mitigating ASR, including use of ground slag, silica fume, or lithium compound admixtures will be acceptable if appropriate tests and documentation are submitted in advance to LANL and approved (per Appendix A, Submittal Table).

NOTE: Mix designs intended to provide more flexibility than the ranges (e.g., slump, air-content, water cement ratio, etc.) must obtain a formal variance to the Section.

 Where aggregates are provided which are demonstrated through appropriate tests to have acceptable reactivity levels (i.e., less than 0.1%), mix designs may be provided without the fly ash required by Para.
 2.7.A.1. Test required is ASTM C1260 (or other pre-approved alternate).

- 2. Demonstrate acceptable ASR resistance for concrete with fly ash using ASTM C 1567 (i.e., less than 0.1%).
- 3. Proportion concrete IAW ACI 301 paragraph 4.2.3
- 4. Mix designs shall be original designs performed by the supplier's testing agency. Mix designs extrapolated from pre-selected data are not permitted. Configuration mix designs -- i.e., those already in use by the supplier -- are also not permitted. All mix designs will be established through the process of trial batch determination of the compressive strengths at the various water-cement ratio trial points for each concrete class, and shall adhere to the requirements of this Section.
- 5. Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Subcontractor. Mixture proportions shall be based on compressive strength (as noted above) as determined by test specimens fabricated IAW ASTM C 192 and tested IAW ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test report indicating compliance with this Section. Trial mixtures having proportions, consistencies, and air content suitable for the Work shall be made based on methodology described in ACI 211.1. Note that the use of fly ash may require an increase of air entraining admixture to attain specified air content of concrete. The trial mixture shall use at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratio required will be based on equivalent water-cement ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan, and ground granulated blast-furnace slag by weight equivalency method. Laboratory trial mixture shall be designed for maximum permitted slump and air content. Each combination of materials proposed for use shall have a separate trial mixture, except accelerators or retarders can be used without separate trial mixtures. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured IAW ASTM C 192 and tested IAW ASTM C 39 for 7 and 28 days. From these results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition a curve shall be plotted showing the relationship between 7 and 28 day strengths.
- C. Provide concrete meeting the following criteria:
 - 1. Exterior concrete exposed to freezing and thawing:
 - a. Minimum compressive strength, f ' c: 4,500 psi @ 28 days.
 - b. Maximum nominal aggregate size: 0.75 in.
 - c. Maximum water / cement ratio: 0.45
 - d. Slump: 3 inch

- e. Air content: 6 percent.
- 2. Exterior concrete to be pumped, exposed to freezing and thawing⁽¹⁾:
 - a. Minimum compressive strength, f ' c: 4,500 psi @ 28 days.
 - b. Maximum nominal aggregate size: 0.75 in.
 - c. Maximum water / cement ratio: 0.38.
 - d. Slump: 6 inch at discharge of truck.
 - e. Slump: 4 inches at pump discharge.
 - f. Air content: 6 percent.
- H. Pre-approved LATM Design Mixes (Ref: AMEC Project 14-519-00761 for Mix Nos. 5000-4N and -8E and AMEC Project No. 4-519-003279 for LATM Mix Nos. 20 and 21).
 - 1. Several Los Alamos Transit Mix (LATM) design mixes are pre-approved by LANL.
 - 2. LANL Engineering Project Delivery (EPD) will provide quality control of the concrete as follows: LATM will provide EPD with test results from a LANL Building Official-approved test agency eight times per year for aggregate (fine and coarse) gradations to comply with the current ASTM C 33. In addition, LATM will provide aggregate soundness, abrasion, and reactivity test results to EPD annually. EPD will re-evaluate each LATM pre-approved concrete mix bi-annually. These test results and other evaluations will be documented and any required actions will be identified and implemented as necessary.
 - 3. The pre-approved mixes are:
 - a. LATM Mix 5000-4N⁽¹⁾ Exterior, 5000 psi concrete @ 28day, 4" slump, 6% air, 25% fly ash (proportions per CY), 0.34 water-cementitious ratio, 3/4 large aggregate, 1-1/2 hour placement time.

Material	Source	Description	Quantity
Cement	GCC – Tijeras, NM	Type I/II	578lbs
Fly Ash	Salt River Materials Group, 4 Corners	Class F	192lbs
Coarse Aggregate	Los Alamos Transit Mix, El Guique Pit, Espanola, NM	#67	1600lbs
Fine Aggregate	Los Alamos Transit Mix, El Guique Pit, Espanola, NM	Washed Sand	1147lbs
Water	Los Alamos Transit Mix, Public Water Supply	Site Water	262lbs
Air			6.00%
Air Entraining Admixture (Note 1)	BASF	MasterAir AE 200	7.3oz (1.0 oz/cwt)

Full Range Water Reducer (Note 1)	BASF	MasterGlenium 3030	70.7oz (9.2 oz/cwt)	
Note 1: Admixture dosages may vary based on temperature.				

LATM Mix 5000-8E⁽¹⁾ - Exterior, 5000 psi concrete @ 28day, 8" slump at arrival and no less than 4inches after 2-1/2 hours after initial mixing, 6% air, 25% fly ash (proportions per CY), 0.343 water-cementitious ratio, 3/4 large aggregate. Note Mix 5000-8E has been developed with an extended placement time of 2-1/2 hours from initial mixing.

Material	Source	Description	Quantity	
Cement	GCC – Tijeras, NM	Type I/II	572lbs	
Fly Ash	Salt River Materials Group, 4 Corners	Class F	191lbs	
Coarse Aggregate	Los Alamos Transit Mix, El Guique Pit, Espanola, NM	#67	1600lbs	
Fine Aggregate	Los Alamos Transit Mix, El Guique Pit, Espanola, NM	Washed Sand	1153lbs	
Water	Los Alamos Transit Mix, Public Water Supply	Site Water	262lbs	
Air			6.00%	
Air Entraining Admixture (Note 1)	BASF	MasterAir AE 200	3.1oz (0.4 oz/cwt)	
Full Range Water Reducer (Note 1)	BASF	MasterGleniu m 3030	76.3oz (10.0 oz/cwt)	
Hydration Stabilizer (Note 1)	BASF	Delvo	53.4oz (7.0 oz/cwt)	

Note 1: Admixture dosages may vary based on temperature.

c. LATM Mix No. 21⁽⁶⁾ -- Interior, 4000 psi concrete, 4" slump, 3% air (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), 20% fly ash (proportions per CY):

Type I-II Cement: Gcc Rio Grande, Tijeras	520 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	130 lbs
Water	280 lbs
Washed Concrete Sand: El Guique Quarry	1243 lbs
Sz#67 Coarse Aggregate: El Guique Quarry	1750 lbs
Water-Reducing Agent: MB poly heed 997	25.7 oz ⁽²⁾
Air-Entraining Agent: MB Micro Air,	4.6 oz ⁽³⁾

LATM Mix No. 20⁽⁶⁾ -- Interior, 3000 psi concrete, 4" slump, 3% air (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), 20% fly ash (proportions per CY):

Type I-II Cement: Gcc Rio Grande, Tijeras	417 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	104 lbs
Water	268 lbs
Washed Concrete Sand: El Guique Quarry	1378 lbs
Sz#67 Coarse Aggregate: El Guique Quarry	1765 lbs
Water-Reducing Agent, MB poly heed 997	20.8 oz ⁽⁴⁾
Air-Entraining Agent: MB Micro Air,	2.6 oz ⁽⁵⁾

- Note (1): If construction circumstances require such, this mix can be pumped. If the mix is pumped, then the requirements of Field QC (i.e., para. 3.11.C herein) apply: strength, slump and air-content criteria must be met at pump discharge (i.e., samples for testing are taken at the placement- end of the pipe / hose). This requirement does not change / alter the ACI tolerances for the criteria (i.e., the tolerances apply to test results on samples taken at the placement-end of pipe / hose). For example, test results from 4.5% to 7.5% for air content will be deemed acceptable since the criteria is 6% and the ACI tolerance is <u>+1.5%</u>.
- Note (2): Temperature and slump variation may require adjustment in dosage within the range of 19.5 fl oz / cy to 45.5 fl oz / cy
- Note (3): Temperature and slump variation may require adjustment in dosage within the range of 0.8 fl oz / cy to 9.75 fl oz / cy
- Note (4): Temperature and slump variation may require adjustment in dosage within the range of 15.6 fl oz / cy to 36.5 fl oz / cy
- Note (5): Temperature and slump variation may require adjustment in dosage within the range of 0.65 fl oz / cy to 7.8 fl oz / cy
- Note (6): When this mix is used in an ML-1 or ML-2 application, the aggregate correction factor (ACF) must be determined by testing IAW ASTM C 231, and the ACF must be reported via submittal.

PART 3 EXECUTION

3.1 GENERAL

- A. Work shall conform to applicable provisions of ACI 301 unless otherwise specified herein.
- B. Construction tolerances for member size and location shall be per ACI 117
- C. Batch, mix, test, transport and deliver concrete, along with test records IAW ASTM C 94. Concrete acceptance for slump shall be based on testing IAW ASTM C 94 and compared to the requirements established in the design documents.
- D. Adding water in the field is only permitted if the ready-mix producer held back water at the batch plant and the slump after transport is less than that specified in the design documents. Care shall be taken to avoid exceeding the water-cement ratio. To adjust for measuring technique accuracy, the amount of water that can be added shall be reduced by 10% from the maximum calculated water-holdback volume. In addition, mixing water added in the field to adjust slump is permitted only when the water measuring device used is as follows:
 - 1. A LANL approved measuring device; or
 - 2. The ready-mix truck sight glass may be used if the following conditions are met:
 - a. The trucks must have a current NRMCA certification
 - b. There must be a pass (i.e. "P") entry on the NRMCA Fleet Inspection Reporting Spreadsheet - Truck Mixers under Section/Column 5.1.6, Water Gage or Meter. The aforementioned

spreadsheet shall be part of a current NRMCA certification of the ready-mix producer and its facilities and its trucks.

3.2 EXAMINATION

Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with the Drawings. Verify "square" for slabs, floors, and walls.
 "Square" specifically means a 90 degree corner or connection, whether horizontal or vertical, such as a floor, wall or ceiling.

NOTE: All required preliminary activities, such as geotechnical and soil compaction/moisture testing, must be confirmed in order to be considered completed.

- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- C. Inspect erected formwork, shoring, and bracing to ensure it is IAW formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- D. Do not use wood formwork more than three times for concrete surfaces to be exposed to view. Do not patch formwork.
- E. Verify that concrete cover for reinforcement conforms to the drawings and to Para 3.4.C below.

3.3 FORMWORK

- A. Hand trim sides and bottom of earth forms. Remove ice, debris, loose soil, etc. prior to placing concrete.
- B. Erect formwork, shoring and bracing to achieve design requirements and maintain tolerances IAW requirements of ACI 301 and ACI 347 (or more stringent design requirements). Camber structural slabs and beams IAW ACI 301. Contact surfaces of the formwork should be carefully installed to produce neat and symmetrical joint patterns, unless otherwise specified. Joints should be vertical or horizontal and, where possible, should be staggered to maintain structural continuity.
- C. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- D. Arrange and assemble formwork to permit dismantling, stripping and removal of remaining principal shores. Do not damage concrete during stripping.
- E. Align joints and make watertight. Keep form joints to a minimum.
- F. Obtain approval from the EOR for all construction joint locations not shown on the drawings and before framing openings (in structural members) which are not detailed /shown.
- G. Provide chamfer strips on external corners of beams, joists, columns, and walls.
- H. Apply form release agent prior to placement of reinforcing steel, anchoring devices, and embedded items.

- I. Install void forms IAW manufacturer's recommendations. Protect forms from moisture or crushing.
- J. Do not apply form release agent where concrete surfaces receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- K. Provide formed openings where required for items to be embedded in or passing through concrete.
- L. Locate and set in place items which cast directly into concrete.
- M. Clean formed cavities of debris prior to placing concrete. Clean and remove foreign matter as erection proceeds.
- N. Install accessories IAW manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- O. Install waterstops continuous without displacing reinforcement.
- P. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- Q. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- R. During cold weather, remove ice and snow from within forms. Do not use deicing salts or water to clean out forms. Use compressed air or other means to remove foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- S. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and other imposed loads without excessive deflection or creep. Perform form removal IAW the recommendations of ACI 347.
- T. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- U. Store removed forms in manner to avoid any damage to form surfaces that will later be in contact with fresh concrete. Discard damaged forms.
- V. After formwork removal, place construction or equipment loads on reinforced concrete only after cylinder break results indicate strengths meet specified requirements. Exceptions to this requirement must be approved in writing by the engineer of record.

3.4 REINFORCEMENT PLACEMENT

A. Edit ACI 301 paragraph 3.3.2.1 to read as follows:

"Tolerances...before concrete is placed", or during concrete placement.

B. Spiral units shall be continuous bar or wire placed with even spacing and without distortion beyond the tolerances for the specified dimensions.

- C. For longitudinal column bars forming an end-bearing splice, the bearing of square cut ends shall be held in concentric contact.
- D. Offset bars shall be bent before placement in the forms.
- E. Do not displace or damage vapor barrier. If vapor barrier is damaged, repair it prior to concrete placement
- F. Maintain the following minimum concrete cover for reinforcement:

Concrete exposure	Concrete exposure Member		Specified cover, in.
Cast against and permanently in contact with ground	inst and ently in All All th ground		3
Exposed to weather		No. 6 through No. 18 bars	2
or in contact with ground	All	No. 5 bar, W31 or D31 wire, and smaller	1-½
	Slabs, joists and walls	No. 14 and 18 bars	1-1⁄2
Not exposed to weather or in		No. 11 bars and smaller	3/4
contact with ground	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals and hoops	1-½

3.5 PREPARATION

A. Modify ACI 301 paragraph 2.2.2.5.a to read as follows:

"Unless otherwise specified...Locate construction joints...equal to or greater than twice the width of the beam", measured from the face of the intersecting beam "; Locate joints in walls..."

B. Prepare previously placed concrete by cleaning with steel brush, pressure washing, or other acceptable means to fully remove any laitance*.

1. When new concrete is to be placed against previously hardened concrete, intentionally roughen the latter to a full amplitude of approximately 1/4 inch.

2. Where indicated / authorized by the EOR, apply bonding agent IAW the manufacturer's recommendations.

*Laitance is a weak layer of cement and aggregate fins on a concrete surface that is usually caused by an over-wet mixture, overworking the mixture, improper or excessive finishing or combination thereof.

- C. In locations shown on the design drawings where new concrete is to be dowelled to existing concrete, unless noted otherwise on the design drawings, drill holes in existing concrete; insert steel dowels to the specified depth and pack solid with non-shrink grout that meets or exceeds the concrete minimum strength.
- NOTE: All aspects of this grouting/grout must comply with Section 03 6000, Grout.

D. Prior to placement of concrete, ensure that the Project Geotechnical Investigation report has been read and understood, soils inspections have been performed with satisfactory results, and soils testing documentation has been completed and the results are satisfactory.*

* For a variety of reasons, some /all of these items might not be applicable to a given project. Refer to Sheet S-0001 of the Project structural drawings, the Statement of Special Inspections (SSI), and the Test & Inspection Plan (TIP) in order to determine which items are applicable to a given project.

3.6 PLACING CONCRETE

- A. Place concrete IAW ACI 301.
- B. Notify the LANL STR a minimum of 24 hours prior to commencement of concrete operations.
- C. Unless permission to do otherwise is granted by LANL, standing water shall be removed from place of deposit before concrete is placed.
- D. Masonry filler units that will be in contact with concrete shall be prewetted prior to placing concrete.
- E. Concrete shall not be pumped through pipe made of aluminum or aluminum alloys.
- F. Ensure that reinforcement, inserts, embedded parts, formed joint fillers, joint devices, and formwork are not disturbed during concrete placement.
- G. Install vapor barrier under interior slabs-on-ground. Lap joints minimum 6 in. and seal watertight by sealant applied between overlapping edges and ends or taping edges and ends.
- H. Install joint filler, primer and sealant IAW manufacturer's instructions.
- I. Separate slabs-on-ground from vertical surfaces with ¹/₄ in. thick joint filler.
- J. Extend joint filler from bottom of slab to within ¹/₄ in. of finished slab surface.
- K. Install joint devices IAW manufacturer's instructions.
- L. Place concrete at a rate that ensures the following:
 - 1. An adequate supply of concrete is provided at the location of placement.
 - 2. Concrete at all times has sufficient workability such that it can be consolidated by the intended method(s).
- M. Concrete shall be placed continuously between predetermined isolation, contraction, and construction joints.
- N. Edit ACI 301 5.3.2.4 to read as follows:

"*Depositing*...Place concrete for beams...haunches," drop panels and shear caps "at the same time...slabs", unless otherwise shown.

- O. Concrete that has been contaminated or has lost its initial workability to the extent that it can no longer be consolidated by the intended method(s) shall not be used.
- P. Consolidate concrete by internal vibration per ACI 301 or ACI 309R; whichever is more stringent, unless otherwise directed by the EOR.
- Q. Top surfaces of vertically formed lifts shall be generally level.

3.7 CONCRETE FINISHING

- A. Unless indicated/ noted otherwise, screed floors and slabs on grade to a surface flatness of maximum 1/4 inches in 10 ft.
- B. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.
- C. Finish concrete floor surfaces IAW ACI 301.
 - 1. Edit ACI 301 5.3.4.1 to read as follows:

"*Placement*—"Unless EOR specifies more, "a minimum of one...or equivalent."

- 2. Finishes shall meet the requirements of ACI 301 section 5.3.4.2.
- 3. Tolerances for floors, slabs, and floor finishes shall be confirmed by measuring in conformance with ACI 301 section 5.3.4.3.
- D. Wood-float surfaces which will receive tile with full bed setting system.
- E. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, or thin-set tile.
- F. Steel trowel surfaces which are scheduled to be exposed.
- G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 in. per foot, minimum.

3.8 CURING AND PROTECTION

- A. General
 - 1. Cure and protect concrete IAW ACI 301 unless noted otherwise.
 - 2. Concrete shall be maintained at a temperature of at least 50°F and in a moist condition for at least the first 7 days after placement.
 - 3. When concrete must be placed in cold weather, as defined by ACI 306R, or hot weather, as defined herein (below), the Contractor (self-performed Work) or Subcontractor must develop a detailed "Cold-Weather Implementation Plan (CWIP)" or "Hot-Weather Implementation Plan (HWIP)," as applicable, and obtain the project EOR's approval of same. This approval shall account for those recommendations contained in ACI 306R for cold weather; or 305R for hot weather; and related requirements in ACI 308.1, as well as any elements of the aforementioned documents required for worker safety.
 - a. The CWIP shall include the items listed in Specification Checklist S ("Submittals") of ACI 306.1. Protection may be removed when the

concrete surface temperature is within 20°F of the ambient temperature measured with a calibrated measuring device.

- b. The HWIP shall include the items listed in paragraph 1.4.2 ("Submittals") of ACI 305.1.
- c. Both the CWIP and HWIP shall include procedures to be implemented upon abrupt changes in weather conditions or equipment failures.

Do not begin hot or cold weather concreting until these procedures have been approved by the EOR and submitted to and approved by the LANL STR.

- B. Cold Weather Applications
 - 1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather.
 - 2. Frozen materials or materials containing ice shall not be used.
 - 3. Forms, fillers, and ground with which concrete is to come in contact shall be free from frost and ice.
 - 4. Concrete materials and production methods shall be selected so that the concrete temperature at delivery complies with the temperature limits specified in ACI 301 paragraph 4.2.2.6.
 - 5. Use the project-approved CWIP (Para. 3.8.A) for cold weather concreting.
- C. Hot Weather Applications
 - 1. Hot weather exists when the ambient daytime temperature at any time at the job-site is 80 °F or more.
 - 2. Concrete materials and production methods shall be selected so that the concrete temperature at delivery complies with the temperature limits specified in ACI 301 paragraph 4.2.2.6.
 - 3. Handling, placing, protection, and curing procedures shall limit concrete temperatures or water evaporation that could reduce strength, serviceability, and durability of the member or structure.
 - 4. Use the project-approved HWIP (Para. 3.8.A) for hot weather concreting.

3.9 CONSTRUCTION OF CONCRETE MEMBERS

3.10 CONTRACTION JOINTS

- A. While the concrete is still plastic (i.e., within several hours after placement), provide joints in slabs at no more than 10 feet on center in each direction. The depth of each joint will be at least one-quarter of the slab thickness, but not less than one inch.
- 3.11 FIELD QUALITY CONTROL
 - A. Provide a certified testing agency to perform field testing IAW ACI 301. Testing laboratory certification may be obtained through AASHTO or another nationally

recognized accreditation service as allowed by ASTM C 1077. National accreditations must be specific to the specific facility and/or mobile unit. The engineer-of-record and the LANL Building Official, or designee must approve the test agency prior to performance of any Work. See LANL Engineering Standards Manual (ESM) Chapter 16 for additional details/requirements.

- 1. Testing agencies for performing testing services on concrete materials shall meet the requirements of ASTM C 1077.
- 2. Field testing of concrete shall be performed by an ACI Certified Concrete Field Testing Technician – Grade I.
- 3. Laboratory testing of concrete shall be done by ACI-Certified concrete laboratory technician-grade 1 or equivalent per ASTM C 1077
- B. Inform the LANL STR 48 hours in advance of field testing to allow for witnessing of testing.
- C. The Testing Agency shall perform the following tests and collect strength cylinders on one batch in every 50 cu. yds. of concrete placed or once a day when less than 50 cu. yds. is placed. Samples for Acceptance Testing are to be taken at the discharge from the transit mixer (and into a wheel barrow per ASTM C 172), except when using concrete pumps or conveyors to transport concrete to its final placement location. When pumps or conveyors are used, the samples for acceptance tests shall be taken at the end of the pipe or last conveyor belt. Pumping of concrete should follow ACI 304.2R and belt conveying ACI-304.4R.

NOTE: The tests below shall always be performed whenever concrete test specimens are taken. All concrete is to be tested.

- 1. Sample concrete IAW ASTM C 172.
- 2. Record temperature of concrete IAW ASTM C 1064.
- 3. Perform slump test IAW ASTM C 143.
- 4. Perform air content test IAW ASTM C 231, pressure method.
- 5. Perform density testing IAW ASTM C 138 when required by ASTM C 94.
- 6. Prepare concrete-strength-test cylinders IAW ASTM C 31.
 - a. Number of cylinders: Four (4) 6-inch diameter x 12-inch tall, or six (6) 4-inch diameter x 8-inch tall.
- D. The Testing Agency shall test the strength test cylinders IAW ASTM C 39 at 7 days and 28 days. Strength test cylinders must be picked-up at the job site between 8 and 48 hours after molding.
- E. Coordinate the sequencing of concrete construction to schedule LANL special inspection per the requirements of IBC Chapter 17. Provide 48-hour notification to schedule special inspectors.
- 3.12 CONCRETE ACCEPTANCE CRITERIA
 - A. Fresh Concrete
 - 1. Temperature Less than 95 degrees F.

- 2. Slump per paragraph 2.7. NOTE: Slump that is lower than the minimum slump may be placed when the LANL inspector determines that the concrete is workable and can be vibrated. (This does not authorize low slump for other reasons such as concrete being placed beyond the time limit.) The LANL inspector will note the low slump in the inspection report but will not generate an NCR unless the concrete strength report indicates that it is unacceptable.
- 3. Air content per paragraph 2.7. NOTE: High air-content beyond the specified range becomes a factor that can impact strength but not durability. The LANL inspector will note the high air-content the inspection report but will not generate an NCR unless the concrete strength report indicates that it is unacceptable.
- 4. Drum revolution counter: 300 maximum revolutions within 1-1/2 hours after initial mixing for Central-Mixed concrete, or 100 to 300 revolutions within 1-1/2 hours after initial mixing for shrink-mixed and truck-mixed concrete.

NOTE: The preceding revolutions / time limits can be exceeded when BOTH a. AND b. (below) are met:

- a. The concrete shall be of such slump or slump flow that it can be placed without the addition of water to the batch.
- b. The air content of air-entrained concrete, slump, and temperature of concrete shall be as specified.
- B. Strength
 - 1. Concrete strength is satisfactory if the average of all sets of 3 consecutive strength test results equal or exceed the specified 28 day strength f' c and no individual strength test result falls below the specified 28 day strength f' c by more than 500 psi.
- C. Appearance
 - 1. Free from honeycombs, embedded debris, and dimensional variance beyond ACI 301 and its references.
- D. Construction requirements
 - 1. Conforming to required lines, details, dimensions and tolerances specified for construction.
- 3.13 DEFECTIVE CONCRETE
 - A. Defective concrete is concrete not conforming to acceptance criteria in para 3.11.
 - 1. NOTE: At the discretion of LANL Building Official, concrete that has not been placed IAW the applicable portions of Para. 3.8 can be considered defective due to the potential for such concrete to not be durable (e.g., concrete that is not placed properly in 'cold/hot weather' is subject to poor long-term performance, etc.).
 - B. Do not accept or place defective concrete that is not in conformance with acceptance criteria. Return the fresh concrete to the supplier.

- C. Replace defective concrete not meeting strength criteria, at Subcontractor's expense. The Subcontractor may, at its expense, evaluate the concrete's inplace strength by testing 3 core samples for each strength test where LANL cured cylinders were more than 500 psi below f 'c IAW ACI 301 and ASTM C 42. Fill core holes IAW ACI 301.
- D. Replace defective concrete not meeting appearance criteria, at Subcontractor's expense. The STR may allow repair of defective concrete at Subcontractor's expense.
- E. Replace concrete not in conformance with details, tolerances, and other construction requirements at Subcontractor's expense.
- F. Concrete that has been determined to be potentially defective regarding durability (ref. Para. 3.13.A.1) will either be replaced at Subcontractor's expense, or tested (to try to prove concrete will be durable) at Subcontractor's expense.
 - 1. If Subcontractor chooses to test the concrete in question, the test method will be ASTM C 457. If the test results indicate a maximum air-void spacing factor (\bar{L}) of 0.008, on average, and with no single value exceeding 0.010, the concrete will be considered to have been proven to be durable. Otherwise, the concrete will be replaced at Subcontractor's expense.

APPENDIX A SUBMITTAL TABLE

Subcontractor is responsible for full compliance with this Section and all applicable portions of ACI 301. The submittals listed in the Submittal Table below are those specific submittals that LANL must receive from the Subcontractor.

Other potential submittals associated with the various codes and standards, and indicated as being required by the engineer of record (EOR), remain the responsibility of the Subcontractor.

The submittals must be submitted by the Subcontractor to the LANL STR within the time frame noted in the "timeframe" column to the right of the submittal item. The submittal time frames may be adjusted for individual projects by Subcontract or the LANL STR. The LANL STR will obtain the review and approval of the EOR and any other authority and notify the Subcontractor after approval is granted for each submittal.

In addition, the Subcontractor must schedule and manage any sub-tiers to ensure that the proper approach and scheduling is used to obtain all necessary approvals and tests of concrete constituents that make up new mix designs.

The submittal reviews should be generally consistent with the following schedule:

- 1. 2 days for the STR to give the submittal to the A/E
- 2. 10 days for the A/E to approve the submittal.
- 3. 2 days for the STR to return the approved submittal
- 4. 5 10 days for the Subcontractor to act on the approval
- 5. 5 days for the Subcontractor to correct any submittals for re-review followed by a 5-day review period

(A mature process will take approximately 5 weeks if the submittal is not returned unapproved).

<u>Note 1</u>: Design-build Subcontractors shall obtain their EOR approvals before submitting the submittals to the LANL STR (differs from 3rd bullet in schedule above).

<u>Note 2</u>: For "Work not specified" in /by ACI 301 (e.g., heavyweight shielding concrete, shotcrete, self-consolidating concrete, etc.), the main body of this Section requires editing, and related submittal items must be added to the following table.

<u>Note 3</u>: The term "engineer-of-record (and EOR)" is synonymous with the term "architect/engineer (i.e., as applicable to project in question)."

<u>Note 4</u>: The term "Contract Documents" includes the set of documents prepared by the EOR as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.

Note 5: Source: Requirement source is ACI 301-10 unless noted otherwise.

TABLE 1 REQUIRED SUBMITTALS

All submittals and review comments (from LANL and/or EOR) should be retained in files for future reference during the Work.

In addition to the submittal requirements listed below, any/all submittal requirements indicated on the Construction Drawings are also applicable to the Project. In the event of a conflict between the submittal requirements listed below and any that appear on the Construction Drawings, contact the LANL STR. As necessary, review the Source of an indicated submittal item(s) for additional detail.

Submittal Items that begin with "Request" are required only when the subsequent text is applicable (exception: the submittal associated with ACI 301 paragraph 5.1.2.1.f)

There are additional Submittal Items herein that are required only when they are applicable to Project; however, they are not as identifiable as those beginning with "Request."

LANL Submittal ID	Submittal Items	Timing	Source
General rec	uirements		
1.	Request to use a testing agency that is not currently approved by LANL. NOTE 1: Submittal also applies to sub-tier concrete fabricators and batch plants. NOTE 2: Request must be approved before such agency can be used.	3 months before initial placement.	1.5.F herein
2.	Test data on materials and concrete mixtures.	1 month before initial placement	1.6.2.2.e
3.	Quality control program of the concrete supplier.	1 month before initial placement	1.6.2.2.f
4.	Request to use accelerated testing. Correlation data and statistical procedure that will be used to estimate the standard-cured, 28-day strength from the measured accelerated strength.	1 month before initial placement	1.6.2.2.g
5.	Documentation of actions to increase strength test results (if/ when ACI 301 1.6.6.1 isn't met).	Within 3 work days of "finding"	1.6.5.1
6.	Correlation data relating compressive strength to the results of the in-place test (if/ when in-place testing, as permitted by ACI 301, is used). Refer to ACI 228.1R for acceptable correlation testing programs. Using cast-in-place cylinders in accordance with ASTM C873 does not require correlation; however, measured strengths need to be corrected using the factors in ASTM C42 if the length-diameter ratio is less than 1.75.	Within 3 work days of testing.	1.6.5.3
7.	Proposed repair methods, materials, and modifications to the Work (if/ when completed concrete work is found to be noncompliant with Contract Documents).	Within 3 work days of "finding"	1.7.1.4
8.	Description of repair to be performed to bring potentially under-strength concrete into compliance with Contract Documents.	Within 3 work days of "finding"	1.7.4.2.e
9.	Description of repair work performed to bring nondurable concrete into compliance with Contract Documents.	Within 3 work days of "finding"	1.7.5.2.e
10.	Identification of any "as-found/as-received" out-of-tolerance devices, and description of where and how the device(s) was used.	Within 3 work days of "finding"	1.5.I herein
Formwork a	and formwork accessories		
11.	Data on form-facing materials (if different from that specified in 2.2.1.1).	1 month before formwork installation.	2.1.2.1.a
12.	Alternative locations and details for construction and contraction joints (if different than those indicated).	1.5 months before formwork installation.	2.1.2.1.b

LANL Submittal ID	Submittal Items	Timing	Source
13.	Correlation data on alternative methods of determining concrete strength for formwork removal.	1.5 months before formwork installation.	2.1.2.1.c
14.	Drawings and procedures for installation and removal of reshoring and backshoring.	1.5 months before formwork installation.	2.1.2.1.d
15.	Data on formwork release agent or formwork liners.	15 work days before formwork installation.	2.1.2.1.e, & 2.2.D herein
16.	Shop drawings for formwork.	15 work days before formwork installation.	2.1.2.2.a
17.	Design calculations for formwork shoring, reshoring, and backshoring.	15 work days before formwork installation.	2.1.2.2.b
18.	Data sheet on form ties.	15 work days before formwork installation.	2.1.2.2.c
19.	Data sheet on isolation/ expansion joint materials.	15 work days before formwork installation.	2.1.2.2.d
20.	Data sheet on waterstop materials and splices. C of C from manufacturer that waterstops meet specified requirements.	15 work days before formwork installation.	2.1.2.2.e, and 2.2.I herein
21.	Other form-facing materials.	15 work days before formwork installation.	2.2.1.1
22.	Request to use ferrous ties with breakback less than 3/4 in. with Surface Finish-2.0 or Surface Finish-3.0.	1 month before formwork installation.	2.2.1.2
23.	Alternative material or size (to those specified or permitted), or both, for chamfer strips.	1 month before formwork installation.	2.2.1.6
24.	Request to use earth cuts as form surfaces.	1 month before formwork installation.	2.2.2.3
25.	Location and details of construction, isolation/ expansion, and contractions joints (not shown /indicated), or alternative locations and details (to those shown /indicted) of these joints.	1.5 months before formwork installation.	2.2.2.5.a
26.	Alternative locations and details (to those indicated) for construction, expansion, and contraction joints.	1.5 months before formwork installation.	2.2.2.5.c
27.	Request to use ferrous ties with breakback less than 3/4 in.	1 month before formwork installation.	2.2.3.3
28.	Request to remove formwork at a lower compressive strength than specified compressive strength for removal of forms.	1.5 months before formwork installation.	2.3.2.5

LANL Submittal ID	Submittal Items	Timing	Source
29.	Data correlating alternative concrete strength-measuring methods for for for for for movel.	1.5 months before formwork installation.	2.3.4.2
Reinforcem	ent and reinforcement supports		
30.	CMTRs for each delivery traceable to the bundle tags by heat (or lot) number.	Upon receipt of delivery.	3.1.1.1.a, & 1.5.F herein
31.	Placing drawings showing fabrication dimensions and locations for placement of reinforcement and supports.	1 month before reinforce- ment placement.	3.1.1.1.b
32.	List of splices and request to use splices not indicated in Subcontract Documents.	1 month before reinforcement placement.	3.1.1.1.c
33.	Request to use mechanical splices* not indicated in Subcontract Documents. An ICC Evaluation Service Report (ESR) – or something comparable – for the splice product shall accompany the request, and must indicate that the product complies w/the Project Code of Record. *Includes typical proprietary splicing / coupling systems, as well as Form Saver, and Cadweld.	1 month before reinforcement placement.	3.1.1.1.d
34.	Request for placement of column dowels without using templates.	15 work days before reinforcement placement.	3.1.1.1.e
35.	Request and procedure to field bend or straighten partially embedded reinforcing bars.	15 work days before reinforcement placement.	3.1.1.1.f
36.	Copy of CRSI Plant Certification.	15 work days before planned shipment date.	3.1.1.1.g
37.	Request to weld reinforcing bar; and description of reinforcing bar weld locations, welding procedure specifications, and welder qualifications. For other than ASTM A 706 reinforcing bar, CMTR of the reinforcing bar material properties that demonstrate conformance to the requirements of AWS D1.4.	15 work days before welding.	3.1.1.2.a, & 1.5.F herein
38.	Proposed supports for coated reinforcement and materials for fastening coated reinforcement not covered in 3.3.2.4.	15 work days before reinforcement placement.	3.1.1.2.b
39.	Request to relocate reinforcement beyond the specified placing tolerances (to avoid interference with other reinforcement, conduits, or embedded items), in which the 'relocated' reinforcement arrangement shall be indicated.	1 month before reinforcement placement.	3.1.1.3.a, & 3.3.2.2
40.	Inspection and quality-control program of plant that is not certified by Concrete Reinforcing Steel Institute.	1 month before planned shipment date.	3.1.1.3.b
41.	Provide equivalent certification program for evaluation by EOR.	1 month before planned shipment date.	3.2.1.2.b

LANL Submittal ID	Submittal Items	Timing	Source
42.	Request use of alternative reinforcement support type.	15 work days before reinforcement placement.	3.2.1.10
43.	Request to heat reinforcement before bending.	15 work days before reinforcement placement.	3.2.2.1
44.	Request to extend reinforcement through control joints, including saw-cut joints.	15 work days before reinforcement placement.	3.3.2.5
45.	Request to use alternative method for setting column dowels.	15 work days before reinforcement placement.	3.3.2.6
46.	Request and procedure to field bend or straighten partially embedded reinforcing bars.	15 work days before reinforcement placement.	3.3.2.8
47.	Request to use other method to measure preheat temperature.	15 work days before reinforcement placement.	3.3.2.8.a
48.	Request to field-cut reinforcement.	15 work days before cutting.	3.3.2.9
Concrete m	ixtures		
Standard M	ix Designs (i.e., Pre-Approved Mix Designs)		
****The 1 st s	ubmittal listed (pertaining para. 2.7.H herein) is applicable only for ML-1 or l	ML-2 concrete****	I
49.	Test report(s) indicating aggregate correction factor (determined IAW ASTM C 231).	Prior to first concrete placement	2.7.H herein
50.	Request to deliver concrete at a temperature exceeding 95°F.	10 work days before placement	4.2.2.6
51.	Delivery ticket (for each batch of concrete).	At the completion	4.3.2, and
	NOTES:	of each day's	ASTM C94 14.1
	Content of ticket shall be legible, and shall comply with ASTM C94 14.1 with the following changes /exceptions:	placement(c)	
	14.1.7: LATM Mix No. of the concrete in conformance with that employed in job specifications.		
	14.2.2: Amount of cement.		
	14.2.3 – 14.2.5: Delete / Not necessary.		
	14.2.6: Amount of admixtures		
	14.2.12: Delete / Not necessary.		
	amount of water that can be added at the jobsite with exceeding w/cm		
	Any/ all water added at the jobsite shall be witnessed by a LANL technical representative (e.g., field engineer, inspector, etc.).		

LANL Submittal ID	Submittal Items	Timing	Source
Alternative	Mix Designs		
**** If only a deleted. ****	Standard Mix(es) will be used on/ by the Project, this portion of the Table (i.e	e., Alternate Mix D	esigns) should be
52.	Mixture proportions and characteristics. If different mixtures are to be used for different portions of proposed Work,	15 work days before placement	4.1.2.1; 2.7.C herein; and ACI 318. 26.4.3.1(d)
	requirements. ****Check that mixture proportions conform to the requirements of 4.2.2	1	
	and 2.7.C for cementitious material content, w/cm, slump, nominal maximum size of coarse aggregate, air content, admixtures, and chloride- ion concentration, as well as compressive strength and yield.		
53.	Mixture proportion data (i.e., calculation of f ' cr, and, if applicable, the field- test records used for this; and field-test data, or trial mixtures, used to establish average compressive strength).	15 work days before placement	4.1.2.2, and 4.2.3.4.a or 4.2.3.4.b; 2.7.B
	Strength test records shall be \leq 2-years old.		herein; and ACI
	****Several different methods can be used to select mixture proportions that will produce the necessary placeability, density, strength, and durability of the concrete.		318, 26.4.3.1(b)
	Field experience of concrete mixtures previously used under similar conditions provides the best assurance that the proposed concrete mixture can be used satisfactorily and will have the specified properties.		
	If no field test records are available, refer to ACI 211.1 for selecting the initial quantities of materials based on material properties and specified concrete properties. ACI 211.1 recommends mixture characteristics be checked by trial batches in the laboratory or in the field.		
	Blending aggregates to meet criteria for a combined grading is another proportioning method that can be used. Listed below are some of the different procedures that have been used to determine proportions of blended aggregates:		
	Combined fineness modulus;		
	 8 to 18% retained on each of the standard sieves; 		
	Coarseness factor chart; and		
	• 0.45 power chart.		
	When one of the above or similar proportioning methods is used, the specific combined grading to which aggregate is to be blended, along with the tolerances for control, must be submitted. This proportioning method also requires concrete characteristics to be checked by trial batches.****		
54.	Information on types, classes, producers' names, and plant locations for cementitious materials; types, pit or quarry locations, producers' names, gradings, and properties required by ASTM C33 for aggregates; types, brand names, and producers' names for admixtures; and source of supply for water and ice, and properties required by ASTM C1602 for water	1 month before placement	4.1.2.3; 1.5.C and 2.7.B herein; and ACI 318, 26.4.3.1(c)
	Except for admixtures, test results confirming conformance to applicable specifications shall not be older than 90 days. Test results for aggregate soundness, abrasion, and reactivity may be older than 90 days, but not older than 1 year, provided test results for the other properties specified in ASTM C33 indicate that aggregate quality has not changed.		
	C of C confirming the source of the concrete materials (except for admixtures), that test results confirm conformance to applicable specifications, and confirming that ALL concrete materials used to develop mixture proportions correspond to those to be used in the proposed Work.		

LANL Submittal ID	Submittal Items	Timing	Source
55.	Field-test, or Trial-mixture, records; and data on material and mixture proportions.	15 work days before placement	4.1.2.4, 4.1.2.5, and ACI 26.4.3.1(b)
56.	Requests for adjustments to mixture proportions. Requests to adjust mixture proportions necessary for workability or consistency. **** If Subcontractor desires to decrease the cementitious materials content of the concrete mixture after having satisfied the requirements of 4.2.3.6, review a request for acceptance of the proposed revised mixture with a lower cementitious-materials content on a trial basis.	15 work days before use in a placement	4.1.2.6, 4.2.3.5, and 4.2.3.6
	If Subcontractor finds it necessary to increase the cementitious-materials content, review a request for acceptance of the proposed revised mixture with a higher cementitious-materials content on a trial basis. Confirm adequacy of modified proportions has been verified from a set of new field test data.****		
57.	Evaluation and test results required in 4.2.2.1 verifying the adequacy of concrete to be placed in floors if the cementitious materials content is less than the minimum specified in Table 4.2.2.1.	15 work days before the initial placement	4.1.2.7
58.	Request to use the volumetric batching and proposed method.	15 work days before the initial placement	4.1.2.9, 4.3.1.2
59.	Requests to use cementitious materials other than ASTM C150 Type I or Type II. When ASTM C595 or C1157 cements are used in structures that will be subjected to deicing chemicals, verify compliance of the concrete with Table 4.2.2.7.b.2.	15 work days before the initial placement	4.2.1.1
60.	Request to use admixtures.	15 work days before the initial placement	4.2.1.4; 2.7.E and 2.7.G herein
61.	Request to change materials and data verifying that properties of the concrete mixture conform to the requirements of 4.2.2.	15 work days before the initial placement	4.2.1.5
62.	Request to use a lower cementitious-materials content.	15 work days before the initial placement	4.2.2.1
63.	Request to use a slump other than that specified.	10 work days before placement	4.2.2.2
64.	Request to deliver concrete at a temperature exceeding 95°F.	10 work days before placement	4.2.2.6
65.	Documentation indicating compliance with the specified requirements for sulfate resistance.	15 work days before the initial placement	4.2.2.7.a
66.	Documentation verifying compliance with specified requirements for freezing and thawing exposure.	15 work days before the initial placement	4.2.2.7.b
67.	Documentation verifying compliance with specified requirements for low permeability.	15 work days before the initial placement	4.2.2.7.c

LANL Submittal ID	Submittal Items	Timing	Source
68.	Documentation verifying compliance with specified requirements for corrosion resistance.	15 work days before the initial placement	4.2.2.7.d
69.	Delivery ticket (for each batch of concrete). NOTES: Content of ticket shall comply with ASTM C94 14.1 and be legible. In addition to content required by '14.1,' the ticket shall also indicate w/cm, and the amount of water that can be added at the jobsite with exceeding w/cm. Any/ all water added at the jobsite shall be witnessed by a LANL technical representative (e.g., field engineer, inspector, etc.).	At the completion of each day's placement(s)	4.3.2, and ASTM C94 14.1
Handling, p	lacing, and constructing		
**** <i>Review</i> (70.	he submittals listed pertaining 5.1.2.1 and delete those items that are not re Quality-control Test and inspection reports.	<i>quired to be subm</i> Within 1 month after placement	5.1.2.1.a
71.	Proposed method of measuring concrete temperature.	15 work days before the initial placement	5.1.2.1.b, 5.3.6.5
72.	Qualifications of finishing sub-tier /-contractor and flatwork finishers for finishing unformed surfaces.	15 work days before the initial placement	5.1.2.1.c, 5.3.4.1; & 3.7.C.1 herein
73.	Shop drawings of placing, handling, and constructing methods.	15 work days before the initial placement	5.1.2.1.d
74.	Notification of concrete placement. NOTE: As soon as, if not prior to, "notification" is given /submitted, ensure the associated tests and inspections are coordinated properly /adequately.	48 hours before initial placement, and at least 24 hours before subsequent ones	5.1.2.1.e
75.	Request for acceptance of preplacement activities to ensure the preplacement activities are properly inspected.	48 hours before placement	5.1.2.1.f
76.	Description of conveying equipment.	15 work days before the initial placement	5.1.2.2.a
77.	Proposed method for removal of stains, rust, efflorescence, and surface deposits.	15 work days before performing the work	5.1.2.2.b, 5.3.7.6
78.	Proposed wet-weather protection activities.	48 hours before placement	5.1.2.2.c, 5.3.2.1.a
79.	Hot-weather Implementation Plan. Request for placement of concrete with a temperature exceeding that required in 5.3.2.1.c.	5 work days before placement	5.1.2.2.d & 3.8.A herein
80.	Cold-Weather Implementation Plan.	5 work days before placement	5.1.2.2.e & 3.8.A herein
81.	When permitted, alternative mixture for pumped concrete.	5 work days before placement	5.3.2.3.c

LANL Submittal ID	Submittal Items	Timing	Source
82.	Detailed plan for alternative saw cutting method, such as shallow-cut and dry-cut method. Refer to ACI 302.1R for further guidance.	5 work days before beginning 'jointing'	5.3.5
83.	Request to use shorter duration for moisture retention, or if a curing method other than that specified is desired.	5 work days before placement	5.3.6.1
84.	Request to delay repair of tie holes and surface defects.	5 work days before placement	5.3.7.1
85.	Alternative repair method.	5 work days before placement	5.3.7.3
86.	Procedures to apply repair materials.	5 work days before placement	5.3.7.4

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 03 3001 Rev. 10, dated June 30, 2016.

SECTION 03 3053

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, drive pads, and median pavement.
- B. Concrete curb and gutters.
- C. Concrete for fence posts
- D. Concrete thrust blocks on utility lines
- E. Concrete foundations or bases for manholes

1.2 ACTION SUBMITTALS

- A. Submit the following:
 - Material certifications documenting compliance with the New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction (SSHBC) including any Supplemental or Interim Specifications (i.e., latest specs). Exclude NMDOT Division 100, General Provisions, and any other references to METHOD OF MEASUREMENT, to BASIS OF PAYMENT, and for pay factor determination. Guidance: Document(s) at http://www.dot.state.nm.us/content/nmdot/en/Standards.html
 - 2. Design mix of each class of concrete, unless LANL pre-approved mix design is used.
 - 3. Laboratory test reports for design mix for concrete, unless pre-approved mix design is used.
 - 4. Batch tickets.
 - 5. Test Reports of Concrete Field Testing (except per 3.4.E)
- 1.3 RELATED SECTIONS
 - A. Section 31 2000 Earth Moving
 - B. Section 03 3001 Reinforced Concrete
- 1.4 QUALITY ASSURANCE
 - A. Perform work, materials and construction requirements, in accordance with the NMDOT SSHBC, Section 608, Sidewalks, Drive Pads, and Concrete Median Pavement and NMDOT SSHBC Section 609, Curb and Gutter.

- B. Furnish and place concrete in conformance to the NMDOT Supplemental SSHBC Section 510.
- 1.5 JOB CONDITIONS
 - A. Do not place concrete when base surface temperature is less than 40 degrees F.
 - B. Perform concrete washout, trucks and mixers, in a designated and controlled area to prevent the runoff of washout material and the co-mingling of unset concrete with storm water. Properly dispose of all hardened concrete.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide materials and construction requirements for forms, concrete, joints, and required accessories conforming to NMDOT SSHBC Section 608, Sidewalks, Drive Pads, and Concrete Median Pavement and NMDOT SSHBC Section 609, Curb and Gutter.
- 2.2 ACCESSORIES
 - A. Joint Fillers shall be preformed and conform to the requirements of AASHTO M33 or M153.
- 2.3 CONCRETE MATERIALS
 - A. Cement: ASTM C 150, Type I or Type II.
 - B. Fine and Coarse Aggregates: Conform to ASTM C 33.
 - C. Water: Potable water that is clean and not detrimental to concrete.
 - D. Fly Ash: Conform to ASTM C 618, type F.
- 2.4 ADMIXTURES
 - A. Air Entrainment: Conform to ASTM C260.
 - B. Chemical: Conform to ASTM C494.
- 2.5 CONCRETE MIX
 - A. Standard Mix Design
 - The standard mix design for LANL shall contain a minimum of 20% by weight of total cementitious material Type F fly ash conforming to ASTM C 618 for mitigating the deleterious effects of alkali-silica reaction in concrete that is common with the siliceous nature of aggregates found in Northern New Mexico. (The pre-approved LATM mixes meet this standard mix design).

- B. Provide concrete meeting the following criteria:
 - 1. Exterior Concrete Exposed to Freezing and Thawing:
 - a. Minimum compressive strength, f ' c: 4,000 psi @ 28 days.
 - b. Maximum nominal aggregate size: 0.75 in.
 - c. Maximum water / cement ratio: 0.45
 - d. Slump: 4 inch
 - e. Air content: 6 percent.
 - 2. Exterior Concrete to be Pumped, Exposed to Freezing and Thawing:
 - a. Minimum compressive strength, f ' c: 4,000 psi @ 28 days.
 - b. Maximum nominal aggregate size: 0.75 in.
 - c. Maximum water / cement ratio: 0.38.
 - d. Slump: 6 inch at discharge of truck.
 - e. Slump: 3 to 7 $\frac{1}{2}$ inch at pump discharge.
 - f. Air content: 6 percent.
 - 3. Interior and Below Grade -- Fill Concrete, Thrust Blocks, Anchors, Cradles, and Encasement, with Minimum Two Feet of Cover (not Exposed to Freezing and Thawing):
 - a. Compressive strength, f'c: 3,000 psi at 28 days.
 - b. Maximum nominal aggregate size: 0.75 inch.
 - c. Maximum water/cement ratio: 0.44.
 - d. Slump: 4 inch.
 - e. Air content: 3 percent.
 - 4. Pre-approved LATM Design Mixes (Ref: AMEC Project No. 4-519-003279). These mix designs can be used as long as material properties remain constant (LANL will verify this periodically).
 - LATM Mix No. 19 -- Exterior, 4,000 psi concrete, 4" slump, 5% air <u>+</u>1.5% tolerance (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), minimum 20% fly ash (proportions per CY):

Type I-II Cement: Gcc Rio Grande, Tijeras	656 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	164 lbs
Water	295 lbs
Washed Concrete Sand: El Guique Quarry	1079 lbs
Sz #67 Coarse Aggregate: El Guique Quarry	1630 lbs
Water Reducer: Mb poly heed 997	41 oz ⁽¹⁾
Air Entraining Agent: MB Micro Air,	8.2 oz ⁽²⁾

 LATM Mix No. 44 -- Exterior, 4,000 psi concrete to be pumped, 6" slump, 5% air <u>+</u>1.5% tolerance (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), minimum 20% fly ash (proportions per CY):

Type I-II Cement: Gcc Rio Grande, Tijeras	656 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	164 lbs
Water	295 lbs
Washed Concrete Sand: El Guique Quarry	1079 lbs
Sz #67 Coarse Aggregate: El Guique Quarry	1630 lbs
Water Reducer, Mb poly heed 997	57.4 oz ⁽¹⁾
Air Entraining Agent: MB Micro Air,	8.2 oz ⁽²⁾

 LATM Mix No. 20 – Interior and below grade, 3,000 psi concrete, 4" slump, 3% air (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete)⁽⁷⁾, minimum 20% fly ash (Proportions per CY):

Type I-II Cement: Gcc Rio Grande, Tijeras	417 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	104 lbs
Water	268 lbs
Washed Concrete Sand: El Guique Quarry	1378 lbs
Sz#67 Coarse Aggregate: El Guique Quarry	1765 lbs
Water Reducer, Mb poly heed 997	20.8 oz ⁽³⁾
Air Entraining Agent: MB Micro Air,	2.6 oz ⁽⁴⁾

Note (1): Temperature and slump variation may require adjustment in dosage within the range of 24.6 fl oz / cy to 57.4 fl oz / cyNote (2): Temperature and slump variation may require adjustment in dosage within the range of 1.025 fl oz / cy to 12.3 fl oz / cyNote (3): Temperature and slump variation may require adjustment in dosage within the range of 15.6 fl oz / cy to 36.5 fl oz / cyNote (4): Temperature and slump variation may require adjustment in dosage within the range of 0.65 fl oz / cy to 7.8 fl oz / cy

> LATM Mix Class A -- Exterior, 3,000 psi concrete, 3.5" +/-1" slump, design 6.5% air <u>+</u>1.5% tolerance (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), 28.2% fly ash by wt. of cement (Proportions per CY):

Type I-II Cement: GCC Rio Grande, Tijeras	440 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	124 lbs
Water	263 lbs
Washed Concrete Sand: El Guique Quarry	1176 lbs
Sz #67 Coarse Aggregate: El Guique Quarry	1764 lbs
Water Reducer: Mb Polyheed 997	50.8 oz
Air Entraining Agent: MB Micro Air,	9.0 oz

 LATM Mix Class AA -- Exterior, 4,000 psi concrete, 3.5" +/-1" slump, design 6.5% air <u>+</u>1.5% tolerance (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete), 28.2% fly ash by wt. of cement (Proportions per CY):

560 lbs
158 lbs
280 lbs
990 lbs
1759 lbs
64.6 oz
Air Entraining Agent: MB Micro Air,

 LATM Mix Class F – Exterior (Slip Form), 3,000 psi concrete, 1.5" +/-1" slump, design 6.5% air (use aggregate correction factor of 0.3 for ML-3 and ML-4 concrete)⁽⁷⁾, 33.4% fly ash by wt. of cement (Proportions per CY):

Type I-II Cement: GCC Rio Grande, Tijeras	461 lbs
Class F, Fly Ash: Salt River Materials, 4-Corners	154 lbs
Water	258 lbs
Washed Concrete Sand: El Guique Quarry	1100 lbs
Sz #67 Coarse Aggregate: El Guique Quarry	1795 lbs
Water Reducer, Mb Polyheed 997	65.2 oz
Air Entraining Agent: MB Micro Air,	24.6 oz

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify compacted, treated base is ready to support concrete and imposed loads.
- B. Verify grades and elevations of base are correct.
- C. Verify forms are set to the required grade and alignment and extend to the required depth.

3.2 PLACING CONCRETE

- A. Notify the LANL Subcontract Technical Representative (STR) a minimum of 48 hours prior to commencement of concreting operations.
- B. Ensure that reinforcement, inserts, embedded parts, fence posts, formed joint fillers, joint devices, and formwork are not disturbed during concrete placement.
- C. Concrete shall be placed in the forms in one layer. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.
- D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.
- E. Install joint devices in accordance with manufacturer's instructions.
- F. Place concrete continuously between predetermined expansion, control, and construction joints.
- G. Concrete Finishing
 - 1. The surface shall be finished true to grade and section with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Sidewalks shall receive a scored

surface produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

- 2. All slab and sidewalk edges, including those at formed joints, shall be finished with an edger having a radius of 1/4 inch.
- 3. Finished concrete slab surfaces shall be free from irregularities. Check and ensure that the slab has the proper crown, slope, and/or grade. Trueness shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge.
- 4. Finished concrete sidewalks and curb and gutters shall be free from irregularities. Check and ensure that the sidewalks, curb and gutters, and medians have the proper crown, slope, and/or grade. Do not allow the surface of concrete sidewalks, curb and gutters, and medians to deviate more than 1/4 inch (in any direction), if tested with a ten (10) foot straightedge.
- 5. Slope top of concrete fence post bases to provide positive drainage.
- 6. Finish thrust blocks to the extent where surface voids are eliminated.

3.3 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.
- B. Use all applicable practice and recommendations: for hot weather concrete application, from ACI 305.1; for cold weather concrete applications from ACI 306.1; for curing from ACI 308.1.

3.4 FIELD QUALITY CONTROL

- A. Provide a certified testing agency to perform field testing in accordance with ACI 301.
 - Testing agencies performing testing services on concrete materials shall meet the requirements of ASTM C 1077. Test agency must be approved by LANL Building Official; listing of pre-approved agencies is here <u>http://engstandards.lanl.gov/ESM_Chapters.shtml#esm16</u>
 - 2. Field testing of concrete shall be performed by an ACI Certified Concrete Field Testing Technician – Grade I.
- B. Notify the LANL STR 48 hours in advance of field testing to allow for witnessing of testing.
- C. The testing agency shall perform the following tests and collect strength cylinders on one batch in every 50 cu. yards of concrete placed or once a day when less than 50 cu. yards is placed.
 - 1. Record temperature of concrete in accordance with ASTM C 1064.

- 2. Perform slump test in accordance with ASTM C 143.
- 3. Perform air content test in accordance with ASTM C 231, pressure method.
- 4. Take 4 concrete strength test cylinders in accordance with ASTM C 31.
- D. The testing agency shall test the strength test cylinders in accordance with ASTM C 39 at 7 days and 28 days.
- E. Concrete to be used for nonstructural purposes that comprises a total quantity of less than 2 cu. yds. (i.e., per project) does not require field testing provided the concrete is mixed per manufacturer's instructions or approved mix design parameters as reflected by the mix ticket. For the purposes of this testing exclusion, "nonstructural" will be taken to mean concrete on or below the ground surface that will not adversely affect life safety and does not require a structural design. Examples of such concrete that meet this definition of nonstructural include sidewalks, curbs and gutters, thrust blocks, valve boxes and test box collars, post and pole anchorage when 8 feet in height or less, and manhole collars in non-vehicle-traffic-bearing areas.

3.5 DEFECTIVE CONCRETE

- A. Defective concrete is concrete not conforming to strength requirements, not being free from excessive cracking, discoloration, form marks, tool marks, honeycombs, embedded debris, or otherwise non-consistent with the overall appearances of the work.
- B. Do not accept or place defective concrete that is not in conformance with acceptance criteria. Return the fresh concrete to the supplier.
- C. Replace defective concrete not meeting appearance criteria, at Subcontractor's expense. The STR may allow repair of defective concrete at Subcontractor's expense.
- D. Replace concrete not in conformance with details, tolerances, and other construction requirements at Subcontractor's expense.

END OF SECTION

Do not delete the following reference information:

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 03 3053 Rev.8, dated June 29, 2015.

EPC-DO: 18-052

SECTION 03 6000

GROUTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portland cement grout
 - 2. Non-shrink epoxy grout
 - 3. Non-shrink cementitious grout
- B. Related Sections:
 - 1. Section 03 3000 -- Cast-In-Place Concrete: Formwork Products.
 - 2. Section 05 0520 Post-Installed Concrete and Grouted-Masonry Anchors Normal Confidence: Use of an anchorage system consisting of grout and an anchor rod, wherein the latter consists of concrete reinforcing steel (i.e., rebar)

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 Specifications for Structural Concrete.
 - 2. ACI 318 Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C33 Standard Specification for Concrete Aggregates.
 - 2. ASTM C40 Test Method for Organic Impurities in Fine Aggregates for Concrete.
 - 3. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
 - 4. ASTM C150 Standard Specification for Portland Cement.
 - 5. ASTM C191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 6. ASTM C307 Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.

- 7. ASTM C531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
- 8. ASTM C579 Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacings and Polymer Concretes.
- 9. ASTM C827 Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
- 10. ASTM C1090 Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout.
- 11. ASTM C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 1.3 ACTION SUBMITTALS
 - A. Product Data: Submit product data on grout, fine aggregate (demonstrating compliance with ASTM C33 and C40).
 - B. Manufacturer's Installation Instructions: Submit manufacturer's instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.
 - C. Manufacturer's Certificates of Compliance: Certify [non-shrink cementitious grout] and [Insert Other Products Here] meet or exceed [ASTM C 1107] and [Insert Other Specified Requirements Here].
 - D. Mix Designs: Submit proposed mix design [of each class of grout] to LANL Site Technical Representative (STR) for review prior to commencement of Work.
 - E. Field Quality-Control Results: Submit results of Subcontractor-furnished tests and inspections.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements related to recycled content and point of origin of materials.

1.5 QUALITY ASSURANCE

- A. The work shall be subject to inspection at all times by LANL and, if applicable, LANL's Independent Testing Agency for the purpose of determining that the work is properly executed in accordance with this specification. Failure to detect defective workmanship or material during any interim inspection shall not constitute acceptance of workmanship and materials.
- B. Acquire all materials from same source as used to produce the specific mix design for all work. Formally notify LANL of any material source changes prior to grout placement including the test agency test documentation. The subcontractor must

provide LANL a certificate of conformance prior to the initial placement that confirms the source of the constituents, that tests confirm compliance, and that these sources are the same for the mix design testing and the placed mix.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 *Product Requirements*: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver grout in manufacturer's unopened containers with proper labels intact.
- C. Store grout in a dry shelter, protected from moisture and, for prepackaged grout, if applicable, maintained at a temperature required by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 6000 *Product Requirements*: Environmental conditions affecting products on site.
- B. For prepackaged grout, do not perform grouting if ambient temperature exceeds that which is specified by manufacturer. In the case of non-prepackaged, Portland cement grout, comply with ACI 301.
- C. For prepackaged grout, maintain minimum temperature specified by manufacturer before, during, and after grouting, until grout has set. In the case of non-prepackaged, Portland cement grout, comply with ACI 301.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

- A. Portland cement: ASTM C150, Type I and II.
- B. Water
 - 1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
 - a. Corrosion of steel.
 - b. Volume change increasing shrinkage cracking.
 - c. Efflorescence.
 - d. Excess air entraining.
- C. Fine Aggregate
 - 1. Washed natural sand.
 - 2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
 - 3. Free from injurious amounts of organic impurities as determined by ASTM C40.
- D. Mix

1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID-CURING EPOXY GROUT

A. Rapid-Curing Epoxy Grout: Precision, high strength, minimal shrinkage, 100% solids, three-component epoxy grout. Rapid-curing, low creep, high effective bearing area, high-vibration and chemical resistance.

Property	Test	Result
Compressive Strength	ASTM C579	[14,000] psi at 7 days
Tensile Strength	ASTM C307	[2,100] psi minimum
Coefficient of Expansion	ASTM C531	[20x10 ⁻⁶] per degree F
Linear Shrinkage	ASTM C531	[0.04%]
[Early Age Height Change (Plastic State)	ASTM C827	Minimum change in height [0.10%] Maximum change in height [0.40%]]
[Height Change of Hardened Grout	ASTM C1090	Minimum change in height [0%] Maximum change in height [0.5%]]

2.3 NON-SHRINK CEMENTITIOUS GROUT

- A. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.
- B. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with ASTM C 1107:

Property	Test	Time	Result
Early Age Height Change (Plastic State)	ASTM C827		Minimum change in height [0.0%] Maximum change in height [4.0%]
Height Change of Hardened Grout	ASTM C1090		Minimum change in height [0%] Maximum change in height [0.3%]
Compressive Strength*	ASTM C	1 day	2,000 psi
	1107 (ASTM	7 days	5,000 psi
	modified)	28 days	6,500 psi

* For grouts, compressive strength is typically reported for multiple consistencies (e.g., plastic, flowable and fluid, etc.). Since the number and /or names of the consistencies can vary from manufacturer to manufacturer, the compressive strength given in the table is the lowest strength that all manufacturers report (i.e., fluid / max. water).

2.4 FORMWORK

A. Refer to Section 03 3001 for formwork requirements.

2.5 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify areas to receive grout.

3.2 PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.
- B. Rough concrete lightly, but not enough to interfere with placement of grout.
- C. Remove foreign materials from metal surfaces in contact with grout.
- D. Align, level, and maintain final positioning of components to be grouted.
- E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.
- 3.3 INSTALLATION FORMWORK
 - A. Construct leak proof forms anchored and shored to withstand grout pressures.
 - B. Install formwork with clearances to permit proper placement of grout.
 - C. For dry packing of grout, use braced backboards with sufficient strength to pack grout against.
 - D. Coat all formwork with approved form release agents

3.4 MIXING

- A. Mix and prepare rapid curing epoxy grout in accordance with manufacturer's instructions.
 - 1. Capable of developing compressive strength of [14,000] psi in 7 days.
 - 2. Field proportioning of epoxy grouts shall not be permitted.

3.5 PLACING GROUT

- A. Place grout material quickly and continuously.
- B. Do not use pneumatic-pressure or dry-packing methods.

- C. Apply grout from one side only to avoid entrapping air.
- D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.
- E. Thoroughly compact final installation and eliminate air pockets.
- F. Do not remove leveling shims for at least 48 hours after grout has been placed.
- G. Where grout depth will exceed 2 inches, place grout using two pours. The first pour shall be such that the second pour can be conducted with a depth of 1 to 2 inches.

3.6 CURING

- A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. After grout has attained its initial set, keep damp for minimum of 3 days.
- 3.7 FIELD QUALITY CONTROL
 - A. Field testing will be performed in accordance with [ACI 301] [ACI 318] and under provisions of Section 01 4000 Quality Requirements.
 - B. Epoxy grout: Test compressive strength per ASTM C579. Strength is satisfactory if 7-day compressive strength is equal to or exceeds specified compressive strength.
 - 1. The test method used shall be the same as that which is applicable to PART 2.
 - C. Cementitious grout: Test compressive strength per ASTM C109. Strength is satisfactory if 28-day compressive strength is equal to or exceeds specified compressive strength.
 - D. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification Section 03 6000 Rev. 3, dated May 8, 2017.

SECTION 03 6001

GROUTING OF ABANDONED WATER MAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers provisions for grout filling abandoned water mains and pertains to all water mains that are to be abandoned within paved roadway limits.
- B. Abandonment in place, by cutting and capping, of existing water mains, hydrants, service lines, and valves.
- C. Abandonment in place of water mains using flowable fill. Flowable fill will be utilized when abandoning water mains underneath roadways and paved areas, and at the direction of the LANL STR as field conditions dictate, or as specified on the Drawings. Related Sections:

1.2 RELATED SECTIONS

- A. Section 01 3300 Submittal Procedures
- B. Section 01 6000 Product Requirements
- C. Section 03 3053 Miscellaneous Cast-in-Place Concrete

1.3 SUMITTALS

- A. Conform to requirements of Section 01 3300 Submittals.
- B. Submit product data for proposed plugs and clamps for approval.
- C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.
- D. At least 15 days prior to commencing flowable fill abandonment activities, submit plan for abandonment, describing proposed grouting sequence and other information pertinent to completion of Work.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

- A. Concrete for reaction blocks: See Section 03 3053
- B. Plugs and clamps: Applicable for type of pipe to be plugged.

2.2 FLOWABLE FILL REQUIRMENTS

- A. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
- B. Placement characteristics: self-leveling.
- C. Shrinkage characteristics: non-shrink.
- D. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C940.
- E. Minimum wet density: 90 pounds per cubic foot.

2.2 BALLAST

- A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.
- B. Ballast Composition: Free of regulated waste material.

PART 3 - EXECUTION

- 3.1 DEMOLITION OF FIRE HYDRANTS, VALVES, AND PIPELINE STRUCTURES PRIOR TO ABANDONMENT
 - A. Remove all watermain appurtenances, such as hydrants, valves, and valve boxes. Appurtenances shall be returned to AW for future use.
 - B. Demolish and remove precast concrete adjustment rings, concrete vaults and covers, or other pipeline structures, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned water main. Poke holes in floor prior to filling.
 - C. Until a fire hydrant is physically removed, any hydrant that becomes nonusable during abandonment procedures shall have a heavy duty cover placed over it and secured and marked "Abandoned" so that fire department personnel know its status.

3.2 CUTTING AND CAPPING OF MAINS

- A. Do not begin cut, plug, and abandonment operations until replacement water main has been constructed and tested, all service connections have been installed, and replacement main is approved for use.
- B. Install plug, clamp, and concrete reaction block and make cut at the water main and/or at the location shown on Drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than as shown on Drawings.
- D. After main to be abandoned has been cut and capped, check for other sources feeding abandoned water main. When sources are found, notify LANL STR immediately. Cut and cap abandoned main at point of other feed as directed by AW Project Manager.
- E. After main to be abandoned has been cut and capped, check for other sources feeding abandoned water main. When sources are found, notify LANL STR immediately. Cut and cap abandoned main at point of other feed as directed by AW Project Manager.
- F. Backfill excavations in accordance with Section Excavation and Backfill for Utilities.

Repair street surfaces in accordance with local base and DPW regulations.

G. Mark location of abandoned water service laterals on Drawings and provide to AW Project Manager.

3.3 CUTTING AND CAPPING OF WATER SERVICES

- A. Do not begin cut, plug, and abandonment operations until replacement service, if necessary, has been constructed and tested, and all service connections have been installed.
- B. Service lines shall be cut and capped at the water main and/or as directed by AW Project manager.
- C. Before backfilling of a capped service line is started, the capping must be observed by a representative of AW.
- D. After service to be abandoned has been cut and capped, check for any other sources feeding abandoned water service. When sources are found, notify LANL STR immediately. Cut and cap abandoned main at point of other feed as directed by AW Project Manager.
- E. Plug or cap ends or opening in abandoned service in manner approved by AW Project Manager. Install concrete around cap and over pipe to ensure it's not penetrable by groundwater.
- F. Remove all water service surface identifications and appurtenances such as valves and valve boxes, meters, and backflow devices. Return appurtenances to AW.
- G. Backfill excavations in accordance with Section 31 23 33 Excavation and Backfill for Utilities.

- H. Repair paved surfaces in accordance with local base and DPW regulations.
- I. Mark location of abandoned water services on Drawings and provide to AW Project Manager.

3.4 PREPARATION FOR ABANDONMENT VIA FLOWABLE FILL

- A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by the LANL STR prior to start of placement. Notify the LANL STR at least 24 hours in advance of grouting with flowable fill.
- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.
- C. Clean water lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of the Work, and report them to the AW Project Manager. During placement of fill, compensate for irregularities in water pipe, such as obstructions, open joints, or open pipe to ensure no voids remain unfilled.
- D. Remove free water prior to starting fill placement.

3.5 EQUIPMENT FOR ABANDOMENT VIA FLOWABLE FILL

- A. Mix and report them to the AW Project Manager. During placement of fill, compensate for irregularities in water pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.
- B. Use concrete or grout pumps capable of continuous delivery at planned placement rate

3.6 INSTALLATION OF FLOWABLE FILL

- A. Abandon existing water lines underneath roadways, paved areas and other required locations by completely filling water mains with flowable fill.
- B. Place flowable fill to fill volume between abandonment points. Continuously place flowable fill with no intermediate pour points, but not exceeding 500 feet in length.
- C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- D. Pump flowable fill through bulkheads constructed for placement of two 2inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.
- E. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill water main from down-

stream end, to discharge at upstream end.

- F. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.
- G. Remediate placement of flowable fill which does not fill voids in water main or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside watermain or from surface.
- H. Plug each end of the water main being abandoned.
- I. Backfill to surface, above pipe left in place. Place and compact backfill in compliance with Section Excavation and Backfill for Utilities.
- J. Backfill to surface, above pipe left in place. Place and compact backfill in compliance with Section Excavation and Backfill for Utilities.

3.7 PROTECTION OF PERSONS AND PROPERTY

- A. Provide safe working conditions as required by OSHA and applicable State and local laws for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
- B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

3.8 ASBESTOS CONCRETE PIPE

A. Any work involving or impacting asbestos concrete pipe must be in accordance with the EPA's document titled "Demolition Practices under the Asbestos NESHAP".

END OF SECTION

EPC-DO: 18-052

SECTION 05 0520 POST-INSTALLED CONCRETE AND GROUTED-MASONRY ANCHORS— NORMAL CONFIDENCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The technical requirements for purchasing post-installed (PI) concrete anchors for Management Level ML-4 and Risk Category (RC)-1 through RC-IV structures, systems, and components (SSC). This specification applies to expansion, adhesive, undercut, and screw.
- B. The technical requirements for field installation and inspection of PI anchors (including anchor systems consisting of steel reinforcing bars/dowels and grout) in concrete and grouted masonry for Management Level (ML) 3 and 4, and RC-I–RC-IV SSCs. The inspection requirements of this Section do not apply to Seismically Exempt Anchors (LANL definition).
- C. Does not cover cast-in-place anchors, design of PI anchorage, or purchase of tools or equipment required for installation or testing.

1.2 RELATED SECTIONS

- A. 01 4000 Quality Requirements
- B. 03 6000 Grout
- 1.3 DEFINITIONS

Definitions of anchors per ACI 355.2 (as amended by ICC-ES AC 193) and ACI 355.4 (as amended by ICC-ES AC 308) apply, and all notations are identical to those used in those documents and in ACI 318 Chapter 17. Where additional terms or notations are used, their definitions are included in this Section.

1.4 REFERENCES

ACI 355.2	Qualification of Post-Installed Mechanical Anchors in Concrete
ACI 355.4	Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4) and Commentary
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ASTM A 36	Standard Specification for Carbon Steel
ASTM A 193	Standard Specification for Alloy-Steel Bolting Materials for High- Temperature or High Pressure Service and Other Special Purpose

EPC-DO: 18-052	Enclosure 3	LA-UR-17-31305
	Applications	
ASTM A 615	Standard Specification for Deformed an for Concrete Reinforcement	nd Plain Carbon-Steel Bars
ASTM B 633	Standard Specification for Electrodepor	sited Coatings of Zinc on
ASTM C 928	Standard Specification for Packaged, D Cementitious Materials for Concrete Re	Dry, Rapid-Hardening epairs
ASTM E 488	Standard Test Methods for Strength of Masonry Elements	Anchors in Concrete and
ASTM E 1512	Standard Specification for Testing Bon Anchors	d Performance of Bonded
ASTM F 436	Standard Specification for Hardened S	teel Washers
DOE-STD-1021	Natural Phenomena Hazards Performa Guidelines for Structures, Systems, an	ance Categorization d Components
FEMA 308	Repair of Earthquake Damaged Concre Buildings	ete and Masonry Wall
IBC	International Building Code	
Other ICC Docume	<u>ents</u>	
ICC-ES Reports	International Code Council Evaluation	Services Reports (ESRs)
ICC ESR-1545	Hilti HSL-3 Carbon Steel Metric Heavy Concrete	Duty Concrete Anchors in
ICC ESR-1546	Hilti HDA Carbon Steel and Stainless S Anchors in Concrete	Steel Metric Undercut
ICC ESR-1917	Hilti Kwik Bolt TZ Carbon and Stainless	s Steel Anchors in Concrete
ICC ESR-2322	Hilti HIT-RE 500-SD Adhesive Anchor	Systems
ICC ESR-3187	Hilti HIT-HY 200 Adhesive Anchoring S	System
ICC ESR-3027	Hilti Kwik HUS-EZ Carbon Steel Screw Cracked and Uncracked Concrete	Anchors for Use in
	International Code Council ES Accepta	ance Criteria
ICC-ES AC 01	Acceptance Criteria for Expansion An	chors in Masonry Elements
ICC-ES AC 58	Acceptance Criteria for Adhesive And	chors in Masonry Elements
ICC-ES AC 106	Acceptance Criteria for Predrilled Fas Masonry	steners (Screw Anchors) in

- ICC-ES AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
- ICC-ES AC 308 Acceptance Criteria for Post-installed Adhesive Anchors in Concrete Elements

1.5 ACTION SUBMITTALS

A. Verification Documents

The following verification documentation shall be submitted by the supplier for any anchors <u>not</u> in Tables 2.1.a and 2.1.b, Examples of Approved Concrete Anchors and Examples of Approved Grouted-Masonry Anchors, respectively:

- 1. Submit the ICC-ES Evaluation Report (ESR), or similar, for each product.
- 2. Submit technical documentation of the product, including, but not limited to: anchor design strength in shear and tension, minimum spacing and edge distances, anchor dimensions, materials and coatings used, installation instructions, and all required design parameters.
- 3. For chemical anchors, also submit information on adhesives, including, but not limited to: characteristic bond stress, elevated temperature versus load capacity effects (80–350°F), fire resistance, radiation effects, sunlight exposure effects, adverse chemical reactions, storage instructions, missing system, injection systems, mixing rations, gel time, setting time, shelf life, and hole drilling and cleanliness requirements.
- 4. For chemical anchors, also submit information as applicable on anchor element (e.g., threaded rod, deformed reinforcing bar, etc.), including geometry, shape, material properties, and any special requirements.
- 5. Submit shipping, handling, and packaging procedures as described in Para 1.6 below.
- 6. Submit cleaning and coating documentation for review.
- 7. Submit quality assurance program to meet requirements of Article 1.6.
- 8. Certificates of Compliance certifying that the anchors meet the requirements of this specification.

1.6 QUALITY ASSURANCE

- A. All material shall be procured as commercial material. The same quality assurance requirements shall be passed down to any lower tier subcontractor.
- B. The installation (and associated design) shall be in full compliance with the "Installation" and "Conditions of Use" sections of applicable ICC-ESR reports. Any departures must be acknowledged via a formal variance in accordance with ESM Chapter 1 Section Z10.

- C. The inspection, testing, and documentation requirements for same contained herein are the responsibility of the Subcontractor installing PI anchors (i.e., versus the PI-anchor inspection requirements contained in a project's Statement of Special Inspections, which is the responsibility of the LANL Special Inspector).
 - 1. To reduce delays and potentially redundant LANL inspection effort, notify LANL Inspectors at least 24 hours prior to any Subcontractor installation, inspection, or testing activities associated with Special Inspection and treat such tasks as hold/witness points.
- 1.7 PACKAGING, SHIPPING, HANDLING, AND STORAGE
 - A. Establish and maintain controls for material handling and storage during fabrication and preparation for shipment to prevent damage and deterioration.
 - B. Prior to packaging an item, remove dirt, oil residue, water, metal chips, or other contamination.
 - C. If nuts, washers, sleeves and anchors are packaged and shipped unassembled, any components that are damaged during handling, shipping & storage, or that don't fit properly (upon assembly during anchor installation), shall be replaced at no cost to LANL.
 - D. Bolting of different types and/or different sizes shall be packaged separately.

PART 2 PRODUCTS

2.1. Anchor types including nuts and washers: expansion, adhesive, screw, and undercut and their intended Natural Phenomena Hazards (NPH) Risk Category.

Anchor Type	Manufacturer	Product Name	Acceptance Report			
Expansion:						
Drop-in	not allowed	n/a	n/a			
Heavy-Duty Sleeve	Hilti	HSL-3	<u>ESR-1545</u>			
Wedge	Hilti	Kwik Bolt TZ	ESR-1917			
Wedge	Powers	Power-Stud+ SD2 Carbon Steel Anchors, & SD4 & SD6 Stainless Steel Anchors	ESR-2502			
Wedge	Powers	Power-Stud+ SD1	ESR-2818			
Adhesive	Hilti	HIT-RE 500-SD	ESR-2322			
Adhesive	Hilti	HIT-HY 200	ESR-3187			
Screw	Hilti	Kwik HUS-EZ	ESR-3027			
Undercut	Hilti	HDA	<u>ESR-1546</u>			
Undercut	Drillco	Maxi-Bolt ¹	See footnote 1			
Undercut	Powers	Atomic+	ESR-3067			

Table 2.1.a Concrete-Anchor Products

¹For Drillco Maxi-Bolts, LANL accepts the stud-type and flush-mount (coupling-type) per ESM <u>Chapter 16</u> IBC Program LBO Approval Listing. When listed in Section 05 0521 for ML-1/2 and NDC-3 use they may also be used in lower NPH Design/Risk-Category installations (e.g., this Section).

Note to installer: In rad and cleanroom areas, use of Hilti dust removal system (vacuum attachment) HIT-DRS (Item No. 362323) during hole blow-out with air is normally required. Consider purchase along with anchors if DRS is not on hand.

Anchor Type	Manufacturer	Product Name	Acceptance Report				
Expansion:							
Drop-in	not allowed	n/a	n/a				
Wedge	Hilti	Kwik Bolt 3	ESR-1385				
Wedge	Simpson	Wedge-All	ESR-1396				
Wedge	Powers	Power-Stud +SD1	ESR-2966				
Adhesive	USP	CIA-GEL 7000	ESR-1702				
Adhesive	Hilti	HIT-HY 70	ESR-2682				
Screw	Simpson	Titen HD	ESR-1056				
Screw	Powers	Wedge-Bolt+	ESR-1678				

Table 2.1.b Grouted-Masonry Anchor Products

2.2. SUPPLY ANCHOR PRODUCTS OF THE FOLLOWING TYPES:

- A. Mechanical anchors: undercut, expansion (heavy-duty sleeve, and wedge), and screw anchors.
- B. Bonded or adhesive anchor systems: chemical anchors.
- C. All material shall be commercial material.
- D. All anchors shall have a current ICC-ES Evaluation Service Report that contains recommended design capacities.
 - 1. Load tests used in the ICC-ES Reports for concrete anchors shall be performed in accordance with ICC AC 193 for mechanical anchors; and AC 308 for adhesive anchors.
 - 2. Load tests used in the ICC-ES Reports for grouted-masonry anchors shall be performed in accordance with ICC AC 01 for mechanical anchors; AC 58 for adhesive anchors; and AC 106 for screw anchors.
- E. Provide carbon steel or stainless steel anchors as specified. Submit documentation of materials used.
- F. Outdoor anchors, or those used in a moist environment, shall be of a material, or possess a protective coating, compliant with the associated Condition of Use in the respective ICC-ES Report (for the Drillco Maxi-Bolt, comply with manufacturer's guidance/requirements).
- G. Anchor head shall be stamped, or otherwise permanently marked, with the total anchor length of a length code that can be related to the total anchor length.
- H. Anchor head, nut, or washer shall not be marked with a letter "Q" or be marked with the color blue. If the letter "Q" is contained in the length code, those anchors shall be excluded from use.

- I. Drypack mortar: Packaged, dry, rapid-hardening concrete or mortar in accordance with ASTM C928; 7-day strength of 4,000 psi.
- J. Concrete reinforcing steel (rebar/dowel): ASTM A 615, grade 60 deformed bars.
- 2.3. TEST AND INSPECTIONS
 - A. The anchor supplier is responsible for performing inspections, as necessary to ensure compliance with all material and documentation requirements identified in this Specification. Documentations of inspections will be available to LANL if requested.
 - B. LANL representative shall have the option of inspecting anchors for finish, workmanship, and dimensional tolerances before any shipment is made.
 - C. Materials that are not properly marked, have poor workmanship, are corroded, have defective threads, or are improperly documented shall be rejected.

PART 3 EXECUTION

3.1 INSTALLERS

- A. Implement and document a training and/or qualification program for installers. Installers must be made fully familiar with the manufacturer's instructions and/ or, in the case of chemical anchors, manufacturer's printed installation instructions, additions from the associated ESRs, and additional requirements as noted in this Section (follow most stringent).
- B. For chemical anchors that are indicated as being horizontal or upwardly inclined and supporting sustained tension, installation shall be performed by personnel certified by the ACI/ CRSI Adhesive Anchor Installer Certification program, or equivalent.
 - 1. NOTE: The determination of whether or not an "equivalent" certification program is acceptable will be made by the LBO; hence, approval of such shall be sought and obtained prior to installation.

3.2 EXAMINATION/SITE VERIFICATION OF CONDITIONS

- A. The use of anchors shall be restricted to the applications and installations defined in the design drawings. Construction aids are exempt from this requirement.
- B. Anchors may only be installed in 14-day or older concrete that has attained its minimum specified design strength.
- C. Anchors may only be installed in sound concrete/masonry. Surfaces showing obvious distress by way of porosity, disintegration, carbonation and cracks over 0.02 inches in width and 12 inches or longer and within the distance of the embedment depth shall be reported to the Engineer of Record (EOR) for evaluation.

D. Anchors must not be drilled into the bottom of precast and post-tensioned Tbeam stems. Drilling into the sides of the T-beam stems shall be specifically preapproved by the EOR. Strand-cutting/nicking is prohibited.

3.3 PREPARATION

- A. Use of a rebar locator or drilling pilot holes is recommended to establish the rebar pattern before drilling in congested areas. Pilot holes shall be drilled with a carbide-tip bit to avoid rebar damage.
- B. In rad and cleanroom areas, use of Hilti dust removal system (vacuum attachment) HIT-DRS (Item No. 362323) during hole air blow-out is normally required. Consider purchase along with anchors if DRS is not on hand.
- C. For safety, consider drill bits/drills that automatically shut off when the bit hits metal, particularly in older construction for which electrical configuration is not well-documented.
- D. Rebar cutting is only permitted with pre-approval by the EOR. Multi-cutting of the same bar is considered as one cut. Rebar approved to be cut must be shown on as-built drawings at completion of Project.
- E. Rebar will be considered to be cut if:
 - 1. For #4 through #7: Cuts, nicks, or drill into bar body is greater than 1/16"
 - 2. For #8 and larger: Cuts, nicks, or drill into bar body is greater than 1/8"
- F. When installing anchors through cut rebar, the anchoring mechanism shall be located at least two anchor diameters clear beyond the cut rebar.

3.4 INSTALLATION

- A. Each anchor must be installed in the location, at the spacing, and with the embedment depth and edge distance(s) indicated on the project drawings, and in accordance with, in priority order, 1) this Section, 2) the ESR, 3) the manufacturer's installation instructions.
- B. Obtain and comply with LANL Form 2074, Penetration Permit.
- C. For adhesive anchors, the concrete at the time anchor installation shall have a minimum 1) compressive strength of 2,500 psi, 2) age of 21 days, and 3) temperature of 50° F. In addition, the concrete must be dry (vs. partially- or fully-saturated) at the time of installation if, at the time of installation, the anchors are protected from the environment/ weather. Finally, anchors shall be installed in holes drilled with a rotary impact drill or a rock drill.
- D. Drill holes and install anchors in accordance with the ESR.

- E. Clean drilled holes of chips, dust, loose material, and water prior to anchor installation. The hole diameters and depths shall be as those required by the ESR. Verify depth of the concrete member before drilling holes. The embedment depth of the anchor must be in accordance with the ESR and the project drawings. Contact the EOR if these requirements conflict.
- F. Anchors must be installed perpendicular to the concrete/masonry surface within $a \pm 5$ degree tolerance. Post-installation verification of this criterion may be satisfied by visual inspection to verify proper seating of the nut and washer. When an anchor is replaced with an anchor of diameter one size larger, maintain the spacing requirements of the original size anchor.
- G. In areas where concrete/masonry has been removed, the minimum anchor embedment must be measured from the surface of sound concrete/masonry.
- H. Unless otherwise noted on project drawings, use the spacing requirements per the ESR. For an anchor located adjacent to an NDC-3 anchor or embedded item, use a spacing equal to the sum of 1.5 times the embedment depth of one anchor plus 1.5 times the embedment depth of the other anchor, unless otherwise approved by the EOR.
- I. Bending and welding of PI anchors, except grouted anchors, are not permitted.
- J. The nut thread engagement for the anchors (studs) shall be such that the bolt threads are flush with or project beyond the outside face of the nut when completely installed.
- K. Nuts and washers for anchors that are lost or damaged during installation shall be replaced with manufacturer's specified component or equivalent as preapproved by the EOR.
- L. Flat washers supplied with anchors shall be used in all cases except where details of the design drawings specify the use of another washer under the nuts. A washer may be trimmed to clear interferences. The trimmed edge shall not be closer than 7/8 of the bolt diameter from the center of the washer (ref. ASTM F436).
- M. Do not damage the length identification code on the head of the anchor. Anchor projection may be cut off subject to pre-approval by the EOR and documentation of the location, embedment, and length code on a LANL inspection report by a LANL Construction Inspector prior to cutting.
- N. Unused adhesive anchors shall be cutoff flush with the surface of the concrete/masonry. Unused mechanical anchors shall be driven in and cut-off flush unless there is/could be personnel and/or equipment below, in which case anchors shall be cut off and ground flush. Cut-off anchors shall be considered an abandoned unrepaired hole for future anchor spacing requirements.
- O. The center-to-center distance between a new hole and an exploratory or unused hole or an abandoned cut-off anchor shall not be less than three times the diameter of the larger hole or 1" of clear concrete/grout between the holes, whichever is greater, unless approved by the EOR. When exploratory or unused holes are repaired (ref. para. 3.8.A) and the repair material has attained the strength of the surrounding concrete, the center-to-center distance shall not be

less than 1.5 times the diameter of the larger hole or 1" of clear concrete/grout between holes, whichever is greater, unless approved by the EOR.

- P. Anchors may be installed in the upper and lower flutes of metal decking, as indicated on project drawings. Edge distance(s), embedment depth, spacing, etc. must be in accordance with the ESR. Contact the EOR if any of these requirements conflict with project drawings. If an installation requires the use of an attachment plate that spans deck ribs then the space between the decking and attachment plate must not be filled with grout or concrete or any other material except that spray-applied fire-resistive materials are permitted.
- Q. Exercise care to avoid bending anchors to match baseplate holes, or loosening of anchors by prying sideways after tightening. Also ensure that the cone nut of an undercut anchor does not become loose from the stud during the setting or tensioning operation.
- R. Anchors that must be tensioned (via torque or direct tension) in order to be properly set/installed must not be used with leveling nuts placed under mounting plates (in order to preclude interference with pretensioning of the anchor).
- S. Relocating holes within baseplate: The baseplate with bolts may be relocated no more than 1" in any direction with respect to the attachment principal axis, unless otherwise noted on the engineering drawings.
- T. Installation-related devices (e.g., torque wrenches, hammer drills, manufacturer's setting tools, etc.) must be calibrated and controlled in accordance with LANL standards <u>P 330-2</u>, Control and Calibration of Measuring and Test Equipment (M&TE)] or equivalent.

3.5 INSTALLATION OF GROUTED ANCHORS

- A. Holes shall be drilled as shown on the engineering drawings.
 - 1. For anchors up to 1 inch in diameter, provide 2-inch diameter hole in concrete.
 - 2. For anchors greater than 2 inches in diameter, provide a hole at least 2 inches greater than the anchor diameter.
- B. Clean all surfaces of anchor to be bonded to grout from oil, grease, or other foreign material.
- C. The hole surfaces shall be wire brushed to clean them and to remove all loose particles. In addition, for core-drilled holes with diamond-tip bits, the holes shall be visually examined to confirm that there is no smooth glazing on the hole surface, and the sides of the hole may be roughened, as required, to ensure proper bond. Remove all debris, dust, cement, and other foreign materials from the hole.
- D. Soak the hole to saturation with potable water, and keep damp for a minimum of six hours prior to grouting. Immediately prior to grouting, remove all free surface water using oil-free compressed air, sponge, or vacuum.
- E. Anchors shall be properly positioned in the hole prior to grouting, and supported to maintain that position during grouting.

- F. Mix the grout specified in Section 03 6000, Grout, in accordance with that section and place it in accordance with same.
- G. Cold bending of grouted anchors is permitted to enable the anchor to clear reinforcing steel, provided that the axis of bent anchor is not more than 30 degrees from straight. Field bent anchors should be inspected by LANL construction inspection to verify radius of bend and lack of surface cracking.]

3.6 INSPECTION

- 1. Visually inspect anchors in order to verify and document that they have been installed in accordance with Articles 3.4 and 3.5 as applicable. Attributes requiring inspection are those shown in Tables 3.1 plus any additional attributes imposed by this Section and the EOR. These attributes must be identified in the inspection report documentation.
- 2. If visual inspection reveals that the installed anchor does not meet the requirements of this Section, the anchor shall be relocated as permitted by this Section, or shall be removed and replaced by another anchor, or referred to the EOR for evaluation.

Table 3.1.a Required Inspection Attributes for Concrete Anchors

For attribute definitions/details above and beyond footnote contents, refer to ESR, manufacturer's installation instructions, and, where indicated in parenthesis, previous portions of this Section.

		Wedge	Heavy Duty		
		and	Sleeve		
	Inspection Attribute	Screw		Adhesive	Undercut
1	Anchor/Anchor system ¹ type/description	~	\checkmark	\checkmark	\checkmark
2	Anchor/Anchor element dimensions	✓	✓	✓	✓
3	Concrete type (normal- vs. light- weight) ²	~	\checkmark	✓	~
4	Concrete compressive strength ²	✓	✓	✓	✓
5	Concrete thickness ²	✓	✓	✓	✓
6	Anchor spacing(s)	✓	✓	✓	✓
7	Edge distance(s)	✓	✓	✓	✓
8	Adhesive expiration date			✓	
9	Drill and/or drill bit type, size, power, etc. ³	~	\checkmark	~	~
10	Drilled hole cleaning (3.4.D)	✓	✓	✓	✓
11	Drilled hole dimensions	✓	✓	✓	✓
12	Steel deck hole dia. <u><</u> concrete hole dia. + 1/8" ⁴	~			
13	Adherence to manufacturer's installation instructions	~	\checkmark	~	~
14	Anchor embedment	✓	\checkmark	✓	✓
15	Minimum installation torque	✓	✓		
16	Maximum installation torque			✓	✓
17	Anchor perpendicular to concrete ⁵	\checkmark	✓	✓	\checkmark
18	Nut thread engagement ⁶	✓	 ✓ 	✓	✓

NOTE: Attributes 1–9 are visually inspected prior to the start of the anchor installation process, 10–16 are verified during the process, and 17–18 are verified after the process is complete.

¹ Applies to both anchor element (i.e., steel threaded rod, reinforcing bar/rebar dowel, or insert) AND adhesive material.

² Refer to project drawings if not obvious or somehow otherwise known with certainty.

³ Refer to ESR for requirements associated with hole (for anchor/rod/rebar/insert) drilling/coring.

⁴ Applies to installation in the soffit of concrete-on-steel-deck assemblies.

⁵ Refer to subparagraph under INSTALLATION that includes \pm 5° tolerance on perpendicular.

⁶ Refer to subparagraph under INSTALLATION that includes nut-thread-engagement provision.

Table 3.1.b Required Inspection Attributes for Grouted-Masonry Anchors

For attribute definitions/details above and beyond footnote contents, refer to ESR, manufacturer's installation instructions, and, where indicated in parenthesis, previous portions of this Section.

	Inspection Attribute	Wedge	Screw	Adhesive
1	Anchor/Anchor system ¹ type/description	✓	√	✓
2	Anchor/Anchor element dimensions	✓	√	✓
3	Masonry unit type (min. Grade N, Type _) ²	✓	√	✓
4	Masonry compressive strength (≥ 1500 psi) ²	✓	√	✓
5	Masonry unit size (x 8 x 16) ²	✓	~	✓
6	Mortar type (min) ²	✓	√	✓
7	Grout compressive strength (> 2000 psi) ²	✓	√	✓
8	Anchor spacing(s)	✓	~	✓
9	Edge (and End) distance(s)	✓	~	✓
10	Adhesive expiration date			✓
11	Drill and/or drill bit type, size, power, etc. ³	✓	√	✓
12	Drilled hole cleaning (3.4.D)	√4	✓	~
13	Drilled hole dimensions			✓
14	Adherence to ESR's AND manufacturer's installation instructions	~	~	~
15	Anchor embedment	✓	✓	✓
16	Minimum installation torque	✓		
17	Maximum installation torque			\checkmark
18	Anchor perpendicular to concrete ⁵	 ✓ 	✓	\checkmark
19	Nut thread engagement ⁶	✓	✓	~

NOTE: Attributes 1–11 are visually inspected prior to the start of the anchor installation process, 12–17 are verified during the process, and 18–19 are verified after the process is complete.

- ¹ Applies to both anchor element (i.e., steel threaded rod, reinforcing bar/rebar dowel, or insert) AND adhesive material.
- ² Refer to project drawings if not obvious or somehow otherwise known with certainty.
 - Masonry unit Type (I or II), and size (8x8x16 or 6x8x16), varies with product.
 - ALL products can only be used in fully-grouted masonry units that comply with ASTM C 90.
 - Mortar Type (min. N, or min. S) varies with product.
 - Grout min. compressive strength must be ≥ its specified compressive strength, & 2000 psi is a 'floor (i.e., compressive strength ≥ 2000 psi).
- ³ Refer to ESR for requirements associated with drill and drill bit.
 - A common bit requirement is carbide-tipped, and conforming to ANSI B212.15-1994 (for drilling/coring for anchor/rod/rebar/insert)
- ⁴ In lieu of hole cleaning, some wedge-anchor ESRs require drill-hole depth > anchor embedment.
- ⁵ Refer to subparagraph under INSTALLATION that includes \pm 5° tolerance on perpendicular.
- ⁶ Refer to subparagraph under INSTALLATION that includes nut-thread-engagement provision.

3.7 DOCUMENTATION

A. Installation Inspection Record

The Installation Inspection Record shall contain the information listed in Tables 3.1.

3.8 REPAIR/RESTORATION

A. Repair abandoned holes a) With material specified in Para 2.2, AND b) in accordance with Spall Repair (SR 3) in FEMA 308*. Anchors installed near an abandoned repaired or unrepaired hole must be located as specified previously¹. The repair material shall have structural and thermal properties similar to the existing material.

* For damage to a joint(s) in-between masonry units in grouted masonry, the EOR shall be contacted to develop an appropriate repair.

When anchors are not installed properly, the following repairs may be undertaken:

- 1. Remove the defective anchor, redrill hole and install the same diameter anchor if the integrity of surrounding concrete has not been disturbed.
- 2. For cases where excessive slippage upon torquing is experienced, or usage of the same hole is not possible, fill the existing hole with approved material as specified in Para 2.2 and relocate the anchor location as specified previously¹.
- 3. If breakout of concrete around the anchor occurs during installation, the EOR must develop an appropriate repair. The EOR must be contacted to evaluate the damage and repair method. Local spalling of the concrete around the anchor, up to a maximum depth of 1/4 inch, is not considered a concrete breakout failure.
- 4. Mislocated anchors may be cut flush with concrete surface, and need not be removed if they do not interfere with subsequent installations.
- 5. Mislocated anchors or anchors installed for temporary applications may be left in place. Those anchors that must be removed to accommodate other attachments, aesthetics or safety of personnel, may be removed completely, or abandoned in place by cutting off beneath the surface after chipping the concrete 1" minimum, and patching with approved material (Para. 2.2). Mislocated anchors that will be covered by a baseplate or an attachment may be cut off flush with the concrete. In the event that an anchor must be removed from the hole and a new anchor installed, the removal and installation of the new anchor shall be in accordance with the manufacturer's specifications. The wedges of anchors that are "lost" during anchor removal may be abandoned in place. The abandoned hole or removed concrete shall be filled with approved material.

¹ Refer to the subparagraph under INSTALLATION that starts with "The center-to-center distance..."

6. Removal of installed anchors for inspection or replacement may be performed using Bolt Extractor manufactured by Drillco Devices Ltd. or an equivalent.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 05 0520 Rev. 3 dated November 4, 2015.

SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install pipe hangers, supports, hanger rods, inserts, and sleeves, and other positive fastenings for mechanical non-structural components such that gravity loads are safely transferred to the structure.

1.2 RELATED REQUIREMENTS

A. Refer to Section 22 0548 - Vibration and Seismic Controls for Plumbing piping and equipment for seismic control / protection requirements for mechanical nonstructural components.

1.3 SUBMITTALS

- A. Submit the following in accordance with subcontract submittal procedures:
 - 1. Manufacturer's catalog data of hangers and supports including load capacity.
 - 2. Shop Drawings showing system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
 - 3. Manufacturer's installation instruction for special procedures and assembly of components if required.
 - 4. Certification of offsite welders and qualified welding procedure per Section 01 4444 (follow 01 4455 for onsite work).

1.4 QUALITY ASSURANCE

- A. Hangers and supports shall conform to the requirements of the following codes and standards as applicable:
 - 1. ASME B31.1, Power Piping
 - 2. ASME B31.3, Process Piping
 - 3. ASME B31.9, Building Services Piping
 - 4. Uniform Mechanical Code, (UMC)
 - 5. Uniform Plumbing Code, (UPC)
 - 6. NFPA-13, Standard for the Installation of Sprinkler System
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures
- 2.2 PIPE HANGERS AND SUPPORTS
 - A. Hangers for Pipe Sizes 1/2 to 1-1/2 inches: Malleable iron or carbon steel, adjustable swivel, split ring.
 - B. Hangers for Cold Pipe Sizes 2 inches and over: Carbon steel, adjustable, clevis.
 - C. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 - D. Hangers for Hot Pipe Sizes 6 inches and over: Adjustable steel yoke, cast iron roll, double hanger.
 - E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
 - G. Wall Support for Pipe Sizes to 3 inches: Strut clamp or cast iron hook.
 - H. Wall Support for Pipe Sizes 4 inches and over: Welded steel bracket and wrought steel clamp.
 - I. Wall Support for Hot Pipe Sizes 6 inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - J. Vertical Support: Steel riser clamp.
 - K. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - L. Floor Support for Hot Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - M. Floor Support for Hot Pipe Sizes 6 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - N. Copper Pipe Support: Copper-plated, carbon steel ring.

2.3 HANGER RODS

- A. Mild steel threaded both ends, threaded on one end, or continuous threaded.
- B. Rods for trapeze hangers shall be a minimum 3/8-inch. The use of pipe hooks,

chains, perforated iron strapping, or wire for pipe supports are NOT permitted.

2.4 INSERTS

A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment; top slot for reinforcing rods; lugs for attachment to forms; size inserts to suit threaded hanger rods.

2.5 SLEEVES

- A. Sleeves for Pipes through Non-Fire Rated Beams, Walls, Footings, and Floors: Steel pipe or 18 gage galvanized steel.
- B. Sleeves for Pipes through Fire Rated and Fire Resistive Floors, Walls, and Roof: Prefabricated fire rated sleeves including seals, approved by a nationally recognized testing laboratory (UL listed).
- C. Sleeves for Ductwork: Galvanized steel.

PART 3 EXECUTION

3.1 INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut.

3.2 PIPE HANGERS AND SUPPORTS

- A. Support piping to maintain its alignment, and prevent sagging.
- B. Place hangers within 12 inches of each horizontal elbow.
- C. Support vertical piping with riser clamps secured to the piping and resting on the building structure at each floor.
- D. Install hangers to provide minimum 1/2 inches space between finished covering and adjacent work.
- E. Use hangers with 1-1/2 inches minimum vertical adjustment.

- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.
- I. Provide insulation continuous through hangers and rollers. Protect insulation by steel shields in accordance with Section 22 0713, Plumbing and HVAC Insulation.
- J. Provide hangers on piping on each side of, and within 6 inches of, hubless pipe couplings so the couplings will bear no weight.
- K. Provide supports that allow free axial movement and only support the weight of the piping or tubing. Provide additional hangers or brackets to support valves, flanges, specialties, etc., to prevent excessive deflection.
- L. Prime coat exposed steel hangers and supports. Refer to Section 09 9100, Painting. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 SLEEVES

- A. Provide sleeves for all pipe penetrations through walls, roof, or slab above grade.
- B. Neatly cut holes in existing walls, floors, or roof for placement of sleeves. Place sleeve and grout and caulk annular space to provide finished appearance.
- C. Extend sleeves through floor slab 2 inches above finished floor level. Caulk sleeves full depth and provide floor plate.
- D. Seal space between pipe and sleeve watertight for all sleeves penetrating the roof.
- E. Where piping or ductwork penetrates a fire rated wall or floor, provide firestopping insulation so that the assembly when complete retains the fire rating of construction penetrated by the sleeve.

3.4 HANGER SPACING

- A. Plumbing Piping Water, Gas, Drain, Waste and Vent (DWV)
 - 1. Comply with the requirements of the Uniform Plumbing Code, (IAPMO), Hangers and Supports.
- B. Fire Protection Piping
 - 1. Comply with the requirements of NFPA-13, for hanger spacing and materials.

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- C. Steam/Condensate Piping Inside Building, up to 15 psig.
 - 1. Comply with the requirements of ASME B31.9, Building Services Piping.
 - 2. Maximum Hanger Spacing:

Steel Pipe Size (Inches)	1	1 ¼	1 ½	2	3	4	6	8
Spacing (Feet)	9	11	13	15	17	21	25	28

- D. Steam/Condensate Piping Outside Building, up to 150 psig.
 - 1. Comply with the requirements of ASME B31.1, Power Piping.
 - 2. Maximum Hanger Spacing

Steel Pipe Size (Inches)	1	1 ¼	1 ½	2	3	4	6	8
Spacing (Feet)	9	9	9	13	15	17	21	24

- E. Water Building Services Piping, up to 150 psig (Heating, Cooling, and Tower Water)
 - 1. Comply with the requirements of ASME B31.9, Building Services Piping.

Size (Inches)	Less Than 1	1	1 ¼	1 ½	2	3	4	6	8
Spacing (Feet) Steel Pipe	6	9	11	12	13	15	17	20	21
Spacing (Feet) Copper Tube	5	7	7	8	9	10	12	14	16

2. Maximum Hanger Spacing

- F. Air and Laboratory Gas Building Services Piping, up to 150 psig
 - 1. Comply with the requirements of ASME B31.9, Building Services Piping.

Size (Inches)	1/4 to 1/2	5/8 to 7/8	1	1 ¼	1 1⁄2	2	3	4	6	8
Spacing (Feet) Steel Pipe	6	6	9	11	13	15	17	21	25	28
Spacing (Feet) Copper/SS Tube	3	5	7	9	10	12	15	17	21	24

2. Maximum Hanger Spacing:
- G. Refrigeration Piping
 - 1. Comply with the requirements of the Uniform Mechanical Code, (ICBO) Refrigeration Supports.

3.5 HANGER ROD SIZE

A. Plumbing (UPC) Piping (Water, Gas, DWV)

Pipe Size (Inches)	1⁄2 - 4	5 - 8
Rod Size (Inches)	3/8	1/2

B. HVAC Piping (Steam, Condensate, Water, Air, Laboratory Gas)

Pipe or Tubing Size (Inches)	3/8 - 2	2 ½ - 3 ½	4 - 5	6 – 8	10 - 12
Rod Size (Inches)	3/8	1/2	5/8	3/4	7/8

END OF SECTION

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 22 0529 Rev. 3, dated September 1, 2009.

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ELECTRICAL INDEX

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26 0050	BASIC ELECTRICAL MATERIALS AND METHODS
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26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 0529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 0533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 0553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 0813	ELECTRICAL ACCEPTANCE TESTING
26 2726	WIRING DEVICES
26 2813	FUSES
26 2818	ENCLOSED SWITCHES
26 4300	SURGE PROTECTIVE DEVICES
27 5410	INSTRUMENTATION

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SECTION 26 00 50

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. This section includes general electrical requirements and specific requirements on services and metering.
 - B. Refer to paragraph 3.7 for electrical work not shown on the electrical drawings.

1.2 PROJECT SERVICE CONDITIONS

- A. Environmental Conditions:
 - 1. Ambient Temperature: 0°F minimum 100°F maximum.
 - 2. Altitude: 6000 ft AMSL.
- B. Seismic Conditions:
 - 1. Seismic Zone 2.
- 1.3 SUBMITTALS
 - A. Product Data:
 - 1. Illustrate and indicate style, model, materials, loads, connections, support fastening provision, and finish for each type and size of electrical component used.
 - 2. Provide descriptive information that states conformance to building codes and recognized testing, manufacturing, and performance standards.
 - 3. Provide manufacturer's name and catalog data listing type, catalog number, accessories, and options.
 - B. Shop Drawings:
 - 1. Scaled drawings with dimensions and sizes showing information particular to this project for each item with differences.
 - 2. Scaled plan drawings showing locations, necessary installation and maintenance clearances, and inter-connection routing between components.
 - 3. Diagrams and renderings showing relationships and interconnections necessary between components.
 - C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - D. Operations and Maintenance Manuals shall include the following information:
 - 1. All information submitted with shop drawings.
 - 2. Manufacturer's maintenance and repair instructions.
 - 3. Manufacturer's instructions provided with equipment.
 - E. Review submittals for equipment furnished under other sections prior to installation and

electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

- F. Contractor shall note any deviations from the requirements of the contract plans and specifications. Contents of the submittal documents that are not applicable to this project, particularly product options, accessories, and alternate models, shall be clearly marked as not applicable or redacted.
- G. Contractor shall note any deletions and highlight any changes and additions on resubmittal documents.
- 1.4 QUALITY ASSURANCE
 - A. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction such as Underwriters Laboratories, Inc. (UL), and marked for the intended use.
 - B. Perform the work in accordance with the current edition of the National Electrical Code (NEC) and the National Electrical Safety Code (NESC).
 - C. Perform the work in accordance with local ordinances, building codes, and statutes.
 - D. Work shown and specified in these Contract Documents establishes the minimum standard of construction. Comply with any additional requirements of the building codes or local requirements.
- 1.5 ELECTRICAL SERVICE
 - A. Coordinate with the local electric utility company, LANL Utilities.
 - 1. Install service as indicated on the drawings. LANL Utilities will provide service transformer(s), primary conductors, metering, and secondary connections at the transformer.
 - 2. Provide secondary conductors from the service equipment to the transformer secondary. Provide trenching, backfill, compaction, conduit, warning tape, and concrete encasement as shown on the drawings.
 - 3. Provide meter base, enclosure, grounding, support, and protection as required by LANL Utilities.
 - 4. Provide reinforced concrete transformer pad, grounding, and pipe bollards as required by LANL Utilities. Coordinate the pad size, thickness, openings in the pad (block outs), grounding, and location and size of pipe bollards with LANL Utilities.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT FOR UTILITY'S ELECTRICAL METERING
 - A. Current-Transformer Cabinets: Comply with LANL Utilities requirements.
 - B. Meter Base: Comply with LANL Utilities requirements.

2.2 EQUIPMENT ENCLOSURES

A. Do not install equipment in a more severe environment than recommended by the equipment manufacturer. When not indicated, provide enclosures suitable for the environment in which they are located in accordance with NEMA Standard No. 250.

2.3 DEVICE CONNECTIONS

A. Provide suitable lugs or connectors to accommodate line and load side conductors shown on the drawings. Where available device connections are inadequate for the number and/or size of conductors required, provide bus extensions, adapter plates or power distribution blocks as required.

2.4 CONCRETE BASES AND HOUSEKEEPING PADS

- A. Concrete Forms and Reinforcement Materials: As specified in section "Cast-in-Place Concrete".
- B. Concrete: Minimum of 3000-psi (20.7-MPa), 28-day compressive strength.
- 2.5 TOUCH-UP PAINT
 - A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
 - B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.6 FIRE STOPPING

A. Fire stopping materials shall meet the requirements of section "Fire Stopping".

PART 3 - EXECUTION

- 3.1 COORDINATION
 - A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow:
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
 - B. Coordinate installing electrical materials and equipment for efficient flow of the work. Coordinate installing large equipment requiring positioning before closing in the building.
 - C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Comply with the requirements of the NEC.
 - D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

3.2 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Working clearance. Provide working clearance as required by NEC Article 110.
- E. Dedicated space. Provide dedicated space for electrical equipment as required by NEC Article 110.
- 3.3 UTILITY COMPANY ELECTRICAL METERING EQUIPMENT
 - A. Install equipment according to LANL Utilities' written requirements. Provide grounding and empty conduits as required by LANL Utilities.
- 3.4 FIRE STOPPING
 - A. Apply UL listed fire stopping materials to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. See architectural drawings for locations of fire rated floors, walls, ceilings and partitions.
- 3.5 CUTTING AND PATCHING
 - A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
 - B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing fire-stop has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.
- 3.6 CONCRETE HOUSEKEEPING PADS
 - A. Install all freestanding electrical and control equipment on 4-inch high reinforced concrete pads (top of pads shall be 4 inches above finished floor) with smooth finish. Arrange components in the electrical equipment so that any switch operating handle is not more than 6 feet 7 inches above the surrounding floor to comply with NEC Article 404.8.
 - B. Construct concrete housekeeping pads necessary for the footprint of the equipment furnished but not less than 3 inches (100 mm) larger than the equipment footprint and so that anchor bolt inserts will be a minimum of 10 bolt diameters from any edge of the pad. Chamfer exposed edges.

3.7 MECHANICAL SYSTEMS COORDINATION

- A. Provide power circuits and connections to actuators, solenoids, controllers, processors, switches, sensors, etc. necessary for the required controls for plumbing, HVAC, and fire protection systems. These devices and circuits are generally not shown on the electrical drawings. Power for control system devices is to be generally supplied by the same branch circuit supplying the equipment being controlled, or by control power supplied from the equipment controller, such that disconnecting the power to the equipment also disconnects power for the controls.
 - 1. Refer to Div. 24 and Div. 25 drawings, specifications, and system submittals for control diagrams, sequence of operation descriptions, and power requirements.
 - 2. Refer to Div. 11 and Div. 13 specifications and system submittals for control diagrams, sequence of operation descriptions, and power requirements.
- B. Coordinate with each system installer the locations and arrangements of control system components.
- C. Any control system device requiring more than 120-volt or 100-watts shall be brought to the attention of the Engineer. Any control system requiring more than 120-volt or 1000-watts shall be brought to the attention of the Engineer.

3.8 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up painting:
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.9 CLEANING AND PROTECTION

- A. On completion of installation, inspect and clean all electrical equipment and enclosures including panel board, switchboard, transformer, motor control center, control panel and electrical enclosure interiors, light fixtures and lenses, outlet boxes, floor mounted devices, fittings, and wiring devices. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building wire (600 V)
- B. Wire and cable connectors
- C. Insulating tape and tubing
- D. Wire pulling lubricant

1.2 QUALITY ASSURANCE

- A. Comply with the *National Electrical Code* (NEC) installation requirements.
- B. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL). If listed products are unavailable, contact LANL Electrical Safety Office via LANL Subcontract Technical Representative (STR) for instructions.
- C. Calibrated tools and test instruments shall be maintained and calibrated per NETA ATS.

1.3 ACTION SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Certification of the Subcontractor's tool and instrument calibration program.
- 1.4 CLOSEOUT SUBMITTALS
 - A. Submit the following in accordance with the provisions of Section 01 7839, *Project Record Documents*:
 - 1. Field Test Records:
 - a. Tool and instrument calibration records.
 - b. Termination torque records.
 - c. Cable pulling records.

d. Field Quality Control inspection reports and tests results.

1.5 RECEIVING, STORING AND PROTECTING

A. Receive, store, and protect, and handle products per NECA 1, *Standard Practices* for Good Workmanship in Electrical Construction.

PART 2 PRODUCTS

- 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS
 - A. Refer to Section 01 2500, *Substitution Procedures*.

2.2 BUILDING WIRE

- A. Provide NRTL-listed building wire as shown on the Drawings with the following characteristics:
 - 1. Description: Single conductor 600 V insulated wire.
 - 2. Conductor:
 - a. 98% conductivity, annealed, uncoated copper, ASTM B 3 *Standard Specification for Soft or Annealed Copper Wire*, solid or stranded as specified in Part 3 of this Section.
 - b. Aluminum conductors may be used under the following conditions:
 - Conductors are AA 8000 series aluminum alloy registered in ASTM B 800 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes—Annealed and Intermediate Tempers, compact stranded per ASTM B 801 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation.
 - Conductors are 8AWG or larger
 - If construction drawings show copper conductors, subcontractor is responsible for recalculating wire sizes, voltage drop, raceway sizes, junction box sizes, and conduit body sizes.
 - 3. Insulation: The following types, rated 600 volts:
 - a. Unless otherwise indicated on the Drawings: Type THHN/THWN-2
 - b. Where indicated on the Drawings: Type XHHW-2

- B. Color-code conductors in <u>new installations</u> as follows:
 - 1. Use colored insulation for color coding conductors 6 AWG and smaller, unless part of a listed cable assembly. Conductors that are part of a listed cable assembly may be marked at terminations points.
 - 2. Use water and oil resistant colored plastic adhesive tape, 3/4 inch minimum width, for color coding conductor 4 AWG and larger.
 - a. Manufacturer: 3M "Scotch 35".
 - 3. Use the following color codes for AC power system conductors:

Conductor	208Y/120V	
Phase A	Black	
Phase B	Red	
Phase C	Blue	
Grounded (Neutral)	White	
Equipment Grounding	Green	
Switched	Pink or color of feeding circuit with labels: S1, S2	

Caution: The phasing of a system might require colors to be swapped in some locations. This is acceptable.

4. Use the following color codes for DC power system conductors:

Positive: Red Negative: Black

5. Use the following color codes for 120/240 volt AC single-phase systems:

Line 1: Black

Line 2: Red

Grounded Conductor: White

Equipment grounding conductor: Green

6. Provide color code for control conductors as indicated on equipment or control system manufacturer's drawings.

2.3 WIRING CONNECTORS

A. For splices and taps on copper wire, sizes 12 to 10 AWG solid and 12 to 6 AWG stranded, use push-on, insulated, spring type connectors, or twist on connectors with helical coiled spring rated 600 V and 105 °C that are NRTL-listed to UL 486C

Splicing Wire Connectors and provide a means of visual inspection of the connection.

- 1. Manufacturer:
 - a. IDEAL "In-Sure."
 - b. IDEAL "Twister Series"
 - c. 3M "Scotchlock"
 - d. Wago "773 Series"
- B. For splices and taps on copper wire, sizes 6 AWG through 1 AWG, use the following materials:
 - 1. Tin-plated copper split-bolt connectors meeting UL 486A-486B, *Wire Connectors*; provide with matching 600-volt snap-on insulating cover.
 - a. Manufacturer: FCI Burndy "Type KSA" with "Type SC" insulating cover.
 - 2. Multi-tap connectors meeting UL 486A-466B that have two or more rangetaking mechanical lugs and matching 600-volt insulated cover.
 - a. Manufacturers: Burndy 'POLYTAP" or "UNITAP", Ilsco "Type PCT", Blackburn "AMT."
- C. For wire, sizes 12 AWG and larger, use UL 486A-486B listed mechanical terminals, splices, or adapters.
 - 1. Provide mechanical terminals and splices made from aluminum, aluminum alloy, copper or a copper alloy, and marked "CU", "AL-CU" or "CU-AL" Manufacturers: FCI Burndy, Ilsco, or Thomas & Betts.
- D. For aluminum wire, use UL 486A-486B listed mechanical terminals, splices, or adapters.
 - 1. Provide mechanical terminals and splices made from aluminum, aluminum alloy, and marked "AL", "AL-CU" or "CU-AL". Manufacturer: FCI Burndy, Ilsco, or Thomas & Betts.
- E. For control wiring use nylon insulated crimp-on terminals with insulation grip that meeting UL 486A-486B. Manufacturer: 3M "Scotchlok MNG," Thomas & Betts "Sta-Kon."
 - 1. Use ring tongue terminals for nutted studs.
 - 2. Use flanged fork terminals for barrier terminal blocks.

- 3. Use pin terminals or ferrules for DIN type terminal blocks.
- F. Insulation-piercing type connectors are not acceptable for power or control wiring.
- 2.4 INSULATING TAPE AND TUBING
 - A. Insulate taped splices and connections using ethylene propylene rubber (EPR) tape meeting UL 510 *Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape* and is rated for 90°C continuous operation and 130°C short-term overload service. Manufacturer: 3M "Scotch 130C"
 - B. For the outer covering of tape-insulated splices and connections, use vinyl plastic tape meeting UL 510 *Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape* and with the following characteristics:
 - 1. 8.5 mil minimum thickness,
 - ASTM D-3005, "Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape – Type 1."
 - 3. Rated 600 volts and 105°C, suitable for indoor and outdoor applications.
 - 4. Retains flexibility, adhesion, and applicable at temperature ranges from 0 through 100°F without loss of physical or electrical properties.
 - 5. Resistant to abrasion, moisture, alkalis, acid, corrosion, and sunlight.
 - 6. Manufacturer: 3M "Scotch Super 88"
 - C. Provide heat shrinkable tubing meeting UL 486D *Sealed Wire Connector Systems* and with the following characteristics:
 - 1. Rated 600 volts
 - 2. Factory applied adhesive/sealant
 - 3. Split resistant
 - 4. Manufacturer: 3M "ITCSN"
 - D. Use motor lead splicing kits to insulate and seal connections to leads for motors rated 480V and less. Manufacturer: 3M "5300 Series"

2.5 WIRE PULLING LUBRICANT

A. Provide NRTL-listed wire pulling lubricant that is compatible with the conductor insulation or jacket, has a maximum coefficient of dynamic friction of 0.25, and

leaves no flammable residue. For cold weather installations, provide wire pulling lubricant suitable for conduit temperature.

- B. Manufacturer:
 - 1. For conduit temperature above freezing: Polywater "Lubricant J."
 - 2. For conduit temperature below freezing: Polywater "Lubricant WJ."

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that work of other trades likely to damage wire and cable is completed.
 - B. Verify raceway installation is complete and supported.
 - C. Field-verify dimensions shown on Drawings.
 - D. Wire and cable routing shown on Drawings is approximate unless dimensioned.
 - 1. Route wire and cable as required to meet Project conditions.
 - 2. Where cable routing is not shown, and destination only is indicated, determine exact routing and lengths required to meet Project conditions.

3.2 PREPARATION

- A. Examine raceways and building finishes that are to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected. Ensure conduit bodies meet the Code requirements for the number of conductors
 - 1. NEC 314.16 for conductors 6 AWG and smaller
 - 2. NEC 314.28 for conductors 4 AWG and larger
- B. Swab raceway before installing wire.
- C. Do not handle or pull cables that are colder than +14 degrees F. Store cold cables for at least 24 hours in a heated building prior to installation.

3.3 EXISTING WORK

- A. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- B. Extend existing circuits using materials and methods as specified.

C. Determine and record the existing power distribution system phase rotation, ABC clockwise or ABC counterclockwise. Maintain the existing phase rotation throughout the new installation.

3.4 BUILDING WIRE INSTALLATION

- A. Install building wire per the NEC, the requirements in this Section, and the following NECA installation standards as applicable:
 - 1. NECA 1 Standard for Good Workmanship in Electrical Construction (ANSI).
 - 2. NECA/AA 104 Recommended Practice for Installing Aluminum Building Wire and Cable (ANSI).
- B. Do not "through-pull" conductors at boxes, fittings or cabinets where a change of raceway alignment occurs.
- C. Do not damage conductor, insulation, or jacket by excessive installation pulling tension or sidewall bearing pressure.
 - 1. Use a tension measuring device to monitor pulling force on conductors 1/0 AWG and larger where any of the following combinations of bends and raceway length is exceeded between accessible pull points:
 - a. 4 equivalent 90-degree bends and 10 feet of raceway.
 - b. 3 equivalent 90-degree bends and 40 feet of raceway.
 - c. 2 equivalent 90-degree bends and 80 feet of raceway.
 - d. 1 equivalent 90-degree bend and 150 feet of raceway.
 - e. Straight pull with more than 250 feet of raceway.
 - 2. Where a pulling winch is used, use a tension measuring device to monitor pulling force on each pull of conductors for ML-1, ML-2, fire pump, and emergency circuits. Record and submit the maximum measured pulling tension for each cable pull.
 - 3. Record the maximum measured pulling tension for each monitored cable or conductor pull.
 - 4. Obtain recommended maximum conductor or cable pulling tension and sidewall bearing pressure values from the manufacturer, or use the following maximum allowable values:
 - a. Maximum sidewall bearing pressure: 500 lb/ft.

- b. Maximum tension, pulling directly on conductor: 0.008 lb/cmil
- c. Maximum tension, pulling on basket grip over insulation jacket: 2000 lb, not to exceed 0.008 lb/cmil of conductor.
- 5. Submit the recorded cable, or conductor, pulling tension for each monitored pull and the corresponding maximum allowable pulling tension.
- 6. Notify the LANL STR of any conductor pull where the maximum measured pulling tension exceeded 80 percent of maximum allowable pulling tension or sidewall bearing pressure Replace the conductors where the maximum measured pulling tension exceeded 100 percent of maximum allowable pulling tension or sidewall bearing pressure.
- D. Use solid copper conductors for power circuits 10 AWG and smaller.
- E. Where both ends of conductor, 10 AWG and smaller, are terminated in pressure plate terminations, stranded conductors may be used.
- F. Use stranded conductors for power circuits 8 AWG and larger.
- G. Use copper conductors not smaller than 12 AWG for power and lighting branch circuits.
- H. Install wiring at outlets with at least 6 inches of slack conductor at each outlet.
- I. Splices in conductors may only be used with the permission of the Authority Having Jurisdiction (AHJ).
- J. Use copper conductors for ML-1, ML-2, fire pump, and emergency systems.

3.5 CONNECTOR INSTALLATION

- A. Install conductors in terminals, splices, adapters, and connectors per the manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.
- B. Do not nick conductors when removing insulation.
- C. Do not cut conductor strands to fit into connectors, splices, adapters, or terminals.
- D. Make connections using clean connection surfaces. Wire brush conductors immediately before installing lugs, terminals, splices, or adapters.
- E. Terminate all power conductors using mechanical lugs.
- F. Terminate control conductors using crimp-on terminals or ferrules. Do not place stranded conductors directly under terminal screws. Install terminals or ferrules on conductors using ratchet-type compression tools.

- G. In new facilities only, the power distribution system's phase rotation shall be ABC clockwise, downstream of the utility transformer. This phase rotation shall be maintained throughout the power distribution system. Make or correct connections at rotating equipment input terminal to ensure proper equipment rotation.
- H. In existing facilities the power distribution system's phase rotation shall match the existing phase rotation. This phase rotation shall be maintained throughout the additions to the power distribution system. Make or correct connections at rotating equipment's input terminals to ensure proper equipment rotation.
- I. Terminate wiring on devices and components as indicated on the drawings or per the manufacturer's instructions.
- J. The LANL STR shall be given 2 weeks written, advance-notice of the date and time when the torqueing of connectors and terminals, including screws and bolts in major electrical distribution equipment, will be performed. Major electrical distribution equipment includes: transformers, switchgear, switchboards, MCCs, panelboards, disconnect switches, motors greater than 10HP, receptacles sized greater than 50A. The LANL STR or STR representative shall be given the opportunity to witness the torqueing.
- K. Tighten connectors and terminals, including screws and bolts, to manufacturers published torque-tightening values using a calibrated torque wrench or torque screwdriver.
 - 1. Where manufacturer's torque-tightening values are not indicated, tighten connectors and terminals to torque-tightening values specified in UL Standard 486A-486B.
- L. Provide a tabulated torqueing record. This shall include as a minimum:
 - 1. The torque values applied to all connectors and terminals,
 - 2. The identification of the torque tools used,
 - 3. The torque tools next calibration due date,
 - 4. The person making each termination,
 - 5. Signing and dating by the person(s) performing the torqueing.
 - 6. The report will be signed and dated by the STR or STR representative witnessing the torqueing, if applicable

3.6 INSULATING TAPE AND TUBING INSTALLATION

- A. Install insulating tape and tubing per the manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.
- B. Insulate splices and taps of irregular shapes with manufactured insulating covers or insulating tape built up to not less than 150 percent of insulation rating of conductor.

- 1. Use rubber insulating tape in half-lapped layers to develop the basic insulation over splices and taps.
- 2. Use vinyl plastic tape in half-lapped layers to provide the outer protective covering over splices and taps.
- C. Insulate cylinder shaped splices and taps, connector barrels and adapter barrels using heat shrinkable insulating tubing, insulating covers manufactured for the connector, or tape insulation as described above.

3.7 IDENTIFICATION

- A. Identify wire and cable under provisions of Section 26 0553, *Identification for Electrical Systems*.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.
- C. Apply color coding tape on conductors at each termination, or splice.

3.8 FIELD QUALITY CONTROL

- A. The LANL STR shall be given 2 weeks, written advance-notice of the date and time when inspection and testing required by this section will be conducted. At the discretion of the LANL STR, any of the following tests or inspections may be witnessed by the STR or STR representative.
- B. Pre-installation Inspection and Tests
 - 1. Inspect conductors and cables for:
 - a. Freedom from material defect or physical damage,
 - b. Correct conductor size, material, and insulation type,
 - 2. For conductors 1/0 and larger, use a megohm meter in a 1-minute test to verify the insulation integrity of the conductors while still on the reel. Record all test results.
 - a. Use 1000-volts dc to test conductors rated 600 volts.
 - b. Conductors with insulation resistances over 50 megohms are acceptable.
 - c. Conductors with insulation resistances less than 2 megohms are defective.
 - d. If the conductor insulation resistance is between 50 megohms and 2 megohms consult the LANL STR for further direction.

- 3. Reject and replace entire reels, rolls, or boxes containing conductors or cables with material or manufacturing defects.
- C. Observe conductors and cables during the installation process.
 - 1. Reject and replace cable or conductor segments that have been kinked, dented, or otherwise damaged during handling or installation.
- D. After installation of wires and cables, perform the following inspections and tests:
 - 1. Inspect conductors and cables for:
 - a. Freedom from material defect or physical damage,
 - b. Correct conductor size, material, and insulation type,
 - c. Correct color coding and identification.
- E. Before energizing the circuit, perform the following and tests:
 - 1. Before connecting conductors to equipment, use a megohm meter in a 1minute test to verify the insulation integrity of each service conductor, feeder conductor, critical system branch circuit conductor, and critical system control conductor with respect to ground and other associated conductors in the same cable or raceway.
 - a. Use 1000-volts dc to test conductors rated 600 volts.
 - b. Conductors with insulation resistances over 50 megohms are acceptable.
 - c. Conductors with insulation resistances less than 2 megohms are defective.
 - d. If the conductor insulation resistance is between 50 megohms and 2 megohms consult the LANL STR for further direction.
 - 2. After connecting conductors to equipment, inspect connections for correct connector size and type.
 - 3. Measure and record torque pass/fail of not less than 10% of each size and type of connector and terminal using a calibrated torque wrench or torque screwdriver.
 - a. Compare measured torque with torque with the torque-tightening values indicated by the manufacturer or specified in UL Standard 486A-486B.

- b. If any connection is found to be less than the recommended torque, notify the LANL STR and re-torque the connection. Record the torque-tightening values for connections that were re-torqued.
- c. If more than 50% of the tested connections are found to be less than the recommended values the LANL STR shall require all bolted connections on the Project to be redone.
- F. Remove and replace defective, incorrect, or improperly installed conductors and connectors. Re-inspect and re-test replacement conductors and connectors.
- G. Submit test and inspection records to the LANL STR.
- H. Refer to Section 26 0813, *Electrical Acceptance Testing* for other inspections and tests that are required before conductors may be energized.

END OF SECTION

This project specification is based on LANL Master Specification Section 26 0519 Rev. 6, dated September 25, 2017.

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Main Grounding Electrode System (Lightning Protection System grounding is specified in Section 26 4100.)
- B. System Grounding
- C. Enclosure and Equipment Grounding System

1.2 ACTION SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Submit the following in accordance with Section 01 3300 Submittal Procedures:
 - 1. Catalog Data: Submit catalog data for grounding conductors, grounding clamps, grounding bushings, grounding plates, grounding bars, chemical ground rods, exothermic weld materials, compression grounding and connector materials.

1.3 REGULATORY REQUIREMENTS

- A. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) where such products are required by the NEC to be listed, or such products enclose an electrical hazard as follow:
 - 1. For AC circuits greater than 50 volts
 - 2. For DC circuits and batteries greater than 100 volts.

1.4 RECEIVING, STORING AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1 Standard *Practices for Good Workmanship in Electrical Construction.*

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures.

2.2 GROUND RODS

- A. Provide NRTL-listed ground rods as shown on the Drawings.
- B. Furnish ground rods that comply with ANSI C135.30 with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
- C. Manufacturers: Blackburn, Thomas & Betts, Harger
- 2.3 MAIN GROUND ELECTRODE BAR AND MAIN GROUND BAR EXTENSIONS
 - A. Provide ground bar, 12 inches long or greater length as indicated on the Drawings, fabricated from 1/4 inch thick, 4 inch wide copper stock with 1.75" x 2" bolt-hole pattern to accept NEMA standard lugs. Mount ground bar on 2,700 volt standoff insulators.
- 2.4 LOW-VOLTAGE DISTRIBUTION TRANSFORMER GROUNDING TERMINAL BAR
 - A. Furnish, if one is not already installed, a terminal bar that is adequate for the type and size of the system bonding jumper, supply side bonding jumper, and primary equipment grounding conductors.
- 2.5 GROUND PLATES
 - A. Provide ground plates designed for flush mounting in concrete structures.
 - B. Furnish copper alloy castings with four 1/2" x 13 threaded holes at 1.75" x 1.75" NEMA spacing and a welding stud or compression connection suitable for 2 AWG to 250 kcmil copper conductor.
 - C. Furnish NRTL-listed ground plates that are suitable for direct burial and have been tested successfully according to the requirements of IEEE Std. 837 *IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.*
 - D. Manufacturer: Burndy "YGF"
- 2.6 GROUNDING ELECTRODE CONDUCTOR
 - A. Provide bare, soft-temper copper conductor.
- 2.7 EQUIPMENT GROUNDING CONDUCTORS
 - A. Provide NRTL-listed THHN/THWN-2 insulated copper wire.
 - B. Use solid equipment grounding conductors 6 AWG and smaller where not subject to vibration or repeated flexing.
 - C. Use stranded equipment grounding conductors for 4 AWG and larger.

- D. Use stranded equipment grounding conductors where subject to vibration or repeated flexing. Use stranded equipment grounding conductors in flexible conduit at motor connections.
- E. Color code equipment grounding conductors as follows:
 - 1. Equipment grounding conductor:

Conductors 6 AWG and smaller: Green colored insulation.

Conductors 4 AWG and larger: Green colored insulation or other colored insulation, not white, with 3/4-inch-wide band of water and oil-resistant green plastic adhesive tape.

- 2.8 CONDUIT GROUNDING BUSHINGS
 - A. Provide NRTL-listed, 150 °C rated insulated throat grounding bushings with lay-in type ground cable lugs.
 - B. Manufacturers: O-Z/Gedney Type "BLG".

2.9 COMPRESSION GROUNDING CONNECTIONS

- A. Provide wrought copper connectors, terminals, taps, and splices for making compression grounding connections. Connections, on a ground bar, that are a part of the grounding electrode conductor shall be made with irreversible connections.
- B. Furnish NRTL-listed grounding connectors that are suitable for direct burial
- C. Provide connector manufacturer's hydraulic compression tools and dies that match the connectors.
- D. Match connector and die size to material shapes and conductor sizes to be joined.
- E. Use two-hole, heavy-duty compression lugs for bolted connections to ground bars, ground plates, and equipment ground pads for conductors that are 2 AWG and larger.
- F. Manufacturer: Burndy "Hyground".

2.10 EXOTHERMIC WELD GROUNDING CONNECTIONS

- A. Provide molds and welding material for making exothermic weld connections.
- B. In interior locations and in vaults, use low smoke emission type welding material.
- C. Match mold and weld material to material types, shapes and sizes to be joined.

D. Manufacturer: ERICO Cadweld.

2.11 PIPE GROUNDING CONNECTORS

- A. Provide NRTL-listed copper-alloy connectors for making cable to pipe connections.
- B. Manufacturer: O-Z/Gedney "ABG" or "CG"

PART 3 EXECUTION

3.1 EXAMINATION

- A. Measurements shown on Drawings are approximate. Verify with field measurements.
- B. Electrode locations and grounding cable routing shown on Drawings are approximate unless dimensioned.
 - 1. Install electrodes and route cable as required to meet Project conditions.
 - 2. Where electrode location or cable routing is not shown, and destination only is indicated, determine exact locations, routing, and lengths required to meet Project conditions.

3.2 GENERAL

- A. Install grounding and bonding material according to manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.
- B. Do not use the grounding systems specified in this section for lightning protection grounding.
- C. Use the following connection methods unless otherwise specified or indicated on the Drawings:
 - 1. Use exothermic weld grounding connections for underground or concealed connections of dissimilar materials.
 - 2. Use exothermic weld or compression grounding connections for underground or concealed connections of like materials.
 - 3. Use exothermic weld, compression, or bolted grounding connections for accessible connections.
 - 4. Make bolted connections using bolts, nuts, flat washers, and toothed lock washers suitable for the connector and the installation environment;

acceptable materials include high strength silicon bronze and 18-8 alloy stainless steel.

- 5. Make irreversible bolted connections using stainless steel tamperresistant bolts and tamper-resistant nuts along with flat washers, and toothed lock washers. Tamper-resistant nuts and bolts must resist loosening with common tools; acceptable tamper-resistant fasteners include penta-head, break-away, and oval designs.
- 6. Use a connector that is listed for the application.
- D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torque requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B. Use a calibrated torque wrench. Manufacturer's alternate methods for achieving proper torque values are acceptable.
- E. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Follow connector manufacturer's installation instructions and use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed.
- F. Install exothermic welds in accordance with manufacturer's instructions and recommendations.
- G. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
 - 2. Make connections with clean bare metal at points of contact.
 - 3. Make aluminum to steel connections with stainless steel separators and mechanical clamps.
 - 4. Make aluminum to galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.3 MAIN GROUNDING ELECTRODE SYSTEM

A. Concrete Encased Electrode: Install in accordance with NEC, as shown on drawings.

- B. Ground Rod Electrode: Install a ground rod electrode system constructed per the State of New Mexico Electrical Code.
 - Install at least 20 feet of 2 AWG bare copper conductor in direct contact with the earth at a depth below the earth's surface of not less than thirty (30) inches. The 2 AWG bare copper conductor shall be installed in a continuous trench that is at least twenty (20) feet in length and be augmented with a minimum of two (2), eight (8) foot long, minimum, grounds rods one at each end of the 2 AWG conductor.

3.4 MAIN GROUND ELECTRODE BAR AND MAIN GROUND BAR EXTENSIONS

- A. Install a main ground electrode bar in an accessible location in the main electrical room adjacent to the service entrance or main equipment.
- B. Make an irreversible connection between the main ground electrode bar and the main grounding electrode conductor; use exothermic weld connection or compression grounding lug with tamper-resistant fasteners.
- C. Main ground electrode bar extensions may be established at additional locations by installing main ground bars or ground plates connected to the main electrode ground bar using 4/0 AWG ground conductor with an irreversible connection to each ground bar.
- D. Connections to the main ground electrode ground bar [or extensions] will be considered as connections directly to the main ground electrode.
- E. Bond exterior underground metal fire protection and potable water service pipes to the main ground electrode bar; use pipe grounding fittings and ground conductor as indicated on the Drawings, or not smaller than the grounding electrode conductor required by the NEC and not smaller than 4 AWG. Make bond to each water pipe at an accessible location within 5 ft of where it enters the structure. Comply with NEC requirements for bonding around water meters and insulating joints.
- F. Bond the nearest building perimeter structural steel column or effectively grounded metal structure to the main ground electrode ground bar; use ground conductor as indicated on the Drawings, or not smaller than the grounding electrode conductor required by the NEC and not smaller than 4 AWG.

3.5 SYSTEM GROUNDING

- A. Service equipment
 - 1. Connect the service equipment ground bus to the main electrode ground bar; use a ground electrode conductor as indicated on the Drawings, or not smaller than the grounding electrode conductor required by the NEC and not smaller than 4 AWG.

- B. Separately Derived Systems:
 - 1. Install system bonding jumper in transformer enclosure, from the neutral point of the transformer to the transformer grounding terminal bar. Size system bonding jumper as shown on drawings.
 - 2. Grounding electrode conductor shall be terminated to transformer grounding bar, not the first disconnect.
 - 3. First means of disconnect shall have no system bonding jumper installed and shall have separate neutral and ground bars.

3.6 ENCLOSURE AND EQUIPMENT GROUNDING

- A. Provide permanent and effective equipment, enclosure, and raceway bonding in accordance with NEC requirements and as further specified or shown on the Drawings.
- B. Provide an equipment ground bar, if one is not already a part of the equipment, in all switchgear, switchboards, panelboards, transformers, motor control centers, starters, and disconnect switch, for grounding the enclosure and for connecting other equipment and raceway grounding and bonding conductors.

Note: Some drawings show a bonding jumper between the grounding bar and the enclosure. This is for illustration only and is not meant to be installed in the field.

- C. Make connections and couplings on metallic conduit systems wrench-tight.
- D. Bonding Bushings:
 - 1. Install bonding bushings on metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
 - 2. Install bonding bushings on metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
 - 3. Bond conduit bonding bushing lug to the equipment ground bar or ground lug in switchgear, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. Size bonding jumpers in accordance with the NEC.
- E. Provide an insulated equipment grounding conductor for each raceway containing feeder or branch circuits.
 - 1. Install the equipment grounding conductor within the common conduit or raceway with the related phase and neutral conductors and connect to the grounding terminal or grounding bus in each box or cabinet where a splice or termination of the associated conductors is made.

- 2. Size equipment grounding conductor as shown on the Drawings.
- F. In each 15 or 20 ampere branch circuit outlet box and junction box where a splice is made, install a green-colored, washer-head grounding screw with a 12 AWG equipment grounding conductor pigtail and connect it to the equipment grounding conductor of the associated circuit.
- G. Connect receptacle grounding terminals to the equipment ground system using minimum 12 AWG equipment grounding conductor. Do not use a "self-grounding" receptacle strap as the only equipment grounding path.

3.7 FIELD QUALITY CONTROL

- A. General: Perform on-site inspection. Inspection shall be visual for workmanship and adherence to requirements before grounding is covered up by earth or concrete.
- B. Notify the LANL Subcontract Technical Representative (STR) ten (10) working days in advance of the expected completion of a grounding system installation. Inspection can be scheduled in parts or by area depending on the system and construction schedule.
- C. Before work is concealed, verify and certify that the following grounding installations have been made correctly:
 - 1. The building grounding electrode system. This includes the bonding of the foundation reinforcing bars, bonding of the structural steel columns, and bonding of other metallic systems and other grounding electrode systems.
 - 2. Ground plates and grounding bars.
 - 3. All other underground grounding installations.

END OF SECTION

This project specification is based on LANL Master Specification 26 0526 Rev. 2, dated March 16, 2017.

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- PART 1 GENERAL
- 1.1 SECTION INCLUDES
 - A. Furnish and install, hangers, supports, anchors, concrete bases, and other positive fastenings for electrical components such that gravity loads are safely transferred to the structure.
- 1.2 QUALITY ASSURANCE
 - A. Furnish and install hangers and supports that conform to the requirements of the following codes and standards:
 - 1. NFPA 70, *National Electric Code* (NEC)
 - 2. IBC, International Building Code
 - 3. NECA 1, Standard Practices for Good Workmanship in Electrical Contracting
 - 4. Metal Framing Manufacturers Association
 - a. MFMA-4, Metal Framing Standards Publication
 - b. MFMA-102, Guidelines for the Use of Metal Framing

1.3 ACTION SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Submit the following in accordance with project submittal procedures.
 - 1. Catalog Data: Submit catalog data for each type of product specified. Include information substantiating equivalent corrosion resistance to zinc coated steel of alternative treatment, finish, or inherent material characteristic.
- 1.4 RECEIVING, STORING AND PROTECTING
 - A. Receive, store, and protect, and handle products according to NECA 1.

PART 2 PRODUCTS

- 2.1 SUBSTITUTIONS
 - A. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures.
- 2.2 COATINGS AND MATERIALS
 - A. Furnish products for use indoors protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.
 - B. Furnish products for use outdoors or in damp or corrosive indoor locations with hot-dip galvanized coating or with treatment of equivalent corrosion resistance

using approved alternative treatment, finish, or material such as stainless steel with inherent corrosion resistant characteristics.

2.3 RACEWAY SUPPORTING DEVICES

- A. Furnish supports as described below for the installation of raceway systems.
- B. Use pressed steel, single bolt hangers to support individual RMC, IMC or EMT raceways from threaded rods or beam clamps. Manufacturer: Steel City "6H_ B Series."
- C. For individual runs of EMT up to trade size 1, above accessible ceilings, use spring steel conduit clips with positive snap closure. Manufacturer: ERICO CADDY "M Series".
- D. Use malleable iron conduit clamps to secure individual RMC, IMC or EMT raceway runs across, parallel, or perpendicular to beams, channels and angle supports. Manufacturer: Steel City "RC, EC, and PC Series".
- E. Use two-piece carbon steel riser clamps for individual vertical raceways passing through floors. Manufacturer: Kindorf "C-210 Series".
- F. Use snap-on type, one-hole steel straps to secure individual raceways up to trade size 2 to flat, dry interior surfaces. Manufacturer: T&B "1210 Series" for RMC and IMC and "4100 Series" for EMT.
- G. Use one-hole malleable iron straps to secure individual raceways up to trade size 4 to flat, dry interior surfaces. Manufacturer: T&B "1275 Series".
- H. Use one-hole malleable iron straps and conduit spacers to secure individual conduits to flat exterior or damp flat interior surfaces. Manufacturer: T&B "1275 Series" straps with 1350 Series" spacers.
- I. Support multiple parallel horizontal conduits with trapeze hangers fabricated from framing channel materials specified below.

2.4 OUTLET BOX SUPPORTING DEVICES

- A. Furnish pre-fabricated sheet steel brackets to support outlet boxes from metal studs in dry-wall construction.
- B. Single outlet boxes: Provide brackets that are inset to allow for dry-wall ring and have a far-side support leg. Manufacturer: ERICO CADDY "H Series" or "MEB1" attached with "SMS8" low-profile, self-tapping screws.
- C. Multiple outlet boxes: Provide brackets that are inset to allow for dry-wall rings and span from stud to stud. Manufacturer: ERICO CADDY "RBS Series" attached with "SMS8" low-profile, self-tapping screws

2.5 HANGER RODS

- A. Furnish mild steel rods that conform to ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- B. Furnish rods that are threaded on both ends, threaded on one end, or continuous threaded with UNC (coarse) thread pitch.

C. Provide swivel hangers to eliminate inelastic bending of hanger rods that are not seismically braced.

2.6 FASTENERS

- A. Pre-set Concrete Inserts
 - 1. Furnish pre-set concrete inserts as shown on the Drawings.
 - 2. Manufacturers:
 - a. Continuous inserts for wood forms: B-Line "B22I-12" or longer.
 - b. Spot inserts for wood forms or metal decks: B-Line "B2500" with "N2500" nut, "B2501".
- B. Post-installed Concrete Anchors
 - 1. Furnish post-installed expansion, adhesive, and undercut concrete and masonry anchors as shown on the Drawings and Section 05 0520 "Post Installed Concrete and Grouted-Masonry Anchors Normal Confidence".
 - 2. Power-actuated threaded studs: Use zinc-plated carbon steel or stainless steel suitable for the intended service:
 - a. 1/4-20 threaded stud: Manufacturer: Hilti X-W6
 - b. 3/8-16 threaded stud: Manufacturer: Hilti W10
- C. Beam Clamps:
 - 1. Furnish beam clamps that are NRTL-listed and compliant with Federal Specification WW-H-171E Type 23 or Manufacturers' Standardization Society SP-69 and SP-58 Type 23.
 - 2. Provide beam clamps with a locknut on the setscrew.
 - 3. Provide NRTL-listed restraining strap for each beam clamp. Strap shall be not less than 16 gauge thickness, not less than 1 inch wide, and of sufficient length to wrap around the beam flange not less than 1 inch.
- D. Hollow Wall Anchors: Furnish zinc-plated steel hollow wall anchors that meet GSA Specification FF-B-588C, Type III.
- E. Toggle Bolt Anchors: Furnish zinc-plated steel toggle bolt anchors that meet GSA Specification FF-B-588C, Type I, Class A, Style 1.

2.7 FRAMING CHANNEL SYSTEMS

- A. Furnish U-channel framing systems that conform to MFMA-4 and are fabricated using minimum 12-gage steel.
- B. Furnish fittings and accessories that mate and match with U-channel and are of the same manufacturer. Use two-piece, single bolt type conduit straps on U-channel supports.
- C. Manufacturers: Unistrut, B-Line, Superstrut.
- 2.8 FABRICATED SUPPORTING DEVICES
 - A. Furnish shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Furnish steel brackets fabricated from angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 EXECUTION

- 3.1 GENERAL
 - A. Install hangers and supports according to the NEC, IBC, NECA 1, the requirements in this Section, and specific supporting requirements in other Sections.
 - B. Conform to manufacturer's instructions and recommendations for selection and installation of hangers and supports.
 - C. Do not use wire or perforated strap for permanent supports.
 - D. Refer to Section 26 0533 Raceways and Boxes for Electrical Systems for required flexible sections where raceways cross building expansion joints and where raceways connect to equipment.
 - E. Do not support conduits, boxes, raceways, etc. from ceiling suspension wires.

3.2 EXAMINATION

- A. Examine surfaces to receive hangers and supports for compliance with installation tolerances and other conditions affecting performance of the system. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.3 FASTENERS
 - A. Pre-set inserts: Install pre-set inserts for anchoring to reinforced concrete slabs, sides of reinforced concrete beams, and reinforced concrete walls.
 - B. Post-installed concrete anchors: Install in accordance with Section 05 0520 "Post Installed Concrete and Grouted-Masonry Anchors – Normal Confidence" and the product's ICC-ES report conditions of use.
 - C. Masonry screw anchors: Use in accordance with NECA 1 and the product's ICC-ES report conditions of use.
 - D. Power-actuated threaded studs:
 - 1. Use only to fasten clips or straps for individual RMC or IMC conduits trade size 1.5 and smaller or EMT trade size 2.5 and smaller.
 - 2. Install in accordance with the product's ICC-ES report conditions of use and the manufacturer's instructions using recommended tools and loads.
 - 3. Use only in uncracked concrete.
 - 4. Install to provide embedment as indicated on the Drawings.
 - E. Hollow wall anchors: Use hollow wall anchors for fastening to wallboard, plaster or paneling.
 - F. Toggle bolt anchors: Use toggle bolt anchors for fastening to block, wallboard, or plaster.

- G. Use wood screws for fastening to wood construction.
- H. Use beam clamps for fastening to structural metal beams, joists, and purlins.
 - 1. Install a restraining strap at each beam clamp. Wrap the restraining strap around the beam flange not less than 1 inch. Where purlins or beams do not provide a secure lip for the restraining strap, secure the strap with a self-tapping screw or by through-bolting.
 - 2. Use a locknut on each beam clamp set screw.
- I. Use self-tapping screws or machine bolts, nuts, and washers for fastening to metal studs or metal surfaces.
- J. The use of lead-cinch drop in anchors is not allowed.
- K. Torque threaded fasteners as recommended by the manufacturer's instructions.
- 3.4 RACEWAY SUPPORTS.
 - A. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 - B. Support three or more parallel runs of horizontal raceways together on trapeze hangers.
 - C. Support individual horizontal raceways by separate conduit hangers.
 - D. Do not support raceways from ceiling suspension wires.
- 3.5 BOXES AND CABINETS
 - A. Support sheet metal boxes directly from the building structure, or by approved brackets or bar hangers, as shown on the Drawings or as required. Where bar hangers are used, attach the bar to structure on opposite sides of the box.
 - B. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support.
 - C. Install surface-mounted cabinets and panelboards as shown on the Drawings or as required.

3.6 FRAMING CHANNEL SYSTEMS

- A. Select and install framing channel systems in accordance with MFMA-103.
- B. Use framing channel to support electrical equipment that is mounted free of walls.
- C. Use framing channel to support equipment mounted on walls that do not have sufficient strength to resist pull-out or wallowing out of equipment mounting bolts.

3.7 CONCRETE BASES

A. Install a reinforced concrete base for each piece of floor-mounted electrical equipment. Refer to Section 03 3001, Reinforced Concrete, for materials and installation requirements.

- 1. Form concrete equipment bases using framing lumber with form release compounds.
- 2. Construct concrete bases as shown on the Drawings and not less than 4 inches high and not less than 4 inches larger in both directions than the supported equipment.
- 3. Place pre-set anchors, conduits, and sleeves using the equipment manufacturer's installation template or instructions. Install post-installed anchors in accordance with FASTENERS article above.
- 4. Place concrete and provide a steel trowel finish on top; chamfer top edges and corners.
- B. Cure concrete not less than seven days before installing equipment.
- 3.8 HANGER RODS
 - A. Use minimum 3/8-inch diameter threaded rod; use larger diameter rod as indicated on the Drawings, in other Sections, or in the supported equipment manufacturer's installation instructions.
 - B. Install a locknut at every hanger rod connection.
 - C. Install swivel hangers at the top of hanger rods that are not seismically braced.

END OF SECTION

This project specification section is based on LANL Master Specification Section 26 0529 Rev. 6, dated September 25, 2017.
SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Raceways and fittings
- B. Outlet boxes
- C. Pull and junction boxes, including conduit bodies

1.2 ACTION SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Submit the following in accordance with project submittal procedures. Include data substantiating that materials comply with specified requirements.
 - 1. Catalog data describing conduit, outlet boxes, and pull boxes.

1.3 QUALITY ASSURANCE

- A. Comply with the *National Electrical Code* (NEC) for unlisted components and for installation requirements.
- B. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL), where such products are required by the NEC to be listed or such products contain an electrical hazard as follows:
 - 1. For AC circuits Greater than 50 volts
 - 2. For DC circuits and/or batteries Greater than 100 volts
- 1.4 RECEIVING, STORING, AND PROTECTING
 - A. Receive, store, and protect, and handle products according to NECA 1 Standard *Practices for Good Workmanship in Electrical Construction*.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures*.

2.2 COATINGS AND FINISH

- A. Provide products that are suitable for the environment in which the products will be installed and used.
- B. The following raceway colors shall only be used for the indicated purposes:
 - 1. Blue: for building automation systems
 - 2. Red: for fire alarm systems
 - 3. Raceways shall not be painted to match the building finish.

2.3 ELECTRICAL METALLIC TUBING AND FITTINGS (EMT)

- A. Furnish galvanized electrical metallic tubing (EMT) that conforms to UL797 Electrical Metallic Tubing, NEMA C80.3 – Steel Electrical Metallic Tubing (EMT).
- B. Furnish compression- or set-screw-type fittings that meet UL514B *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes*, *and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated-throat connectors.

2.4 INTERMEDIATE METAL CONDUIT AND FITTINGS (IMC)

- A. Furnish intermediate metal conduit (IMC), nipples, elbows, and couplings that conform to UL1242 *Intermediate Metal Conduit*, NEMA C80.6 *Electrical Intermediate Metal Conduit (EIMC)*.
- B. Furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that meet the requirements of UL514B *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*.

2.5 RIGID METAL CONDUIT AND FITTINGS (RMC)

- A. Furnish rigid metal conduit (RMC) that meets the requirements of UL6 *Rigid Metal Electrical Conduit*, NEMA C80.1 – *Electrical Rigid Steel Conduit (ERSC)*.
- B. Furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that meet the requirements of UL514B and ANSI/NEMA FB1.

2.6 RIGID NON-METALLIC CONDUIT AND FITTINGS (RNC)

- A. Furnish rigid non-metallic conduit (RNC) that conforms to UL651 Schedule 40 and 80 Rigid PVC Conduit, NEMA TC 2 Electrical Plastic Tubing and Conduit.
- B. Furnish non-metallic, solvent-welded socket fittings that meet the requirements of UL514C Non-Metallic Fittings for Conduit and Outlet Boxes, and NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.

2.7 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish galvanized steel flexible metal conduit that meets the requirements of UL1 *Flexible Metal Electrical Conduit*.
- B. Furnish zinc-plated fittings that meet the requirements of UL514B *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes*, *and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Furnish liquid-tight flexible metal conduit that meets the requirements of UL360 Liquid-Tight Flexible Steel Conduit, Electrical.
- B. Furnish zinc-plated malleable iron or zinc-plated steel liquid-tight fittings that meet the requirements of UL514B *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated-throat connectors.

2.9 INSULATING BUSHINGS

- A. Provide NRTL-listed, insulating bushings with 105-deg C-rated insulation.
- B. Manufacturer: O-Z/Gedney, Type IB.

2.10 GROUNDING BUSHINGS

- A. Provide NRTL listed, 150-deg C-rated insulated-throat grounding bushings with lay-in type ground cable lugs
- 2.11 EXPANSION FITTINGS
 - A. Furnish NRTL listed expansion fittings with hot dipped galvanized malleable iron body, factory installed packing and a bonding jumper.
 - B. Manufacturer: O-Z/Gedney, Type AX, TX or EXE with Type BJ bonding jumper.

2.12 RACEWAY SEALS

- A. Duct Sealant
 - 1. Furnish a two-part, foam-based, duct sealing system.
 - 2. Provide sealing compound specifically listed for use with the foam damming materials.
 - 3. Provide sealing compound that is identified for use with the conductor or cable insulation.
 - 4. Manufacturer: Polywater FST-250.
- B. Sealing Fittings for Use in Hazardous-Classified Locations
 - Furnish zinc-plated, malleable iron sealing fittings that meet the requirements of UL1203 Explosion-Proof and Dust-Ignition-Poof Electrical Equipment for Use in Hazardous (Classified) Locations.
 - 2. Select each sealing fitting so the cross-sectional area of conductors passing through the seal is not more than 25 percent of the cross-sectional area of a rigid metal conduit of the same trade size unless the fitting is specifically identified for a higher percentage of fill.
 - 3. Provide sealing compound specifically listed for use with the sealing fitting.
 - 4. Manufacturer: Crouse-Hinds Type EYS, EYSX, EYD.

2.13 CORROSION PROTECTION TAPE

- A. Furnish pressure-sensitive, 10 mil thick. PVC based tape for corrosion protection of metal conduit and fittings.
- B. Manufacturer: 3M, Type 50.

2.14 OUTLET BOXES

- A. Provide outlet boxes selected for specific installations using the guidance in NEMA OS 3, Selection and Installation Guidelines for Electrical Outlet Boxes, and the requirements of this Section.
- B. For dry locations provide galvanized steel outlet boxes that comply with UL Standard 514-A *Metallic Outlet Boxes* and ANSI/NEMA OS1 *Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.*
 - 1. For fire detection and alarm device outlets use boxes specified in Section 28 3100.

- 2. For flush outlets in stud walls or above-grade cast-in-place concrete walls use 4-inch square or 4-11/16 square boxes; provide deeper boxes or multiple gang boxes as required to fit devices. Provide raised device covers that match the thickness of the wallboard and the number of devices. Provide supplemental box supports to prevent movement of the box.
- 3. For flush outlets in above-grade masonry walls use masonry boxes with conduit knockouts. Provide boxes with depth suitable for the masonry unit size. Provide multiple gang boxes as required by the number of devices.
- 4. For surface outlet boxes in EMT raceway systems, use 4 inch or 4 11/16 inch square boxes. Provide deeper boxes or multiple gang boxes as required to fit devices. Provide square surface covers that match the installed device and have not less than two holes for securing the device to the cover.
- C. For damp or wet locations and for surface-mounted RMC or IMC raceway systems, provide outlet boxes that comply with UL Standard 498 and 514, ANSI/NEMA FB1.
 - 1. For lighting fixture outlets use 4-inch, round, cast gray or malleable iron boxes with threaded hubs, or as required by the manufacturer.
 - 2. For flush or surface wall-mounted outlet boxes, use cast gray or malleable iron boxes with threaded hubs. Provide multiple gang boxes as required to fit devices. Provide gasketed cast gray, malleable-iron, or cast copper-free aluminum covers that match the installed device and have not less than two holes for securing the device to the cover.

2.15 PULL AND JUNCTION BOXES

- A. For pull and junction boxes, the NEC size requirements must be met:
 - 1. For conductors 6 AWG and smaller, the conditions of 314.16 must be met
 - 2. For conductors 4 AWG and larger, the conditions of 314.28 must be met
- B. For dry locations in clean, non-contamination environments use galvanized sheet steel pull and junction boxes that comply with UL Standard 50 Type 1 and the NEC as to size and construction.
- C. Conduit bodies are acceptable as long as the NEC requirements, in Section A above, are met
- D. For dry locations in dusty or possible contamination (e.g. beryllium, explosives, or uranium) environments use galvanized steel pull and junction boxes that comply with UL Standard 50 Type 12 and the NEC as to size and construction. Use boxes not less than 6 inches square x 4 inches deep with gasketed covers. Provide larger boxes as required by the number and size of raceways and conductors.

- E. For damp or wet, non-corrosive locations, in raceway runs up to trade size 3/4, provide cast gray or malleable iron pull and junction boxes with threaded hubs and gasketed cast gray or malleable iron or cast copper-free aluminum covers.
- F. For damp or wet, non-corrosive locations, in conduit runs trade size 1 and larger, provide galvanized sheet-steel pull and junction boxes and covers that comply with UL 50 Type 3R.
- G. For damp or wet, non-corrosive locations that are subject to hose-directed water, provide pull and junction boxes and covers that comply with UL 50 Type 4.
- H. For damp or wet, corrosive locations provide pull and junction boxes and covers that comply with UL 50 Type 4X.
- I. For locations subject to occasional submersion, provide pull and junction boxes and covers that comply with UL 50 Type 6.
- J. For in-ground, non-metallic, open-bottom hand-holes, use products that are NRTL-listed to ANSI/SCTE 77, *Specification for Underground Enclosure Integrity*.
 - 1. Material: Polymer concrete.
 - 2. Minimum ANSI/SCTE 77 load rating:
 - a. Located in sidewalks: Tier 8.
 - b. Located in driveways, parking lots, and off-roadway locations: Tier 15.
 - 3. Size: Up to 30" x 48"
 - 4. Cover: Non-skid cover with stainless steel cover bolts.
 - 5. Identification: Permanent mark or logo on cover prominently identifying the function of the enclosure in accordance with NEC requirements.
 - 6. Manufacturer: Quazite "Style PC, PG, or PT"
- K. Provide connection points for equipment grounding conductors in each box.

PART 3 EXECUTION

- 3.1 EXISTING WORK
 - A. Cap, plug, or seal remaining raceway openings to restore the original fire rating and acoustical STC rating of floors, walls, and ceilings after electrical demolition. Patch surfaces to match existing.

- B. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- D. Clean and repair existing raceway and boxes to remain or to be reinstalled, as a part of the job scope.

3.2 EXAMINATION

A. Examine surfaces to receive raceways and boxes for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 GENERAL

- A. Install complete systems of raceways and boxes for wiring systems.
- B. Install raceways and boxes according to NECA 1 Standard Practices for Good Workmanship in Electrical Construction, NECA 101 – Standard for Installing Steel Conduits (Rigid, IMC, EMT), NECA 111 – Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC), the NEC, the manufacturer's instructions, and requirements in this Section.
- C. Raceway termination points and box locations shown on the Drawings are in approximate locations unless dimensioned. Verify locations before rough-in.
- D. Raceway routing is shown on the Drawings in approximate locations unless dimensioned. Coordinate routing with structure and with work of other trades. Route as required for a complete wiring system.
- E. Ground and bond raceways and boxes as required in Section 26 0526, *Grounding and Bonding for Electrical Systems.*
- F. Support raceways and boxes in accordance with the requirements the National Electrical Code, Section 26 0529, *Hangers and Supports for Electrical Systems*.
- G. Identify raceways and boxes as required in Section 26 0553, *Identification for Electrical Systems*.
- H. Arrange raceway and boxes to maintain headroom and present neat appearance.
- I. Install knockout closures in unused openings in boxes or raceways.

3.4 RACEWAY INSTALLATION

- A. For low-voltage wiring systems (less than 1000 volts) use raceway materials according to the NEC and the following:
 - 1. Outdoors–Underground:
 - a. Direct buried: Use RNC, tape-wrapped RMC, or tape-wrapped IMC. Do not use RNC where subject to physical damage. Install with 24 inches minimum cover from top of conduit to finished grade or top of paving.
 - b. Concrete encased: Use RNC, RMC, or IMC for concrete encased underground work. Install with 24 inches minimum cover from top of encasement to finished grade or paving.
 - c. Align and support ducts to prevent trapping moisture at any point.
 - 2. Outdoors-Exposed: Use RMC or IMC.
 - 3. Outdoor corrosive locations (including cooling towers): Use corrosiveresistant raceways and fittings.
 - 4. Outdoors–Concealed: Use RMC or IMC for concealed outdoor work. Do not use bare RMC or IMC in direct contact with earth. EMT may be used for concealed outdoor work where not in contact with earth, not encased in concrete, and where not exposed to deteriorating agents.
 - 5. Indoors–Exposed outside of designated electrical rooms or telecommunications rooms:
 - a. Exposed to severe physical damage during or after installation: Use RMC or IMC.
 - b. Exposed to moisture: Use RMC or IMC.
 - c. Exposed to corrosives: Use corrosive resistant raceways and fittings.
 - d. Not exposed to deteriorating agents and not subject to severe physical damage during or after installation: Use RMC, IMC, or EMT.
 - 6. Indoors–Concealed:
 - a. Within drywall partitions and above false ceilings: Use RMC, IMC, or EMT.

- b. Within masonry or cast-in-place concrete walls or floors: Use RMC or IMC.
- c. Direct-buried under building floor slabs on grade: Use RNC, tapewrapped RMC, or tape-wrapped IMC. Locate top of conduits not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6 inches above the conduits; install multiple warning tapes above parallel conduit runs wider than 18 inches.
- d. Concrete encased under building floor slabs on grade: Use RNC, RMC, or IMC. Locate top of concrete encasement not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6 inches above the concrete encasement; install multiple warning tapes above concrete encasements wider than 24 inches.
- 7. Install flexible conduit sections where raceways cross expansion joints or seismic joints, where they are attached to parts of the structure with a potential for differential seismic displacement, and where they connect to equipment with designed anchors (seismic controls) or vibration isolators. Refer to Section 26 0529, *Hangers and Supports for Electrical Systems*.
 - a. For raceway systems from 1/2 through 1-1/4 inches, install a minimum of 2 feet of flexible conduit, maximum length as determined by the NEC.
 - b. For raceway systems from 1-1/2 through 2 inches, install a minimum of 3 feet of flexible conduit, maximum length as determined by the NEC.
 - c. For raceway systems larger than 2 inches, install a minimum of 4 feet of flexible conduit, maximum length as determined by the NEC.
 - d. Arrange the flexible conduit sections to accommodate 4 inches of movement in all directions.
 - e. Use liquid-tight flexible metal conduit outdoors, in wet, damp, or corrosive indoor locations, and in mechanical rooms. Use flexible metal conduit in dry indoor locations.
 - f. Install pull boxes as required to comply with the limits on raceway bends and distance between pull points in the RACEWAY INSTALLATION section.
- 8. Connection to vibrating equipment (including hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Use a minimum of 24 inches; maximum length as determined by the NEC:

- a. Outdoors: Use liquid-tight flexible metal conduit.
- b. In mechanical rooms: Use liquid-tight flexible metal conduit.
- c. Wet, damp, or corrosive indoor locations: Use liquid-tight flexible metal conduit.
- d. Dry indoor locations: Use flexible metal conduit.
- 9. Connections to luminaires: Use flexible metal conduit, metal-clad cable, or manufacturer's whips, for conductors to luminaires above suspended ceilings.
- B. Use trade size 3/4, or larger, raceways to enclose multiple conductors larger than 12 AWG.
- C. Use raceways to enclose fire alarm wiring. See Section 28 3100 for size and type of raceways to be used to enclose fire alarm wiring.
- D. Conceal raceways, unless otherwise indicated on the Drawings, with finished walls, floors and ceilings. Unless otherwise indicated on the Drawings, install concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions.
- E. Install expansion fittings where embedded raceways cross building expansion joints, or where needed for thermal expansion and contraction
 - 1. For calculating where thermal expansion fittings are needed, use a 100 F temperature difference with 0 degrees as the minimum and 100 degrees as the maximum. The gap must be set on the day of installation, based on the temperature at the time of installation.
- F. Use sealing locknuts, hubs, or similar water-resistant fittings on raceways entering the top of switchgear, switchboards, motor control centers, panelboards, cabinets, pull boxes, and similar enclosures that are in damp and/or wet locations.
- G. Install insulating bushings or connectors with an insulated throat to protect conductors or cables at raceway terminations.
- H. Install raceways as shown on the Drawings or with the following limits of bends and distance between pull points:
 - 1. Less than 50 ft., follow the NEC.
 - 2. 50 ft. to 100 ft., a maximum of 3 equivalent 90 degree bends.
 - 3. 100 ft. to 150 ft., a maximum of 2 equivalent 90 degree bends.
 - 4. 150 ft. to 200 ft., a maximum of with 1 equivalent 90 degree bend.

- 5. Over 200 ft., a straight run with no bend.
- I. Stub-Up Connections:
 - 1. Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor or equipment pad.
 - 2. Extend conductors to equipment with rigid steel conduit, or intermediate steel conduit. Flexible metal conduit may be used 6 inches above the floor.
 - 3. Where equipment connections are not made under this Subcontract, install threaded insert plugs set flush with the floor.
- J. Raceway Sealing:
 - 1. Sealing is required in the following locations. A sealing fitting is not required, but may be used. The sealing compound must be identified for use with the conductor or cable insulation.
 - a. Raceways pass from exterior locations to interior locations.
 - b. Raceways pass from warm locations to cold locations, such as the boundaries of refrigerated and air-conditioned spaces.
 - c. Raceways enter or leave radiological "controlled areas."
 - d. Raceways go between areas where air pressure differential must be maintained.
 - e. Raceways enter an enclosure protected by a clean-agent, totalflooding fire suppression system.
 - f. Otherwise required by the NEC.
 - 2. Locate conduit fittings or boxes at suitable, approved, accessible locations to provide access to the interior of the conduit to be filled with duct sealant.
 - 3. Install sealant in accordance with the manufacturer's written instructions.
- K. Sealing Fittings
 - 1. Where conduits enter or leave NEC Class I hazardous locations.
 - a. Install conduit sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with NRTL-listed conduit 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 at the following points and elsewhere as indicated:

- L. Join nonmetallic raceways using cement as recommended by manufacturer. Wipe nonmetallic raceways dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, or for the manufacturer's recommended time period.
- M. Do not use RNC 90 degree elbows larger than trade size 2; use tape-wrapped RMC, or tape-wrapped IMC for trade size 2.5 and larger 90 degree elbows.
- N. Maintain the following minimum clearances between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C):
 - 1. 6 inches at perpendicular crossings.
 - 2. 12 inches between parallel runs.
- O. For above ground installations, avoid moisture traps in raceway systems; provide boxes with drain fittings at low points in raceway systems.
- P. Install corrosion protection tape on metal raceways and fittings that are in contact with soil using half-lapped wrappings.
- Q. Install grounding bushings at the following locations:
 - 1. On metallic raceways entering enclosures through concentric, eccentric or oversize knockouts.
 - 2. On metallic raceways that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
- R. Install conduit measuring tape in empty raceways. Leave not less than 12 inches of slack at each end of the tape. Secure each end of tape.

3.5 CONCRETE ENCASEMENT

- A. Concrete-encase underground low-voltage (less than 1000 volts) electrical service and feeder raceways outside the perimeter of the building foundation, if indicated on drawings
- B. Concrete-encase underground medium-voltage (1 kV or greater but less than 100 kV) electrical service and feeder raceways outside and inside the perimeter of the building foundation. Use red-colored concrete.
- C. Concrete-encase underground electrical branch circuit, communications, and alarm raceways, if indicated on the Drawings.
- D. Provide not less than 3 inches of concrete coverage on all sides of raceways.

- E. Refer to Section 03 3053, *Miscellaneous Cast-in-Place Concrete* for basic material and installation requirements. Concrete finishing is required for this application.
 - 1. Use a pre-approved concrete mix design that is suitable for exterior use exposed to freezing and thawing.
 - 2. Use un-colored concrete to encase raceways for low-voltage wiring systems
 - 3. Use red-colored concrete to encase raceways for medium voltage cables.
 - a. Use 2.0 lb. of pigment per 94 lb. sack of cement.
 - b. Manufacturer: Rockwood Industries/Davis Colors, No. 1117.
- F. Refer to Section 33 7119, *Electrical Underground Ducts and Manholes* for requirements pertaining to underground ducts for medium-voltage power, telecommunications, and secure communications.

3.6 OUTLET BOX INSTALLATION

- A. Install outlet boxes with centers at the following heights unless noted otherwise on the Drawings:
 - 1. Receptacle, telephone and data outlets:
 - a. Common Areas (such as conference and break rooms): 18 inches above finished floor.
 - b. Offices and Workstations: 7 inches above finished floor.
- B. Coordinate outlet box locations with modular furniture and associated hangers.
- C. Where the Drawings show outlets as adjacent, align outlet boxes with each other and group them symmetrically.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726, *Wiring Devices*.
- E. Install a multi-gang box where more than one device is mounted together. Do not use sectional type boxes.
- F. Install box with plaster ring for single or multiple device outlets.
- G. Use flush mounted outlet boxes in finished areas.
 - 1. Install flush outlet boxes and fittings in walls and ceilings so that front edge is flush with the finished surface. Repair broken wall or ceiling surfaces so no gaps or open spaces exceed 1/8 inch at the edge of boxes or fittings.

- 2. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- 3. Do not install flush mounting boxes back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- 4. Secure flush mounting boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- 5. Install stamped steel bridges to fasten multiple flush mounting outlet boxes between studs.
- 6. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- H. Install adjustable steel channel fasteners for hung ceiling outlet box.
- I. Install partitions in boxes as follows:
 - 1. Between 277 volt devices
 - 2. Between 277 volt devices and 120 volt devices.
 - 3. Between low voltage control switches and both 120 volt and 277 volt devices.
- J. Install a blank cover plate on each outlet box in which no device is installed.

3.7 PULL AND JUNCTION BOX INSTALLATION

- A. Install pull and junction boxes as shown on the Drawings and as required for splices, taps, wire pulling, and compliance with regulatory requirements.
- B. Install pull boxes as required to comply with limits on raceway bends and distance between pull points in the RACEWAY INSTALLATION section.
- C. Install indoor pull and junction boxes in accessible locations above accessible ceilings and in unfinished spaces. Position boxes so covers can be removed. Place boxes to maintain headroom.
- D. Install a concrete collar around hand-holes not placed in sidewalks or pavement.

3.8 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Provide final protection and maintain conditions to ensure that coatings and finishes are without damage or deterioration at final inspection.
- B. Inspection Points Provide not less than 2 working days advance notice to the LANL STR for the following LANS inspection points. In the notice identify the particular areas of the Project for which LANL inspection is requested. Correct deficiencies identified during inspections. If the requested LANL inspection does not occur within 1 working day of the LANL inspection point, work may proceed.
 - 1. Underground raceways: After raceways have been installed but before concrete-encasement or trench backfilling commences. LANL inspection may include but is not limited to:
 - a. Correct raceway material and size,
 - b. Proper raceway spacing and supports,
 - c. Correct raceway stub-up locations.
 - d. Raceway connection and coupling integrity.
 - 2. Raceway systems in concrete walls, floors, slabs, and equipment pads: After raceways and boxes have been installed but before concrete placement commences. LANL inspection may include but is not limited to:
 - a. Correct raceway system materials and sizes,
 - b. Proper raceway spacing and supports,
 - c. Raceway system connection integrity,
 - d. Correct raceway stub-up locations.
 - e. Correct floor box locations and proper height setting,
 - f. Correct outlet box locations.
 - 3. Raceway systems in drywall partitions: After raceways and boxes have been installed but before drywall installation that would cover the raceway system commences. LANL inspection may include but is not limited to:
 - a. Correct raceway system materials and sizes,
 - b. Proper supports for raceways and boxes,

- c. Raceway system connection integrity,
- d. Correct outlet box locations and proper depth setting.
- 4. Raceway systems above ceilings: After raceways and boxes have been installed but before ceiling system installation commences. LANL inspection may include but is not limited to:
 - a. Correct raceway system materials and sizes,
 - b. Proper supports for raceways and boxes,
 - c. Raceway system connection integrity,
 - d. Correct outlet box locations and proper depth setting.

END OF SECTION

This project specification is based on LANL Specification Section 26 0533 Rev. 7, dated June 15, 2017.

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- PART 1 GENERAL
- 1.1 SECTION INCLUDES
 - A. Component identification tags
 - B. Equipment nameplates
 - C. Switch and receptacle labels
 - D. Wire markers
 - E. Voltage markers
 - F. Arc flash and shock hazard warning labels

1.2 SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Submit the following:
 - 1. Catalog Data: Submit manufacturer's catalog literature for each product.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
 - 3. Manufacturer's Installation Instructions: Submit installation instructions, indicating special procedures and installation requirements.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of the National Electrical Code (NEC), NFPA 70E, and 10CFR851.
- B. Conform to applicable requirements of the following ANSI Standards:
 - 1. Z535.1 Safety Color Code.
 - 2. Z535.2 Environmental and Facility Safety Signs.
 - 3. Z535.3 Criteria for Safety Symbols and Labels.
 - 4. Z535.4 Product Safety Signs and Labels.
 - 5. Z535.5 Safety Tags and Barricade Tapes (for Temporary Hazards).

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Subcontract Documents, Shop Drawings, and manufacturer's wiring diagrams with those required by codes, standards, and 29CFR1910.145. Use consistent designations throughout Project.

B. Verify electrical equipment designations with LANL through the Subcontract Technical Representative.

PART 2 PRODUCTS

- 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS
 - A. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures.
- 2.2 COMPONENT IDENTIFICATION TAGS
 - A. Furnish component identification tags as specified below and as shown on the Drawings to identify electrical equipment using the system designation, equipment identification, tech area number, and building number.
 - B. Coordinate electrical component identification tag schedule with final equipment identification scheme for project.
 - C. Provide component identification tags with black letters on yellow background with 2 inches by 3 inches dimensions.
 - D. Provide minimum 48 point size lettering.
 - E. Provide tags made of one of the following materials:
 - 1. Type 1 (Indoor Applications Only):
 - a. Laminated plastic adhesive tape with machine printed letters.
 - b. Manufacturer: Brother, Seton, Brady.
 - 2. Type 2:
 - a. Two-ply plastic nameplate with letters engraved through yellow surface showing black core.
 - b. Provide UV stabilized material for outdoor applications.
 - c. Manufacturer: Seton Nameplate Corp.

2.3 EQUIPMENT NAMEPLATES

- A. Furnish equipment nameplates as specified below and as shown on the Drawings to indicate the following information:
 - 1. Category I nameplates:
 - a. Supplied by nameplates: circuit directory information including circuit number, equipment identification, location of equipment supplying the item, and the circuit voltage (e.g., 480Y/277V, 480V 3Ø, 208Y/120V, 120/240V).
 - b. Supplies nameplates: circuit directory information including circuit number, equipment identification, location of equipment being supplied, and the circuit voltage (e.g. 480Y/277V, 480V 3Ø, 208Y/120V, 120/240V).

- 2. Category II nameplates general or operational information including basic instructions or specific operating procedures.
- 3. Category III nameplates emergency operations information including emergency shutdown procedures.
- B. Coordinate equipment nameplate schedule with equipment numbering scheme provided on the drawings, or by the Subcontract Technical Representative.
- C. Provide nameplates made of one of the following materials:
 - 1. Type 1 (Indoor Applications Only):
 - a. Laminated plastic adhesive tape with machine printed letters.
 - b. Manufacturer: Brother, Seton, Brady.
 - 2. Type 2:
 - a. Two-ply plates with letters engraved through surface color showing core color.
 - b. Use UV stabilized material for outdoor applications.
 - c. Manufacturer: Seton Nameplate Corp.
- D. Provide 10-point-minimum size lettering.
- E. Provide colors as follows:
 - 1. Category I nameplates: white or black letters on blue background.
 - 2. Category II nameplates: white letters on black background.
 - 3. Category III nameplates: white or black letters on red background.
- F. Dimensions shall be as follows:
 - 1. Category I nameplates: 1 inch by 2 1/2 inch minimum.
 - 2. Category II nameplates: as required for instructions, 1 inch by 2 1/2 inch minimum.
 - 3. Category III nameplates: as required for instructions, 1 inch by 2 1/2 inch minimum.

2.4 SWITCH AND RECEPTACLE LABELS

- A. Furnish a typewritten or machine printed label for each switch and receptacle indicating circuit number, panelboard, and voltage.
- B. Provide labels of the following materials:
 - 1. Laminated plastic adhesive tape with machine printed letters.
 - 2. Manufacturer: Brother, Seton, Brady.
- C. Provide black, 10-point-minimum size lettering on a white background.

2.5 WIRE MARKERS

- A. Provide wire markers for power, control, instrumentation, alarm, and communication circuit wires that indicate the panel and circuit designation
- B. Furnish split sleeve, heat-shrinkable sleeve, or self-laminating adhesive wire markers.
- C. Locate a wire marker on each conductor at each termination and splice point.
- D. Manufacturer: Brady, Panduit, LEM Products, Inc.

2.6 VOLTAGE MARKERS

- A. Furnish voltage markers, as required, to identify voltages present in equipment
 - 1. For medium voltage, in addition to the above, furnish voltage markers for pull boxes and raceways.
- B. Provide flexible pressure sensitive vinyl markers with minimum 1 inch X 4 inches orange background and black letters.
- C. Provide voltage markers with lettering indicating all voltages present:
 - 1. 120 or 208Y/120
 - 2. 120, 240, or 120/240
 - 3. 480 or 480Y/277
 - 4. 13.2 kV or 13.8 kV
 - 5. Fire alarm system: FIRE ALARM
 - 6. Telephone/data system: TELEPHONE
- D. Manufacturer: Electromark, LEM Products, Inc.
- 2.7 ARC FLASH AND SHOCK HAZARD WARNING LABELS
 - A. Furnish arc flash and shock hazard warning labels, as indicated in approved construction documents.
 - B. Provide warning labels that comply with ANSI Z535.4. The color in top part of WARNING labels shall be ANSI "safety orange." The color in top part of DANGER labels shall be red. Lettering on labels shall be black.
 - C. Provide either machine-produced custom labels or manually filled-in pre-printed labels that meet the requirements below.
 - 1. Label dimensions shall be approximately 4 inches high by 6 inches wide.
 - 2. Outdoor labels shall be suitable for a high-UV environment.
 - 3. Machine-produced custom labels:
 - a. Use polyester label stock that is NRTL-recognized to UL969, *Marking and Labeling Systems*, and has a high-adhesion adhesive back.

- b. Use printing ribbon recommended by the label stock manufacturer.
- c. Use a suitable thermal transfer process label-printing machine to generate labels and enter the application-specific information indicated in the installation sub-paragraphs.
- 4. Pre-printed labels:
 - a. Use labels printed on self-adhesive UV-resistant polyester with pressure-sensitive adhesive back. Provide labels with a clear polyester overlay film to protect manually-entered information.
 - b. Use a black, UV-resistant, industrial permanent marker pen to legibly hand letter the application-specific information indicated in the installation sub-paragraphs.
- A. Use Shock Hazard Warning Label Design #1 for equipment that is either:
 - 1. Operating at a nominal system voltage less than 240 V and fed by a transformer with a rating less than 125 kVA or
 - 2. Operating at 120 volts, regardless of the size of the transformer feeding the system.

Arc Flash and Shock Hazard Warning Label — Design #1

	WARNING						
Shock Hazard only. Appropriate PPE Required.							
No arc flash	hazard. Arc rated PPE is not required.						
<u> </u>	Shock Hazard exists when personnel are exposed to energized electrical conductors or circuit parts.						
42 inches	Limited Approach Boundary.						
## inches or	<i>'avoid contact'</i> Restricted Approach Boundary.						

B. Use Arc Flash and Shock Hazard Warning Label Design #2 for equipment where [the criteria for use of Design #1 are exceeded but] the calculated arc flash incident energy does not exceed 40 cal/cm². See installation sub-paragraphs in PART 3 for an explanation of the application-specific information entries on the label.

Arc Flash and Shock Hazard	d Warning	Label —	Design #2
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	WARNING						
Arc Flash and Shock Hazard.							
	Appropriate PPE Required.						
inches	Arc Flash Protection Boundary. (Arc flash hazard analysis based on: <u>SWGR-A main circuit breaker set in energy-reducing maintenance</u> mode.)						
	Arc flash incident energy at <u>##</u> inches working distance						
### V	Shock Hazard exists when personnel are exposed to energized electrical conductors or circuit parts.						
## inches	Limited Approach Boundary.						
## inches	Restricted Approach Boundary						
Equipment I.D	.: <u>####################################</u>						
##,#### A	Maximum Available Fault Current (RMS symmetrical amperes).						

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive identification products for compliance with installation tolerances and other conditions affecting performance of the identification products. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION GENERAL
 - A. Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
 - B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
 - 1. Coordinate installation of identifying devices with location of access panels and doors.
 - 2. Where the required labels do not fit on the face of the equipment, labels may be placed on a plate immediately adjacent to or above the equipment.
 - C. Install electrical identification products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.
 - D. Clean surface where electrical identification product is to be placed.
 - E. Use manufacturer's recommended adhesive for engraved tags and nameplates.
- 3.3 COMPONENT IDENTIFICATION TAGS
 - A. Install component identification tag on the front of each piece of electrical equipment as indicated on the Drawings.
 - B. Position tags so they can be read from floor or ground.

3.4 EQUIPMENT NAMEPLATES

- A. Install equipment nameplate or nameplates on the front of each piece of electrical equipment as indicated on the Drawings.
- B. Important Equipment: Install a Category III nameplate at the branch circuit breaker(s) that provide(s) AC power to the following equipment per Table 2-IEN.

Important Equipment Type	Branch Circuit Breaker(s) Nameplate Wording				
Fire alarm control panel	WARNING – AC POWER TO FIRE ALARM CONTROL PANEL – DO NOT TURN OFF WITHOUT AUTHORIZATION				
Other life safety system	WARNING – AC POWER TO LIFE SAFETY SYSTEM				

Table 2-IEN

components	– DO NOT TURN OFF WITHOUT AUTHORIZATION
Other safety systems	WARNING – AC POWER TO SAFETY SYSTEM – DO NOT TURN OFF WITHOUT AUTHORIZATION
Security system components	WARNING – AC POWER TO SECURITY SYSTEM – DO NOT TURN OFF WITHOUT AUTHORIZATION

C. Position nameplates so they can be read from floor or ground.

3.5 SWITCH OR RECEPTACLE LABELS

A. Install label on outside of device cover for each receptacle and light switch.

3.6 WIRE MARKERS

A. Install wire markers on power, control and communication conductors at each termination or splice point

3.7 VOLTAGE MARKERS

- A. Install voltage markers at the following locations and position markers so they can be read from floor or ground:
- 3.8 ARC FLASH AND SHOCK HAZARD WARNING LABELS
 - A. Install arc-flash and shock-hazard warning labels at all locations, as shown on the Drawings.

END OF SECTION

This project specification is based on LANL Master Specification 26 0553 Rev. 4, dated February 15, 2017.

SECTION 26 0813

ELECTRICAL ACCEPTANCE TESTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide the services of a qualified Electrical Testing Agency (ETA) to perform the functions described below:
 - 1. Acceptance tests, inspections, and system function tests of certain electrical systems, equipment, components, and material (SSCs) installed under the scope of this Project; refer to Part 3 of this Section.
 - 2. System function tests after completion of acceptance tests on certain electrical SSCs installed under the scope of this Project.

1.2 REGULATORY REQUIREMENTS

- A. Perform inspections and tests in accordance with the following codes and standards:
 - 1. International Electrical Testing Association NETA ATS-[current edition], Acceptance Testing Specifications (ANSI). NETA ATS forms a part of this specification to the extent referenced.
 - 2. Los Alamos National Laboratory LANL
 - a. P 101-3: Lockout/Tagout for Hazardous Energy Control
 - b. P 101-13: *Electrical Safety Program.*

1.3 QUALITY ASSURANCE

- A. The ETA shall be independent of the subcontractors installing the equipment.
- B. Independence: The ETA shall be a first tier subcontractor. A second tier subcontractor shall perform no work required by this section of the Specifications.
- C. The ETA shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- D. The ETA shall have a documented quality assurance program, documented inspection and test and procedures, and a documented electrical safety program.
- E. The ETA shall have successfully completed not less than five acceptance testing, inspection and calibration projects of similar scope to this project.
- F. The ETA shall have a calibration program, and test instruments used, for measurements that require calibration, shall be calibrated in accordance with

NETA ATS.

- G. ETA technicians performing testing, inspection, calibration, and adjustments shall be:
 - 1. Trained and experienced concerning the apparatus and systems being evaluated.
 - 2. Capable of conducting the tests in a safe manner with complete knowledge of the hazards involved and the appropriate safety-related work practices.
 - 3. Qualified to evaluate the test data and make a judgment on the serviceability of the specific equipment.
- H. Testing, inspection, calibration, and adjustments shall be performed or supervised on the Project site by an ETA employee with one of the following minimum qualifications:
 - 1. An engineering technician certified to at least Level III in accordance with ANSI/NETA ETT *Standard for Certification of Electrical Testing Technicians* (ANSI), or
 - 2. An engineering technician certified to at least the NICET ET-grade in Electrical Testing Engineering Technology, or

1.4 ACTION SUBMITTALS

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Submit the following in accordance with Section 01 3300 Submittal Procedures:
 - 1. Certifications: Name and qualifications of the ETA.
 - 2. Certifications: Quality assurance program of the ETA.
 - 3. Certifications: Instrument calibration program of the ETA.
 - 4. Certifications: Electrical safety program of the ETA.
 - 5. Certifications: Submit name and qualifications of the lead engineer or engineering technician performing the required testing services.
 - 6. Test Plans: Acceptance and system functions test plan for each item of equipment or system to be field tested at least 45 days prior to planned testing date. Include applicable procedures, forms, and lists of test equipment. Do not perform testing until test plan and procedures have been approved.
 - 7. Test Reports: Certified copies of inspection reports, test reports, and system function tests. Reports shall include certification of compliance with specified requirements including test instrument calibration, identification of deficiencies, and recommendation of corrective action

when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test report not more than 10 days after each test is completed.

1.5 COORDINATION

- A. Schedule the project to allow adequate time for electrical acceptance testing BEFORE equipment or system is energized.
 - 1. Notify the ETA when equipment becomes available for acceptance inspections and tests.
 - 2. Coordinate work to expedite inspections and tests.
- B. Notify the LANL Subcontract Technical Representative (STR) at least 14 days in advance scheduled acceptance tests, inspections, and system function tests.
 - 1. Notify the LANL STR again approximately 24 hours before start of testing.
 - 2. The LANL STR will arrange for witnessing of the tests and inspections by appropriate LANL personnel when required by the Test & Inspection Plan, the applicable codes and consensus Standards or when deemed appropriate by the LANL Design Authority.
- PART 2 PRODUCTS

Not Applicable

- PART 3 EXECUTION
- 3.1 GENERAL
 - A. Perform the installation insulation-resistance, continuity, and rotation tests for electrical SSCs described in each Section of these Specifications before, and in addition to, tests performed by the ETA that are specified in this Section.
 - B. Supply one set of the following to ETA prior to the performance of any final testing:
 - 1. Complete set of electrical Drawings, Specifications, and any pertinent Change Orders.
 - 2. Approved construction submittal documents for material and equipment.
 - 3. Site specific hazard notification and safety training.
 - 4. Other information necessary for a safe and accurate test and inspection of the system.

3.2 INSPECTION AND TEST PROCEDURES

A. The ETA shall use test methods, follow procedures, and evaluate test values in accordance with the applicable sections of the NETA ATS, the manufacturer's

recommendations, and each applicable specification section.

- B. Tests identified as optional in NETA ATS are not required unless specified.
- C. The ETA shall perform acceptance tests and inspections on electrical SSCs as identified in the following paragraphs. Perform tests and inspections as specified in the applicable clauses of the NETA ATS and as modified by the following paragraphs:
 - 1. Section 26 0519 Low Voltage Electrical Power Conductors and Cables.
 - a. Test low-voltage conductors using the graded approach indicated in Table 1 of this Section.

TABLE 1 - Low Voltage Electrical Power Conductors (Management Level [ML] as determined by AP-341- 502)	ML-1 SSCsML-2 SSCs		SCs SCs					
Conductor Type/Size/Rating	rvice	eder	anch ≥6 AWG	anch <6 AWG	ntrol ≥ 120V			
Inspection or Test per NETA ATS	Se	Ге	B	B	ပိ			
Compare conductor data with drawings and specifications.	х	Х	Х	Х	Х			
Inspect for physical damage and correct connections.	Х	Х	Х	Х	Х			
Inspect connections for high resistance.	Х	Х	Х	Х	Х			
Inspect compression applied connections for correct cable match and indentation.	Х	Х	Х	Х	Х			
Inspect for correct identification and arrangements.	Х	Х	Х	Х	Х			
Inspect jacket insulation.	Х	Х	Х	Х	Х			
Test connections for high resistance using low- resistance ohmmeter.	Х	Х	Х	Х	Х			
Perform insulation-resistance test on each conductor to ground and other conductors.	х	х	Х	х	Х			
Perform continuity tests to insure correct connections.	Х	Х	Х	Х	Х			
Verify uniform resistance of parallel conductors.	Х	Х	Х					

- 2. Section 26 0526 Grounding and Bonding for Electrical Systems.
 - a. ML-1 or ML-2 low-voltage systems: Visually inspect bonding for each system and circuit.

TABLE 2 - Molded Case Circuit Breakers (Management Level [ML] as determined by AP- 341-502)	• ML-1 SSCs • ML-2 SSCs			 ML-1 SSCs ML-2 SSCs 			•	
Circuit Breaker Type/Size								
			uit C/B					
Inspection or Test per NETA ATS	Main C/B	Feeder C/B	Branch Circi					
Compare nameplate data with drawings and specifications	х	Х	х					
Inspect physical and mechanical condition.	Х	Х	Х					
Inspect anchorage and alignment.	Х	Х	Х					
Verify the unit is clean.	Х	Х	Х					
Operate the circuit breaker to assure smooth operation.	Х	Х	Х					
Inspect connections for high resistance.	Х	Х	Х					
Inspect compression applied connections for correct cable match and indentation.	х	Х	Х					
Measure resistance through connections with a low-resistance ohmmeter.	х	Х	Х					
Measure insulation-resistance on each pole phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole.	х	х	х					
Measure contact/pole resistance.	Х	Х	Х					
Perform insulation resistance tests on all control wiring,	х	Х	х					
Perform adjustments for final setting in accordance with coordination study.	х	Х	х					
Determine long-time pickup and delay by primary current injection.	х	Х	Х					
Determine short-time pickup and delay by primary current injection.	х	Х						
Determine ground fault pickup and delay by primary current injection.	Х	Х	Х					
Determine instantaneous pickup by primary current injection.	Х	Х	Х					
Verify correct operation of auxiliary functions.	Х	Х	Х					

- 3. Section 26 2816 Enclosed Switches and Circuit Breakers
 - a. ML-1 or ML-2 enclosed switches and circuit breakers: Test each enclosed switch and circuit breaker.
- D. Tests and inspections on the following equipment and systems will be performed

by either the installing firm or LANL and are excluded from the scope of this Section:

- 1. Revenue-type electricity metering
- 2. Security system
- 3. Telecommunications system

3.3 TEST REPORT

- A. The ETA shall include the following information in the final test report:
 - 1. Summary of project.
 - 2. Description of equipment inspected and tested.
 - 3. Description of inspections and tests.
 - 4. Data record resulting from each inspection and test.
 - 5. Results of system function tests.
 - 6. Analysis of the tests, identification of deficiencies, and recommendations for corrective action.
- B. Include the following minimum information in each data record:
 - 1. Identification of the ETA.
 - 2. Equipment identification: Equipment ID code based on Drawings and including TA number, building number, and system identifier.
 - 3. Humidity, temperature, and other conditions that may affect the results of the tests or calibration of test equipment.
 - 4. Date inspection, test, or function test was performed.
 - 5. Identification and signature of the testing technician.
 - 6. Description of inspections, tests, maintenance, and function tests performed and recorded.
 - 7. Test equipment used and references to calibration records.
 - 8. Indication of as-found condition and as-left results.
- C. Submit six copies of the complete report to the LANL STR.

3.4 FIELD QUALITY CONTROL

A. Report to the LANL STR, within three working days, any SSC or construction that is found defective based on acceptance tests or inspections by the ETA.

- B. Within 15 days of direction from the LANL STR, rework, repair or replace any SSC or construction that is found defective based on acceptance tests or inspections.
- C. The ETA shall retest any SSC or construction that did not pass acceptance tests or inspections.

END OF SECTION

This project specification is based on LANL Master Specification Section 26 0813 Rev. 2, dated April 12, 2017.

EPC-DO: 18-052

SECTION 26 2726 WIRING DEVICES

- PART 1 GENERAL
- 1.1 SUMMARY
 - A. SECTION INCLUDES
 - 1. Receptacles
- 1.2 ACTION SUBMITTALS
 - A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
 - B. Submit the following per Section 01 3300:
 - 1. Catalog Data
- 1.3 QUALITY ASSURANCE
 - A. Comply with the *National Electrical Code* (NEC) for installation requirements.
 - B. Furnish products listed and labeled by a nationally recognized testing laboratory (NRTL).
- 1.4 RECEIVING, STORING, AND PROTECTING
 - A. Receive, store, and protect, and handle products according to NECA 1, *Standard Practices for Good Workmanship in Electrical Construction*.
- 1.5 COORDINATION
 - A. Coordinate with other work, including painting, electrical boxes and wiring installations, to interface installation of wiring devices with other work.
 - B. Field locations of walls, partitions, doors, windows and equipment may vary from locations shown on the Drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, coordinate with other trades to determine exact field location of the above items.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures.*
- 2.2 RECEPTACLES
 - A. Provide back- and side-wired, screw-pressure terminal, straight-blade and locking-type receptacles as indicated on the drawings. Back-stab devices are not acceptable.
 - 1. Receptacles shall meet the performance and design requirements of Federal Specification WC596 and UL Standard 498, *Electrical Attachment*

Plugs and Receptacles.

- 2. Receptacle configurations shall be in accordance with NEMA WD 6.
- 3. Catalog numbers in this section do not indicate receptacle color; see FINISHES below.
- B. For 125 volt receptacles connected to individual 15 amperes branch circuits provide straight-blade NEMA 5-15R, 15 amperes, 125 volts, grounding single receptacles. Receptacle mounting strap, ground terminal, and ground contact shall be formed from one piece of brass alloy. Manufacturer: Hubbell "HBL5261".

2.3 FINISHES

- A. Wiring device catalog numbers do not designate device color. Provide devices with colors as follows:
 - 1. Wiring devices connected to normal power system: Gray, unless otherwise indicated or required by the NEC.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify outlet boxes are installed at proper locations and heights.
- B. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- C. Clean debris from outlet boxes before installing devices.

3.2 INSTALLATION

- A. Install products following manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.
- B. Install devices plumb, level, and secure.
- C. Except as otherwise indicated on the Drawings, mount devices flush, with long dimension vertical, and grounding point of receptacles on top. Group adjacent switches and receptacles under single, multi-gang wall plates.
- D. Cover devices and assemblies during painting.
- E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

3.3 GROUNDING

- A. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- 3.4 FIELD QUALITY CONTROL
 - A. Inspect each wiring device for defects before installing.
 - B. Test 15 and 20 ampere receptacles for proper polarity and ground continuity using an NRTL listed test device that impresses a momentary current of at

least 15 amperes on the branch circuit conductors and equipment grounding path.

- C. Test ground-fault circuit interrupter operation by using the integral test and reset functions. Do not use an external tester for this purpose.
- D. Replace damaged or defective wiring devices.
- 3.5 CLEANING AND ADJUSTING
 - A. Clean devices and wall plates. Replace stained or improperly painted wall plates or devices.

END OF SECTION

This project specification is based on LANL Master Specification Section 26 2726 Rev. 5, dated August 10, 2017.

EPC-DO: 18-052
SECTION 26 28 13

FUSES

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. This Section includes fuses 600 V and less.
- 1.2 SUBMITTALS
 - A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
 - B. Product Data:
 - 1. Class
 - 2. Current and voltage ratings
 - 3. Short-circuit current rating
 - 4. Time-current coordination curves for each type and size fuse
 - C. Operation and Maintenance Data:
 - 1. Include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
 - a. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - b. Time-current curves, including selectable ranges for each type of overcurrent protective device.
 - c. Manufacturer's written instructions provided with equipment.
- 1.3 QUALITY ASSURANCE
 - A. Fuses shall be UL listed and conform to NEMA FU1.

PART 2 - PRODUCTS

- 2.1 FUSES
 - A. Interrupting Capacity: Provide fuses with interrupting capacities equal to or greater than the available fault current shown on the Drawings.
 - B. Type and Speed:
 - 1. Provide fuses of various types and of the appropriate speeds to provide selective coordination.
 - 2. Provide fuses with blown-fuse indication when available.
 - 3. Submit time-current coordination curves for each type of fuse.
 - C. Labeling: Provide a nameplate or a manufacturer's preprinted label attached adjacent to

each fuse or set of fuses. Label shall indicate manufacturer's name, manufacturer's catalog number, UL class, voltage rating, current rating, and speed.

- D. Manufacturer: All fuses provided shall be of the same manufacturer.
- 2.2 EXTRA MATERIALS
 - A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 20 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 3 - EXECUTION

- 3.1 FUSE APPLICATION
 - A. Service Equipment:
 - 1. ≤600A Class RK1 current limiting time delay
 - 2. >600A Class L current limiting time delay
 - B. Non-motor feeders (panel boards, control panels):
 - 1. ≤600A Class RK1 current limiting fast acting
 - 2. >600A Class L current limiting fast acting
 - C. Motor feeders and motor branch circuits:
 - 1. ≤600A Class RK5 current limiting time delay
 - 2. >600A Class L current limiting time delay

END OF SECTION

SECTION 26 28 18

ENCLOSED SWITCHES

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. This Section includes disconnect switches, also known as safety switches, distribution equipment switches, or disconnects, 600 V and below.
- 1.2 SUBMITTALS
 - A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
 - B. Product Data:
 - 1. For each type and size of disconnect switch indicated include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, mounting, and finishes.
 - a. Enclosure types, ratings and outline drawings.
 - b. Current and voltage ratings.
 - c. Short-circuit current rating.
 - d. Features, characteristics, and ratings.
 - C. Operation and Maintenance Data:
 - . Include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:
 - a. Manufacturer's written instructions for testing and adjusting safety switches.
- 1.3 QUALITY ASSURANCE
 - A. Safety switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards:
 - 1. NEMA KS-1
 - 2. UL 98

PART 2 - PRODUCTS

- 2.1 DISCONNECT SWITCHES
 - A. Fusible and Non-Fusible Disconnect Switches, 1200 amp and smaller: Provide heavy duty Type HD conforming to NEMA KS-1 and Federal Specification W-S-865C, 600-Volts, horsepower rated for motors as required. Provide number of poles and ampacity as noted or required by code. Switches shall be fused where indicated, or where required by UL labeling or listing of equipment served. Handle shall have provisions for padlocking in the off position and the door shall have provisions for padlocking closed.

- B. All disconnect switches in publicly accessible spaces shall have provisions for padlocking in the ON position or if indicated on the plans.
- C. Switch blades shall be visible when the switch is in the "OFF" position and the door is open.
- D. Provide factory installed neutral assembly for switches installed on circuits with a neutral.
- E. Provide factory installed ground lug kits.
- F. Disconnect switches shall have door interlock mechanisms with a tool-operated springloaded defeat feature that prevent the door from opening when the handle is in the ON position. Defeat mechanisms shall be accessible.
- G. Fusible switches 30-amp through 600-amperes shall be furnished with rejection type Class "R" fuse clips. Fusible switches 601-amp through 1200-amperes shall be furnished with Class "L" fuse clips unless otherwise indicated.
- H. The following factory modifications are to be included:
 - 1. Factory installed auxiliary contacts
 - 2. Double line and load lugs for parallel feeders

PART 3 - EXECUTION

- 3.1 COORDINATION
 - A. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required work-space clearances and required clearances for equipment access doors and panels.
- 3.2 INSTALLATION
 - A. Provide enclosures rated for environmental conditions at their installed location.
 - 1. Outdoors, damp or wet: NEMA 250, Type 3R/12.
 - 2. Indoors, dry: NEMA 250, Type 1.
 - 3. Indoors, damp or wet: NEMA 250, Type 3R/12.
 - B. Mount plumb and rigid without distortion of enclosure.
- 3.3 IDENTIFICATION
 - A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Identification for Electrical Systems".
 - B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section "Identification for Electrical Systems".
- 3.4 CLEANING
 - A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

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SECTION 26 4300

SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General requirements for both Type 1 and Type 2 surge protective devices (SPDs) for the protection of electrical power circuits not exceeding 1000 V.
- B. Type 1 surge protective devices (SPDs) for the protection of electrical power circuits not exceeding 1000 V.
- C. SPDs for the protection of signal, data, antenna, and control lines.

1.2 ACTION SUBMITTALS

Submit the following:

- A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
- B. Catalog Data: Catalog data describing SPDs. Include data substantiating that proposed products comply with specified requirements.
- C. Certifications: For Type 1 and Type 2 (power) SPDs, submit current UL 1449 (latest edition) listing certification showing:
 - 1. Short Circuit Current Rating (SCCR)
 - 2. Voltage Protection Ratings (VPRs) for all modes
 - 3. Maximum Continuous Operating Voltage rating (MCOV)
 - 4. Nominal discharge current rating (I_n)
 - 5. Device Listing.
- D. Electrical Diagrams: Internal wiring diagram for each Type 1 SPD illustrating all modes of protection, all field connections, and manufacturer's recommended wire and circuit breaker sizes.
- E. Installation Instructions: Manufacturer's manual.
- F. Operation and Maintenance Data: Manufacturer's instructions.

1.3 QUALITY ASSURANCE

- A. Comply with the *National Electrical Code* (NEC), and NFPA 780 *Standard for the Installation of Lightning Protection Systems* for installation requirements, where applicable.
- B. Provide SPDs that are listed by a Nationally Recognized Testing Laboratory (NRTL). Listing standard shall be the following, as applicable:
 - 1. ANSI/UL 1449 Standard for Safety for Surge Protective Devices.
 - 2. UL 497B Standard for Safety for Protectors for Data Communications and Fire Alarm Circuits.
 - 3. UL 497C Standard for Safety for Protectors for Coaxial Communications Circuits.
- C. Provide SPDs suitable for use at a nominal altitude of 7500 ft.
- 1.4 RECEIVING, STORING AND PROTECTING
 - A. Receive, store, protect, and handle products according to the manufacturer's instructions and NECA 1 *Standard Practices for Good Workmanship in Electrical Construction*.

PART 2 PRODUCTS

- 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS
 - A. Alternate products may be accepted; follow Section 01 2500.

2.2 GENERAL SPD REQUIREMENTS FOR POWER APPLICATIONS

- A. Provide SPD that is NRTL listed to UL 1449, latest edition.
- B. SPD shall provide surge current paths for at least the following modes of protection:
 - 1. L-N, L-G, and N-G for Wye-connected systems;
 - 2. L-L, L-G in Delta-connected systems.
- C. Provide each individual SPD intended for mounting external to the electrical assembly with a NEMA enclosure that is suitable for the installation location and environment.
 - 1. NEMA 1, 12, 3R, and 4 enclosures constructed of powder-coated steel.

- 2. NEMA 4X enclosures constructed of polycarbonate or Type 304 stainless steel.
- D. Each SPD shall pass the manufacturing and production line tests required in UL 1449, latest edition.

2.3 TYPE 1 SPD

A. AC Power SPDs shall have a UL 1449 Short Circuit Current Rating (SCCR) not less than the following:

System Voltage	Circuit Size	Minimum SCCR
208Y/120	400 A and less	200 kA,
120/240	Any	200 kA.

- B. SPD shall be suitable for use without external or supplemental overcurrent protection. Every suppression component of every mode shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary overcurrent protection will not be considered.
- C. SPD shall have a UL 1449 nominal discharge current rating (I_n) of not less than 20 kA.
- D. Suppression components shall be thermally-protected 32 mm or larger metaloxide varistors (MOVs).
- E. AC Power SPDs minimum surge current capability (single-pulse-rated) per phase shall be as indicated for the following applications:
 - 1. Service Equipment or Transfer Switch:

System Voltage	Equipment Size	Minimum Surge Current Capability
208Y/120	400 A and less	80 kA
120/240	Any	80 kA.

F. AC Power SPDs UL 1449 Voltage Protection Rating (VPR) shall not exceed the following:

System Voltage	<u>L-N</u>	<u>L-G</u>	<u>L-L</u>	<u>N-G</u>
208Y/120	700V	700V	1200V	700V
120/240	700V	800V	1200V	700V

G. UL 1449 Maximum Continuous Operating Voltage (MCOV) rating shall be not less than the following:

System Voltage	Allowable System Voltage Fluctuation (%)	<u>MCOV</u>
208Y/120	25%	150V
120/240	25%	150V

- H. AC Power SPDs shall include not less than the following monitoring and diagnostic features that report the protection status of the SPD:
 - 1. One green LED indicator per phase.

- 2. For SPDs with a surge current capacity equal or greater than 100 kA provide an audible alarm and one set of NO/NC contacts that change state under any fault condition.
- I. Manufacturers:
 - 1. Advanced Protection Technologies, Eaton, Siemens, Schneider Electric
- 2.4 SPD FOR SIGNAL, DATA, ANTENNA, AND CONTROL LINES
 - A. Provide SPDs suitable for the protection of signal, data, antenna, and control lines.
 - 1. Select SPDs with consideration for aspects such as the frequency, bandwidth, voltage, and current of the signal, data, antenna, or other communications lines and to ensure that insertion losses introduced by the surge protective devices are within acceptable operational limits.
 - 2. Coordinate selection of SPDs for signal, data, antenna, and control lines with owner of equipment that is served by the lines.
 - B. Provide SPDs for of signal, data, and control lines that provide both common mode and differential mode protection.
 - C. Provide SPDs for signal, data, control, and alarm lines.
 - 1. Provide devices with ratings and connectors as required by the application.
 - 2. Manufacturer: Phoenix Contact, EDCO, MCG Electronics
 - D. Provide coaxial SPDs for antenna and RF signal lines.
 - 1. Devices shall be listed in accordance with UL 497C.
 - 2. Provide devices with ratings and connectors as required by the application.
 - 3. Provide bulkhead plates and low-impedance paths to ground where antenna cables enter the structure.
 - 4. Manufacturers: TII Network Technologies, Inc., Cable Innovations, PolyPhaser, Phoenix Contact

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify mounting area is ready for SPDs.

B. Verify that circuit rough-in is at correct location.

3.2 INSTALLATION

- A. Install SPDs where indicated on the Drawings or specified below and according to the manufacturer's instructions, NFPA 780, and the *National Electrical Code*. Have the manufacturer's installation instructions available at the construction site.
- B. Install listed SPD for each for signal, data, control, and alarm line that enters the structure or exits the structure to serve external detached equipment or other detached structures. Where such signal, data, control, and alarm circuits are longer than 100 ft. install listed SPD at both ends of the circuit.
- C. Install each SPD so it will be accessible for inspection and maintenance.
- D. Install each SPD with conductor length according to the manufacturer's instructions.
 - 1. Twist conductors tightly together and keep runs as straight as possible with no sharp bends or kinks.

3.3 FIELD QUALITY CONTROL

- A. Provide final protection and maintain conditions to ensure that coatings and finishes are without damage or deterioration at final inspection.
- B. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.
- C. Verify that each SPD is correctly connected and that all condition monitoring indicators operate properly.
- D. Verify mechanical integrity of each conductor connection.

END OF SECTION

This project specification is based on LANL Master Specification Section 26 4300 Rev. 1, dated July 24, 2017.

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SECTION 27 54 10

INSTRUMENTATION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Design, construct, program, install, commission, and test the control and monitoring of the process equipment included in this project.
 - B. Provide all instrumentation devices, sensors, communication components, wiring, tubing, valves, fittings, terminals, power supplies, batteries, relays, I/O expansion modules, identification, enclosures, sun shades, sealants, supports, and protection necessary.
 - C. Furnish all tools, installation equipment, calibration and test equipment, consumables, and incidentals necessary for the installation, commissioning, and testing.
- 1.2 SCOPE
 - A. New control and monitoring system to centralize monitoring of new water distribution pipeline flow meters, pressure transducers, and other associated telemetry system devices.
 - B. The telemetry equipment shall provide a distributed multi-point control and communication system. The system shall be open architecture based using commercially available programmable logic controllers (PLC) in the remote telemetry units (RTUs), one or more modular computer software program(s) for data acquisition, processing, reporting, and archiving, and a high-speed wireless communication link to the RTUs. Proprietary or custom RTUs are not acceptable. The computerized data acquisition, processing, reporting, and archiving portion of the system is **not** part of this construction contract and will be provided by the Government.
 - C. Communication system equipment shall be wireless LTE 4G cellular compatible with the Government's existing service (Verizon).
 - D. RTUs shall continue to operate on last inputs and set-points without any active communication link and without a computer designated as a master computer.
- 1.3 RELATED SECTIONS
 - A. Section 01 2500 Substitution Procedures
 - B. Section 01 7839 Project Record Documents
 - C. Section 26 0553 Identification for Electrical Systems
 - D. Section 26 0813 Electrical Acceptance Testing

- E. Section 26 4300 Surge Protective Devices
- F. Section 40 7113 Electromagnetic Flow Measuring System
- 1.4 QUALIFICATIONS
 - A. "System supplier" is the company which assembles the instrumentation, installs and supervises the installation of the equipment, configures the hardware and software, commissions the system, trains Owner's designated operators, and services the completed installation.
 - B. System supplier shall meet the following requirements:
 - 1. Successfully installed five (5) similar municipal water/wastewater collection/distribution or treatment systems. Provide a list of completed projects along with contact names addresses, and phone numbers. Indicate complexity of project, for example, number of I/O points, number of RTU's, and software used.
 - 2. Been in business for minimum 5 years. Indicate number of years in business.
 - 3. Be located within 200 miles of the project site (Los Alamos National Laboratories, NM).
 - 4. Employ a minimum of three service technicians. The technicians shall reside within 200 miles of the project site. Provide resumes of service technicians and the project manager.
 - 5. Submit information indicating financial solvency, such as an audited annual report, if requested.
- 1.5 SUBMITTALS
 - A. Refer to Section "Basic Electrical Material and Methods" 26 0050 Part 1.
 - B. System Supplier Information. Provide documentation indicating compliance with the requirements of paragraph 1.4B.
 - C. Product Data:
 - 1. Illustrate and indicate manufacturer, model, options, style, material, mounting provision, finish, and electrical characteristics for each type and size of component used. Clearly identify and obscure product data in manufacturer's published information that is **not** applicable to this project.
 - 2. Descriptive information that states conformance to building codes and recognized testing, manufacturing, and operating standards.
 - D. Shop Drawings:
 - 1. Component mounting arrangement, enclosure(s), and protection.
 - 2. Wiring methods, connection assignments, and conductor identifiers.
 - 3. Input/output table.
 - 4. Details of any custom fabricated components, supports, or other construction methods.
 - 5. Identification methods and nomenclature.
 - 6. Battery run-time calculations.
- 1.6 QUALITY ASSURANCE
 - A. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction

such as Underwriters Laboratories, Inc. (UL), and marked for the intended use.

- B. Perform the work in accordance with the current edition of the National Electrical Code (NEC) and the National Electrical Safety Code (NESC).
- C. Perform the work in accordance with local ordinances, building codes, and statutes.
- D. Source Limitations: Obtain system main communications, networking, and programmable logic equipment from single consistent manufacturers.
- E. Work shown and specified in these contract documents establishes the minimum standard of construction. Comply with any additional requirements of the building codes or local requirements.
- 1.7 EXISTING FACILITIES AND EQUIPMENT
 - A. Existing water operations, distribution, and process equipment not directly involved with this project shall not be disturbed.
 - B. There is no existing SCADA system to integrate or replace. There are no existing water distribution meter stations to integrate or upgrade.

PART 2 - PRODUCTS

2.1 PERFORMANCE

- A. Instrumentation shall be designed, selected, and constructed such that each system shall resume normal operation without requiring manual reset after power interruptions.
- B. Devices located in Class 1 Division 1 hazardous areas shall be rated for hazardous location installations per NEC and UL. Conduit seal-offs shall be provided outside the hazardous areas where shown or as necessary.
- C. Serial communications protocol shall be Modbus RTU 1.2-115.2 kbps
- D. Internet protocol shall be IP/Ethernet 10/100 MHz.
- E. Analog signal output from equipment that is not 4-20mA shall have the output immediately converted to 4-20 mA. Transmission methods such as impulse duration, pulse rate, and voltage regulated are permitted except where specifically noted.
- F. Instrumentation shall display any fault or alarm within five seconds of initiation and any warning or change of status within ten seconds when normal power is available.
- 2.2 WIRING
 - A. Provide the necessary I/O wiring (raceway, supports, connectors, conductors, terminations, etc) and identification labeling.
 - B. Refer to diagrams and I/O Schedule on the drawings.
 - C. Provide surge protection (signal protector) on each analog input. DIN rail clamp, 28V

signal peak 4 MHz, 55V peak clamping, 50 pico-seconds response, >100 operations surge life at 200A 10x1000 μ sec. Bourns #1820-28-A3 or equal.

- Provide interposing isolation control relay on each discrete output with DO terminal strip.Relay: General purpose slim-line plug-in, SPDT form C, 300Vac 10A contacts, 24Vdc coil, LED pilot light, screw terminal DIN rail socket, Allen-Bradley #700-HK36Z24-4 or equal.Diode: Provide rectifier (diode) across each relay coil, 400V peak 280 Vrms working reverse voltage, Diodes #1N4004 or equal.Terminal strips
 - 1. Finger-safe single circuit high density 600Vac/dc #30-#12 AWG box terminals, with end barriers. Allen-Bradley #1492-HM1 or equal.
- F. Wireway
 - 1. Slotted light gray with snap-on cover, Thomas & Betts (T&B) #TYxxXxWPG6 w/ #TYxxCPG6 or equal.
- G. DIN rail
 - 1. Slotted steel 35mm wide slot. Allen-Bradley #199-DR1, ERICO, or equal.
- H. Conductors
 - 1. Discrete I/O:
 - a. #14 AWG stranded tinned copper MTW 75°C 300V colored jacket. Belden #1015 or equal.
 - 2. Analog I/O:
 - a. #16 AWG stranded tinned copper twisted shielded pair 75°C colored jacket. Belden #8719 or equal.
 - 3. Ethernet:
 - a. #24 AWG solid 4-pair UTP CAT 5e TIA/EIA-568-B.2 350 MHz blue jacket RJ45 terminations.
- I. Identification
 - 1. Nameplates
 - a. 1/16" thick engraved phenolic black with white core (letters). Rowmark #322-402 or equal.
 - 2. Labels
 - a. Machine printed heat-shrink type, #10-#18 AWG. Tyton #THS-620W or equal.

2.3 INSTRUMENTATION

- A. Analytical
 - 1. None.
- B. Fluid Level
 - 1. None.
- C. Fluid Flow
 - 1. Magnetic flow meters with digital remote transmitters specified in Section 40 7113.
- D. Pressure
 - 1. Pressure transducer specified in Section 40 7113
- E. Temperature
 - 1. Cabinet interior sensing
 - a. DIN rail mount

- b. 4-20mA output
- c. 24 Vdc input
- d. 20-120°F range ±0.3% accuracy (full range)
- e. Dwyer Instruments #650-2
- F. Position or State (Status)
 - 1. Utility power not available Control relay See wiring diagram drawing
 - 2. Flow meter fault DI See wiring diagram drawing
 - 3. Network switch fault DI See wiring diagram drawing
 - 4. Battery charge and temperature
- G. Security and Access
 - 1. Cabinet door open Control relay See wiring diagram drawing
- 2.4 LOGIC OR PROGRAMMING
 - A. Programmable Logic Controller (PLC)
 - 1. Modular expandable enclosed telemetry I/O equipment
 - a. provisions for discrete inputs and outputs, analog inputs and outputs, and serial communication as scheduled, indicated, or as necessary. Expandable to at least 128 total I/Os.
 - b. Ethernet IP communications
 - c. 11-30 Vdc input 1 W
 - d. DIN rail mount
 - e. Schneider Electric #TM221CE16R
- 2.5 POWER SUPPLY
 - A. Uninterruptible: Provide a rechargeable battery back-up system at all locations. Unless indicated otherwise, minimum battery capacity shall allow continuous normal telemetry functions for a minimum 48 hours.
 - 1. Charger:
 - a. Automatic bulk, absorption, float, equalization voltage charging for sealed lead-acid AGM batteries
 - 1) 240 Vac primary 24 Vdc nominal secondary
 - a) 25 Åmp 675 Watt output lota #DLS-240-27-25/IQ4
 - 2) 200-240 Vac (universal) primary 24 Vdc nominal secondary
 - a) 40 Amp output 1100 Watt lota #DLS-UI-27-40/IQ4
 - 2. Batteries
 - a. 12-Vdc lead-acid absorption gas mat (AGM) sealed
 - 1) deep-cycle type, gelled electrolyte, each 75-Ah minimum 60 lb maximum
 - 2) Submit calculations of battery capacity (run time) at normal load without charger input.
 - Provide battery rack, hold-down clamps and bolts, cables, terminal clamps, color-coded insulating terminal caps, color-coded terminal anticorrosion pads
 - 4) Optima #D31T, Trojan #24-GEL
 - 3. Monitor
 - a. Battery monitor system with status notification
 - 1) See cabinet detail drawing
 - B. DC-DC Converter Power Supply

- 1. 24 Vdc output ±1% 10-Ampere
- 2. 18-32 Vdc input
- 3. DIN rail mount
- 4. Phoenix Contact #QUINT-PS/24DC/24DC/10

2.6 COMMUNICATION

- A. Industrial LTE 4G Wireless (cellular)(Verizon)
 - 1. Gateway
 - a. DIN rail mount
 - b. 7-36 Vdc input 1 W
 - c. Sierra Wireless #RV50X with #6001125 omni-directional 3-in-1 panel antenna and RG174 cable
- B. Industrial Network Switch
 - 1. 8 fast Ethernet ports (RJ-45 copper 10/100 Mbps)
 - 2. 4 gigabit Ethernet uplink ports (combo copper/fiber 10/100/1000 Mbps)
 - 3. 54 Vdc input 35 W
 - 4. DIN rail mount
 - 5. Cisco #IE4000-8T4G-E
 - 6. Power supply 24 Vdc input 54 Vdc output
 - 7. DIN rail mount
 - 8. Cisco #PWR-IE65W-PC-DC
 - 1.
 - 2.

PART 3 - EXECUTION

3.1 COORDINATION

A. Review submittals for equipment furnished under other divisions and specification sections prior to installation and electrical rough in. Verify location, size, and type of interface connections. Coordinate details of equipment connections with suppliers and installers.

3.2 FACTORY TEST

- A. Before the equipment is shipped to the job site, the supplier's shop test shall be performed. The test shall occur in the supplier's facility.
 - 1. Verify proper power-on operation of all components and load currents within ranges.
 - 2. Simulate all inputs and outputs at the RTU's including 4-20ma DC signals.
 - 4. Verify all warning and alarm conditions and responses on system.
 - 5. Verify compliance with sequence of operation.

3.3 INSTALLATION

- A. Installation activities shall be scheduled with the Owner a minimum of two weeks in advance for each site.
- B. Provide earth ground and bonding of all metal parts and antenna supports.

3.4 PROGRAMMING

- A. Provide configuration and operation programming to authenticate communication requests, upload XML and/or CSV data file(s), download programmed settings or firmware upgrades, initiate communication requests, and upload warning, fault, and/or alarm conditions.
- B. Coordinate with Government project representative(s) data formats and protocols, user identifications, and user passwords to integrate the gateways and device web pages into the existing wireless communication system and monitoring/control/reporting software.
- 3.5 CALIBRATION
 - A. Scale, calibrate, and verify all analog I/Os to and from the RTUs.

3.6 TRAINING

- A. The System Supplier shall conduct training courses for personnel selected by the Owner. Training shall be provided at the operator level and shall be conducted by personnel employed by the System Supplier who are familiar with the specific system supplied and who have experience and training in developing and implementing similar instructional courses.
- B. All costs associated with the complete training program shall be the responsibility of the System Suppler and shall be included in the Contract Price. Training schedules shall be coordinated with the Owner to accommodate all personnel.
- C. Training shall be conducted at the Owner's facilities and shall not begin until the system is installed and operational.
- D. An outline of training shall be submitted 15 days in advance for review. Training sessions shall be divided into a minimum of two categories; operator training, and maintenance technician training.
- E. The training program shall include at least eight (8) clock hours of instruction for the Owner's personnel and shall cover at least the following topics:
 - 1. Preventive and scheduled maintenance for all equipment.
 - 2. Function and normal operation of all circuit boards and modules.
 - 3. Diagnosis of hardware failures to the faulted board or module.
 - 4. Removal and replacement of all removable circuit boards and modules.
 - 5. Emergency maintenance and restoration procedures.
 - 6. Graphic display development and editing.
 - 7. PLC troubleshooting including use of laptop computer as a PLC programming tool.
 - 8. Radio troubleshooting and replacement.
 - 9. System debugging.
- 3.7 CLEANING
 - A. On completion of installation, inspect interior and exterior of RTUs. Remove paint splatters and other spots. Vacuum dirt and debris. Repair exposed surfaces to match original finish.

3.8 FINAL ACCEPTANCE TEST

- A. After completion of installation, a test shall be performed and witnessed. The test shall test all hardware and software to confirm compliance with requirements.
 - 1. Operate all inputs and outputs at the RTU's including 4-20ma DC signals. Display these on the computer screen.
 - 2. Demonstrate all graphic screens and print reports.
 - 3. Demonstrate all alarms on system.
 - 4. Demonstrate compliance with sequence of operation.
 - 5. Demonstrate error free communication over all radios.
 - 6. Demonstrate power failure operation of all computers and RTUs in project.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Potholing.
- B. Grading: Clear, excavate topsoil, grade and dispose of materials at site.
- C. Excavation: Excavate, place, and compact earth at site.
- D. Trenching: Excavate trenches for utilities and install tracer wire/identification tape.
- E. Backfilling.
- F. Soil compaction and testing.

1.2 LANL PERFORMED WORK

- A. Obtain excavation/soil disturbance permit for Subcontractor.
- B. Mark location of known underground utilities and issue the excavation/soil disturbance permit.
- C. Document new and existing utility locations. LANL's Mapping and Locating Group will survey locations of new and existing exterior utilities and infrastructure. Refer to Part 3.8.
- D. Locate utility shut-off points prior to potholing.
- E. Perform an electrical continuity test for each run of tracer wire.

1.3 DEFINITIONS

- A. Mechanical Excavation: Use of backhoes, jackhammers, trenchers, and similar powered digging machines; excludes vacuum excavators that are equivalent to hand digging.
- B. Utility and Pipe: Any active or inactive buried pipe, duct, conduit, or cable in a primary or secondary utility system.

1.4 ACTION SUBMITTALS

- A. Submit the following:
 - 1. Certifications from an independent testing laboratory that pipe bedding materials meet the specification.
 - 2. Certifications from an independent testing laboratory that base course materials, crushed stone or crushed or screened gravel meet the specification.
 - 3. Test reports of field-testing of material compaction.
 - 4. Test reports of field-testing of tracing wire continuity.
 - 5. Catalog data on identification tape, tracing wire test station, and tracing wire.

1.5 QUALITY ASSURANCE

- A. When work or portions of work of this Section requires testing, notify LANL Subcontractor Technical Representative (STR) 48 hrs in advance of testing.
- B. Ensure compacted fills are tested in accordance with Paragraph 3.10 and in compliance before proceeding with placement of next lift.
- C. Do not begin any groundbreaking, fill, or soil disturbance and transfer until known utilities have been marked, and an excavation/soil disturbance permit has been issued to Subcontractor.
- D. Comply with OSHA 29 CFR 1926, Subpart P for excavation and trenching operation.
- E. Maintain a copy of Excavation/Soil Disturbance Permit package, potholing plan, competent person excavation logs, and test reports on site.
- F. Perform pre-job briefing of Permit and associated safety and hazard documentation with workers performing the work.
- G. Ensure that engineering controls and required Personnel Protective Equipment (PPE) are used by workers during work activities to maintain safety, especially during jack hammering. Breaking surface blacktop, curbs and gutters with a jackhammer does not require dielectric PPE, provided locates have been performed and the STR is confident no other unexposed utilities are present in the surface concrete, blacktop, curb, gutter or sidewalk to be removed.
- H. Review and maintain the work within the established boundaries established by the permit.

1.6 SITE CONDITIONS

A. Areas to be backfilled are free of debris, snow, ice, and water, and surfaces are not frozen. Backfill material shall be in a thawed state before being placed, mixed, or compacted. Compensatory measures can be used and should be described in a cold weather protection plan and approved by the STR.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: Unless otherwise noted the existing site soils shall be used for fill and backfill materials. If the on-site soils are found by laboratory test to be unsuitable for use contact the LANL STR. Any additional fill material used must conform to the applicable requirements of this section.
- B. Topsoil
 - 1. Excavated soil material, graded free of roots, rocks larger than 1 inch subsoils, and debris.
- C. Fill and Backfill Material
 - 1. Material consisting of non-plastic granular soils free of organic or other deleterious materials having a maximum particle size of 2 inches.
 - 2. All borrow and fill material shall be provided by the Subcontractor. The LANL STR in consultation with LANL FOD-Utilities and Institutional Facility (U&I) Group may approve a borrow/spoils area.

- D. Engineered Backfill
 - 1. General: Excavated material may be used for fill and/or backfill under sidewalks and site. Use only clean approved materials for engineered fill and/or backfill under buildings and structures. Site materials which have the required properties may be used subject to the approval of the LANL STR. If sufficient materials are not available at the site or if the site materials do not have the specified properties, materials from off-site borrow areas will be used. Off-site materials may be mixed with on-site materials in the proportions necessary to meet the requirements of this section. All arrangements necessary for the use of borrow areas are the sole responsibility of the Subcontractor. Stripped topsoil shall not be used in structural backfill.
 - 2. Laboratory Testing: Perform appropriate and specified laboratory tests as necessary to insure that soil materials proposed for use on this project meet all specified requirements. Provide a moisture-density curve for each material proposed for use as engineered fill.
 - 3. Fill: Engineered fill required to raise the building areas and backfill around and above structures shall be clean material, free of vegetation, debris and other deleterious materials and shall meet the following requirements as determined by ASTM D 422 except as otherwise approved by the LANL STR.

Sieve Size	Percent Passing
2"	100
1/4"	40 - 100
No. 200	25 - 45

Fill shall have a P. I. of not more than 10. Testing shall be in conformance with ASTM D 4318.

- E. Base Courses
 - Provide base course and aggregate composed of materials consisting of crushed stone, crushed or screened gravel, sand, RAP, or a combination of such materials. Provide base course and aggregate free from vegetable matter and other deleterious materials, including silt and clay balls. Ensure that at least 50 percent of the materials on or above the No.4 sieve have at least two fractured faces. Maximum Liquid Limit of 25 and maximum Plasticity Index of 6, per ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. When using RAP the sieve size may be increased to 1.5 inches passing 100% and in accordance with ASTM D 4718 in conjunction with ASTM D 1557.
 - 2. Base course aggregate shall conform to:

Base Course Gradation

Percent Passing
100
80 - 100
30 - 60
20 - 45
3.0 - 10.0

- F. Crushed Stone
 - 1. Provide crushed stone and /or crushed or screened gravel free of any organic or deleterious substance and having 100 percent passing 1 inch sieve and 0 percent passing the 3/8 inch sieve.

2.2 UTILITY TRENCH BED AND FILL MATERIALS

- A. Bedding: Provide clean sand for pipe bedding material free of any organic or deleterious substance and having 100 percent passing 3/8 inch sieve and 0-10 percent passing No. 100 sieve.
- B. Fill: Provide fill and backfill material consisting of non-plastic granular soils free of organic or other deleterious materials having a maximum particle size of 2 inches. Warning Tape
 - 1. Use non-detectable plastic warning tape consisting of high visibility, colorcoded, continuously printed, inert fiber reinforced polyethylene for direct burial service.
 - 2. Provide tape to the following criteria:
 - a. Minimum overall thickness: 4.0 mils
 - b. Minimum tensile strength: 1500 psi
 - c. Width: 6 inches
 - 3. Refer to trench detail on Drawing for warning tape color.
 - 4. Manufacturer: Bradley, Seton Name Plate Co., etc.
- C. Tracer Wire: #12 AWG copper clad steel, insulation of HDPE minimum 30 mil thickness rated for direct burial. Insulation color shall meet the APWA color code for buried utilities.
 - 1. Manufacturer: Copperhead Industries, Pro-Line Safety Products.
- D. Tracer Wire Test Station
 - 1. Manufacturer: C.P. Test Services, Model-Glenn Test Station
 - 2. Test Station: Plastic Pipe, cast iron cover, 2-point terminal box.

PART 3 EXECUTION

- 3.1 INSPECTION
 - A. Verify stockpiled fill to be reused is approved by LANL STR.

B. Verify areas to be backfilled are free of debris, snow, ice, and water, and surfaces are not frozen.

3.2 PROTECTION

- A. Preserve staking, marking, or other designation until the designation is no longer needed for permitted work. If marking is removed or no longer visible, notify LANL STR. The STR will contact LANL's Mapping and Locating Group to revalidate the excavation/soil disturbance permit by locating and marking the utility again.
- B. Protect existing structures from equipment and vehicular traffic.
- C. Maintain excavation free of standing water.
- D. Notify LANL STR of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Grade top perimeter of excavation to prevent subsurface water run-off into excavation.
- G. Barricades shall be erected around the excavation area before beginning work activities to prevent accidental entry into the area.
- H. Protect disturbed soils, drainage ways and watercourses against soil erosion and sedimentation by employing Best Management Practices (BMPs) as identified in excavation permit review (EX-ID) comments, shown on the drawings or identified in the Storm Water Pollution Prevention (SWPP) Plan and approved by LANL STR. Remove any temporary BMP's at the close of the project.
- I. Approved BMPs shall be in place per SWPP plan before soil-disturbing work begins.
- J. Stabilize all disturbed areas.

3.3 PREPARATION

- A. Identify required contours and data.
- B. Notify LANL STR 15 working days prior to startup of construction to have LANL's Mapping and Locating Group identify known underground utilities and stake and flag locations. If a conflict exists between location of such obstacles and proposed work, promptly notify LANL STR and arrange for relocations. Proceed in same manner if a rock layer or any other unforeseen conditions encountered underground make changes advisable.
- C. When necessary, compact subgrade surfaces to density requirements for backfill material. Remove unsuitable and unstable subgrade material.
- D. In rock cuts, the top of the rock cut elevation shall be considered to be the same as top of subgrade. Base course may be placed directly on top of competent rock without further processing of the rock (i.e. scarify and compaction) provided that pockets in the rock are graded to drain before base course is placed. Any fill placed on top of competent rock needed to bring the top of subgrade to required elevation shall be compacted in accordance with subgrade requirements.

3.4 WORKING WITHIN 5 FEET OF UTILITIES

- A. Stop work and notify the LANL STR when an unmarked utility is encountered. The STR shall contact LANL's Mapping and Locating Group so the site can be re-examined by Utility Locators.
- B. If an underground utility is damaged or severed during excavation, immediately notify LANL STR. LANL STR will take immediate action to secure the area, notify the agency responsible for the utility so that the damaged section can be isolated, repairs initiated and other notifications made as required.
- C. Whenever practical, utilities shall be de-energized, isolated, and tagged-out. The decision not to de-energize shall be made by LANL STR and Facility Operations Manager as appropriate.
- D. Do not use mechanical excavating equipment within 5 feet of a marked, nonpotholed utility. Mechanical excavation may commence within 5 feet of the underground utility only after the utility has been potholed, exposed, and wellmarked and the Subcontractor is confident that there are no unexposed utilities in the excavation area.
 - 1. Exception: Use of mechanical excavating equipment may be used where known utility line depths and/or site conditions exceed limitations of hand or vacuum excavation. For purposes of this exception, excavate pothole perpendicular to surface locate markings for 2 feet on each side of marking to a predetermined depth. Mechanical excavation may proceed to within 18 inches of bottom of potholes under this exception. When deemed necessary, Subcontractor will ask LANL STR to contact LANL's Mapping and Locating Group for consultation, checking of existing locate marks and remarking.
- E. Accomplish mechanical excavation at a distance no closer than 18 inches vertically and horizontally to potholed non-fully-exposed utility lines.
- F. Fully-exposed underground utilities shall be protected, supported, or removed and reinstalled as necessary to protect employees and the utility.
 - 1. If approved by LANL STR, powered excavation equipment may be used closer than 18 inches to any fully-exposed utilities provided that these are marked/indicated with a prominent, tall flag-on-pole, plank, or other highly visible object so the equipment operator can clearly see their locations and avoid contact. Prior to such excavating, mark and obtain approval using Attachment 1, Utility Protection Plan Form. Subcontractor shall complete the Utility Protection Plan and clearly indicate the limits of excavation/locates, utilities located, each pothole location, and description of installed marking/flagging measures. More than one form may be required for clarity.
- G. Take care while hand excavating adjacent to utility line since hand tools such as shovels, picks, and digging bars can damage the utility line.
- H. During machine excavation, have a spotter in place to actively monitor the positioning of the equipment.
- I. Hand-excavate obstructions (i.e., guy wires, anchors, bollards, fence posts, etc.) to be removed to determine their relationship to existing marked utilities prior to removal.

3.5 POTHOLING

- A. Prior to potholing the LANL STR will notify LANL's U&I Group to locate utility shut-off points. U&I Group will ensure the shut-off points are field verified and determined operable.
- B. Pothole where existing buried utility lines are inside, or within 5 feet outside of excavation permit boundary limit.
- C. Accomplish potholing by hand excavation or through use of vacuum potholing equipment. The use of vacuum potholing equipment is not permitted within the boundary of a Potential Release Site (PRS).
- D. Pothole at vertical and horizontal utility angle points, at excavation boundary limit, and as needed. Provide additional pothole where utility depths are unknown or are in sloped work areas where utility depths may vary.
- E. When unknown utility lines are marked and hand or vacuum excavation has gone 1 foot deeper than required and 3 feet to the left and right of a locate mark without finding the utility, stop excavating and contact the LANL STR for consultation and remarking.
- F. Manholes or valve boxes may be used as a pothole to verify depths and locations of utilities.
- G. Parallel Utilities: Pothole at 50 feet intervals where existing utilities parallel excavation and existing lines are located up to 6 feet outside excavation boundary. Hand or vacuum excavate non-conductive direct burial lines within 2 feet of excavation boundary along their entire length adjacent to excavation boundary, or pothole at 5 feet intervals.
- H. Backfill potholes to original or better than condition. Refer to Paragraph 2.2B.

3.6 GRADING

- A. Excavate topsoil from areas to be further excavated or regraded, and stockpile topsoil on site in area designated by LANL STR. Topsoil may be used on areas to receive landscaping and seeding.
- B. Remove vegetation, debris, unsatisfactory soil materials, and obstructions from ground surface prior to grading. Properly dispose of material in accordance with Section 01 5705.
- C. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
- D. Match final grade in seeded and unpaved areas to match Drawing finish contours.
- E. Construct the subgrade surface elevation to a tolerance of plus or minus 0.1 foot from the specified grade and plus or minus 0.05 foot of the typical cross section, except unlined drainage ditch flow lines shown on Drawing are allowed plus or minus 0.2 foot.
- F. Construct the base course to the design depth required and the final surface to a tolerance of plus or minus 0.04 foot within 10 feet.
- G. Make changes in grade gradual. Blend slopes into level areas. Prepare finish grade to accept seeding by hand raking or as designated.

H. Remove surplus excavated materials from the site. Movement and proper disposal of materials from the site shall be in accordance with Section 01 5705.

3.7 EXCAVATING AND TRENCHING

- A. Excavate and trench subsoil as required for Work.
- B. Cut trenches sufficiently wide to enable installation of utilities to allow inspection. Trenches shall be benched, sloped, or shored to meet OSHA 29 CFR 1926 Subpart P, in particular Appendix A for Soil Classification and Appendix B for Sloping and Benching requirements. Refer to trench detail on LANL Standard Drawings for minimum trench widths.
- C. Do not interfere with normal 45 degree bearing splay of a structure foundation during excavation work. When excavating near or under a foundation a New Mexico Licensed Professional Engineer shall approve a support system to stabilize the structure or determine that excavation work will not pose a hazard.
- D. Hand trim excavation and leave free of loose matter.
- E. Remove lumped subsoil, boulders, and rock.
- F. Correct errors in excavation.
- G. Take proper precaution, such as shoring, sloping, or using a trench box when working in a trench or excavation. Provide a person who is trained and knowledgeable of soil conditions and safety requirements to make safety determinations.
- H. Evaluate excavations 4 feet or deeper (or other excavation where employee exposure can be reasonably anticipated) daily and document by a designated competent person before employees are permitted to enter the excavation. Documented inspections on an excavation condition log.
- I. When an oxygen deficiency or hazardous atmosphere could be reasonably expected in trenches over 4 feet in depth, such as excavating near roadways, lift stations, sewer/gas lines, etc., the excavation shall be tested with a calibrated, intrinsically safe monitoring device before employees are allowed to enter the excavation. If the atmosphere test indicates hazardous, then do not enter the excavation or if chemical hazards exist or are created within the excavation, stop work immediately and contact the LANL STR.
- J. Excavation boundaries shall be adequately marked and barriers installed to avoid inadvertent entry. Excavations that present a possibility of a worker falling to a lower level shall be evaluated by a designated Fall Protection Competent Person for necessary fall protection requirements.

3.8 DOCUMENTING UTILITY LOCATION

- A. Do not cover new or exposed existing utilities until LANL's Mapping and Locating Group has verified that utility locations have been documented by the use of GPS in compliance with LANL standard reference system.
- B. Subcontractor Responsibility: Notify LANL STR 5 working days in advance that new and exposed utilities will be ready for location verification.
- C. LANL STR Responsibility: Notify LANL's Mapping and Locating at 665-1051 immediately after being notified by Subcontractor.

3.9 BACKFILLING EXCAVATIONS/TRENCHES

- A. Backfill and fill areas to contour lines and elevations shown on the Drawings.
- B. Backfill and fill systematically.
- C. Do not place backfill or fill material over frozen, wet, or spongy subgrade surfaces, including surfaces containing frost or ice. Backfill material shall be in a thawed state before being placed, mixed, or compacted.
- D. Recondition, reshape and recompact areas that are damaged by freezing.
- E. Place backfill and fill materials in continuous layers not exceeding 8 inches in loose depth.
- F. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
- G. Compact each layer to required percentage of maximum density for the area.
- H. Compact layers uniformly before a succeeding layer is placed.
- I. Do no disturb or damage adjacent structures during compaction.
- J. Backfill against structures as follows:
 - 1. Do not place backfill against structure walls prior to verifying the concrete has been properly cured and is of required strength to resist stresses due to backfill.
 - 2. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.
 - 3. When unbalanced pressures are likely to develop on walls:
 - a. Continuously monitor for displacements,
 - b. Erect shoring to counteract imbalance, if required, and
 - c. Leave shoring in place until LANL STR approves its removal.
- K. Utility Trenches
 - 1. Support pipe and conduit during placement of concrete or fill.
 - 2. Install tracer wire (no splices) directly above buried non-metallic pipes and conduits, ductile iron, and cast iron pipes and terminate at grade within a test station or valve box. If the tracer wire can be continuous, do not cut the wire in a test station or valve box but leave as a slack, uncut loop. Tracer wire shall not contact underground piping.
 - 3. Visually inspect tracer wire prior to backfilling to ensure wire has not been nicked or cut, and that continuous unspliced wire runs between test station terminals.
 - 4. Prior to utility tie-ins, perform an electrical continuity test for each run of tracer wire after backfill is complete. The STR will notify LANL's Mapping and Locating Group to verify tracer wire continuity and GPS new and existing utility lines.
 - 5. Install non-detectable plastic warning tape 12 inches below finish grade and directly above buried utility pipe or conduit. Visually inspect warning tape prior to backfilling to ensure tape is continuous and not cut.

3.10 SOIL COMPACTION AND TESTING

- A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D 1557. ASTM D 1557 Method A is the preferred Method with Method B and C being acceptable based on the material gradation with oversize correction adjustments.
- B. Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer material to prevent free water appearing on surface during or subsequent to compacting operations.
- C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
- D. The allowable percent variation from optimum moisture is plus or minus 2 percent.
- E. The paragraphs below identify location and compaction required as a percentage of maximum density and optimum moisture measured using ASTM D 1557.
 - 1. Compact fill in 8 inch lifts that will be beneath concrete and asphalt structures to 95 percent of maximum density.
 - 2. Compact fill in 8 inch lifts that will be beneath unpaved areas to 90 percent of maximum density.
 - 3. Compact new aggregate base course that will be beneath asphalt structures to 95 percent of maximum density.
 - 4. Compact pipe bedding to 90 percent of maximum density.
- F. Subcontractor shall employ an AMRL-accredited independent testing agency to perform field testing of installed products to include compaction and test samples that shall verify quality control requirements and is responsible for the following:
 - 1. Verify fill material to be placed is within the stated specifications, and laboratory testing is complete.
 - 2. Verify that moisture-density relationship, ASTM D 1557, for each soil type to be placed is completed.
 - 3. Determine field density of in-place material in accordance with any of the following methods:
 - a. Nuclear Method, ASTM D 6938.
 - b. Rubber-Balloon Method, ASTM D 2167.
 - c. Sand-Cone Method, ASTM D 1556.
 - 4. Determine field moisture content in accordance with either of the following methods:
 - a. Nuclear Method, ASTM D 6938, or
 - b. Laboratory Determination, ASTM D 2216.
 - 5. Frequency of Tests
 - a. One test per 200 linear feet of trench per 8 inches maximum for each lift.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 31 2000 Rev. 10, dated May 13, 2015.

ATTACHMENT 1

Utility Protection Plan

Complete and receive approval from LANL STR before mechanically excavating within 18" of a fully-exposed underground utility line in accordance with this Specification.

Description of Utility:

Description of Installed Marking/Flagging Measures (e.g., tall flag-on-pole, plank, etc.):

Sketch:

Submitted by: ______ (Subcontractor Name/Date)

Witnessed/Approved by: _____ (LANL STR/Date)

SECTION 32 1216 ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subgrade and Base Course
- B. Hot-Mix Asphalt (HMA) Pavements
- C. Open-Graded Friction Course
- D. Tack Coat and Prime Coat
- E. Traffic Control Markings

1.2 ACTION SUBMITTALS

- A. Submit the following:
 - Material certifications documenting compliance with the New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction (SSHBC) including any Supplemental or Interim Specifications (i.e., use the latest specs). Guidance: Document(s) at http://www.dot.state.nm.us/content/nmdot/en/Standards.html
 - 2. Proposed mix design of each class of the HMA pavement with supporting documents in accordance with AASHTO R35. Mix design analysis shall be developed by a laboratory accredited through AASHTO Materials Reference Laboratory (AMRL) and complying with AASHTO R18 and ASTM D3666.
 - 3. Laboratory test reports and calculations for mix design for the HMA pavement. The mix design reports shall be less than one year old and be from the same source for the aggregate to be used for the project. Two or more aggregate sources may be used only when each individual aggregate source meets all applicable quality requirements.
 - a. Aggregate quality testing shall include Los Angeles Abrasion and Impact, Soundness loss, Absorption, and fractured faces.
 - 4. Certification from the testing laboratory responsible for material analysis and field testing, that equipment to be utilized is properly and currently calibrated.
 - 5. Certification that testing personnel are in compliance with ASTM D 3666.
 - 6. Traffic analysis, vehicle loadings, and structural design.

- 7. Detailed plan for temporary traffic control markings and traffic signs. This plan shall be approved by the LANL Traffic Engineer prior to applying the traffic control markings.
- 8. Detailed plan for permanent traffic control markings and traffic signs. This plan shall be approved by the LANL Traffic Engineer prior to applying the traffic control markings.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with the respective, noted Sections of the NMDOT Standard Specifications for Highway and Bridge Construction latest edition. Exclude NMDOT Division 901, Quality Control/Quality Assurance (QC/QA) unless otherwise noted in section 3.8 "Field Quality Control" of this specification, and any other references to METHOD OF MEASUREMENT, to BASIS OF PAYMENT, and for pay factor determination. *Guidance: Document(s) at* <u>http://www.dot.state.nm.us/Standards.html</u>
- B. Supply the base course and prepare the subgrade in accordance with the NMDOT SSHBC, Section 303, Base Course and in accordance with LANL Standard Specification 31 2000, Earth Moving.
- C. The LANL STR shall submit the approved material certifications and mix designs to the LANL Utilities & Institutional Facilities Roads System Engineer and the LANL Construction Inspector for verification of construction items and certifications during field quality assurance.
- PART 2 PRODUCTS

2.1 MATERIALS

A. SECTION 1 Miscellaneous Asphalt Paving:

Provide Hot-Mix Asphalt (HMA) pavement conforming to NMDOT SSHBC, Section 417, Miscellaneous Paving.

B. SECTION 2 Major Asphalt Paving:

Provide Hot-Mix Asphalt (HMA) pavement conforming to NMDOT SSHBC. Section 423, Hot-Mix Asphalt–Superpave.

- 1. Provide aggregates conforming to the requirements of Table 423.2.2.1:1 "HMA Aggregate Control Points". Ensure aggregate conforms to Table 423.2.2.1.2:1 "Minimum Fractured Faces, Sand Equivalent, and Fine Aggregate Angularity for Virgin Aggregates".
- 2. Provide performance graded asphalt cement conforming to NMDOT SSHBC, Section 402, Asphalt Material, Hydrated Lime, and Anhydrite Based Material.
- C. Provide open-graded friction course conforming to NMDOT SSHBC, Section 403, Open-Graded Friction Course (OGFC).

- 1. Open-graded friction course: Provide aggregates conforming to the requirements of Table 403.2.2:1.
- 2. Provide asphalt cement conforming to NMDOT SSHBC, Section 402, and the submitted laboratory mix design.
- D. Provide liquid asphalt tack coat conforming to NMDOT SSHBC, Section 407, Tack Coat.
- E. Provide liquid asphalt prime coat conforming to NMDOT SSHBC, Section 408, Prime Coat shall be used as required by site conditions or design requirements and approved by the LANL Utilities & Institutional Facilities Roads System Engineer and LANL STR.
- 2.2 TRAFFIC CONTROL MARKING
 - A. Provide paint for pavement markings (words, symbols, and stripes) conforming to NMDOT SSHBC, Section 704, Pavement Markings. Comply with the requirements for the application, protection, and limitations of the paint.
 - B. Provide high performance, reflectorized glass beads for improved retroreflectivity for roadway marking stripes conforming to NMDOT SSHBC, Section 704, Pavement Markings, Section 704.2.2.

PART 3 EXECUTION

- 3.1 PRE-JOB INSPECTION
 - A. Verify the compacted subgrade and base is ready to support paving and imposed loads.
 - B. Verify grades and elevations of base course are correct.

3.2 PREPARATION

- A. Remove loose and deleterious material from compacted base surface immediately. Surface and subgrade shall be free of frozen material and any material that contains ice crystals.
- B. When placing HMA on Base Course, Proof Roll the Base Course with a 27 ton roller or other approved Equipment and correct any soft areas, as directed by the LANL STR. Place the HMA on the approved surface, then spread, and strike off to the specified grade and elevation. Spread and compact the HMA in layers in accordance with the specifications.
- C. Do not place HMA on wet or frozen surfaces or if weather conditions prevent proper handling, finishing, and compacting. Place HMA when the Chill Factor is at least 40 °F and rising. If the air temperature is 60 °F or warmer, do not consider the Chill Factor.

- D. (Apply prime coat at the rate as recommended by the laboratory mix design and approved by the LANL Utilities & Institutional Facilities Roads System Engineer and LANL STR.)
- E. Apply a tack coat to existing asphalt or new Portland cement concrete surfaces to receive the HMA pavement. Apply tack coat to vertical surfaces of existing or new pavement and concrete surfaces abutting or projecting into new asphalt pavement and construction joints. Apply material at a uniform application rate of 0.10 to 0.15 gal/sy to give a 0.03 to 0.05 gal/sy of residual asphalt on surfaces receiving the tack coat.

3.3 PLACING ASPHALT PAVEMENT

- A. Place HMA pavement in accordance with NMDOT SSHBC section 423.3.
- B. Place the HMA by means of a paving machine on prepared surface, spread, and strike-off. Thickness of the pavement lifts shall be as recommended by the approved mix design, and as approved by the LANL Construction inspector and/or the LANL Utilities & Institutional Facilities Roads System Engineer. Place inaccessible and small areas by hand. Place each course to required grade, cross section, and compacted thickness, per the approved mix design and as shown on drawings.
- C. Target temperature: Do not allow the temperature of the HMA discharged from the plant mixer into the transport vehicle to be greater or less than the target mixing temperature of 310 degrees F as specified in the mix design by more than 10% F, not to exceed 350 degrees F.

The laydown temperature of the HMA, at the time of placement shall be 290 degrees + or -22 degrees F as specified in the approved mix design.

HMA delivered to the project site with mix and/or laydown temperatures outside the acceptable range are subject to rejection by the LANL Construction Inspector. The LANL STR and/or the LANL Utilities & Institutional Roads System Engineer shall be notified immediately of conditions where the HMA does not meet the required temperature range.

OGFC placement temperature shall not exceed the asphalt binder Supplier's recommendation or fall below 220 degrees F.

- D. Compact the HMA thoroughly and uniformly immediately after placement. Operate rollers at speeds slow enough to minimize displacement of the HMA, including the lines and grades of the asphalt edges. Remove marks from pneumatic rollers and immediately correct any displacement. Do not use equipment that crushes the aggregate excessively.
- E. At locations inaccessible to the rollers, compact the HMA with hot hand tampers, smoothing irons, or mechanical tampers. Remove areas that become loose, broken, mixed with dirt, segregated or defective, replace with fresh HMA, and compact to match the surrounding area.
- F. Target density for acceptance of HMA shall be 94.50% of theoretical maximum density as determined from AASHTO T 209. For determination of maximum
specific gravity, obtain and test a minimum of two (2) samples that the HMA is placed. Each individual density test value obtained must be from 93.00% to 95.99% of the theoretical maximum density.

- G. Monitor the compaction process by determining the density of the HMA with a portable nuclear density gauge. Establish calibration of the portable nuclear density gauge from cut pavement samples. Determine the density readings of the cut pavement samples in accordance with AASHTO T 166 (weight, volume method) and determine the density readings of the pavement with the portable nuclear density gauge. Perform density testing while the asphalt mixture is hot enough to permit further compaction. Do not roll for compaction when it becomes ineffective or damages the HMA. Do not use vibratory mode when the temperature of the mix is below 200 °F.
- H. Construction joints between old and new pavements, or between successive days' work shall have the same texture, density, and smoothness as other sections of the HMA course. Saw cut and clean the construction joint contact surfaces and apply tack coat. The location of cold joints in roadways shall be pre-determined by the sub-contractor and approved by the LANL STR and/or the LANL Utilities & Institutional Facilities Roads System Engineer.

3.4 PAVEMENT PENETRATIONS, MANHOLES, AND VALVE COVERS

A. Manhole frames and valve covers shall be adjusted as per the Drawings and approved by the LANL STR and/or the Utilities & Institutional Facilities Roads System Engineer. The finish surface at the top of all asphalt concrete pavement penetrations, to include but not be limited to manhole frames and valve covers, shall be constructed to and be parallel in all directions to the finished surface of the surrounding asphalt concrete pavement prior to placing the surface course.

3.5 TOLERANCES

A. Pavement smoothness for roadways shall conform to the tolerances required by NMDOT SSHBC, Section 401, "Pavement Smoothness Measurement", consisting of providing and using profile testing Equipment that incorporates the Mean Roughness Index (MRI).

Use an MRI threshold (inch/mi) of 105.00 and a segment length of 25.00 feet. Identify must grind locations for each lane using the "MRI" Ride Quality Index. Any locations with a MRI of 105.00 to 125.00 will be evaluated by the LANL Construction Inspector, the LANL STR, and the Sub-contractor, to determine if diamond grinding is required. Final determination will be made by the LANL Construction Inspector. All locations with an MRI above 125.00 must be included in a corrective action plan.

B. Pavement smoothness and joints for pedestrian pathways, bicycle paths, and parking Lots shall conform to the tolerances required by NMDOT SSHBC, Section 401, "Pavement Smoothness Measurement", by use of Straightedge Measurements.

Test the final surface of HMA with an approved ten (10) foot straightedge at both right angles and parallel to the centerline, advancing the straightedge in five (5) foot increments. In lieu of a physical ten (10) foot straightedge measurement and at the direction of the STR a profile measurement device that complies with

NMDOT SSHBC, Section 401.3.1.1 "Profile Measurement Device" can be used for the ten (10) foot straightedge measurement. Correct surface deviations greater than 1/8 inch within ten (10) ft., as directed by the LANL Construction Inspector.

- C. Asphalt pavement cuts and potholes shall be patched by hand placement or small asphalt paver suitable for width of the trench. Asphalt patch shall be the same depth as the adjacent pavement with the minimum depth being three inches. The finished surface of the patch shall match the contour and grade of the undisturbed adjacent pavement.
- D. After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances and/or retain water on the surface shall be removed and replaced by the Subcontractor at no additional cost to the project.

3.6 CLEANING AND PROTECTION

- A. Cleaning
 - 1. After completion of paving operations, clean surfaces of excess or spilled asphalt material to the satisfaction of LANL STR.
- B. Protection
 - 1. After final rolling, do not permit vehicular traffic on the HMA pavement until it has properly cooled and hardened.
 - 2. Provide barricades and warning devices as required to protect pavement, employees, and the general public. Temporary traffic control devices shall meet the requirements of the Manual on Uniform Traffic Control Devices, latest Edition.

3.7 PAVEMENT MARKINGS

- A. Sweep and clean surfaces using the means necessary to eliminate any loose material, dirt, grease, and debris.
- B. The Subcontractor shall perform a detailed layout by providing preliminary spotting of the permanent pavement lines and other markings as shown on the approved detail plan. Acceptance by LANL Traffic Engineer shall be obtained before permanent marking begins.
- C. All pavement markings shall be as shown on the Drawings.
- D. Apply three (3) coats of paint. The second and third application of paint shall be placed no sooner than 14 days after the first application unless otherwise approved by the LANL Utilities & Institutional Facilities Roads System Engineer.
- E. Apply paint with a spray-type self-propelled pavement marking machine suitable for applying traffic paint to produce uniform straight edges without running or splattering.

- F. Provide necessary measures to divert traffic from the paint installation area during the application and drying time of the permanent traffic control markings and stripes.
- G. Paint for word markings, letters, numerals, and symbols shall be applied using suitable spray equipment together with stencils and templates that dimensionally conform to existing LANL stencils and templates.
- H. Paint shall be applied within the temperature range specified by the manufacturer.
- I. When existing permanent or temporary detour striping or markings are no longer required they shall be removed by wet blasting.

3.8 FIELD QUALITY CONTROL

- A. Testing
 - 1. Section 1 Miscellaneous Asphalt Paving:

Prior to final acceptance of the HMA, an evaluation of the in place material, and the completed work shall be done by the LANL Construction Inspector and Utilities & Institutional Facilities Roads System Engineer to determine the need for testing of minor and/or miscellaneous paving. Contact the LANL STR immediately if testing will be required.

If required by the LANL Construction Inspector and/or the Utilities & Institutional Facilities Roads System Engineer, the following minimum tests shall be part of final acceptance:

- Density (Nuclear): As needed to control operations per AASHTO T 310.
- Smoothness: See part 3.5 Tolerances.
- Thickness, Mat Density, Cores AASHTO T 166, 209 Determine thickness by coring the in place compacted Material and measuring the thickness to the nearest 1/4 inch using a measuring tape.
- 2. Section 2 Major Asphalt Paving:

Testing of aggregates for HMA shall be as follows (see section 901, Table 901.7.3) of the NMDOT SSHBC for list of all-inclusive testing and required frequency):

- Gradation AASHTO T 11, 27, 146
- Fractured Faces NMDOT Method FF1
- Sand equivalent AASHTO T 176
- Plasticity Index AASHTO T 89, 90
- Moisture Content AASHTO T 255
- Los Angles Wear AASHTO T 96, 104
- Soundness Loss AASHTO T 85

Testing of HMA as specified in the NMDOT SSHBC (see section 901, Table 901.7.4) of the NMDOT SSHBC for list of all-inclusive testing and required frequency):

- Asphalt Content AASHTO T 308
- Gradation AASHTO T 30, 164, 308
- Air Voids AASHTO T 166, 209, 269
- Voids in Mineral Aggregate (VMA) AASHTO R 35
- Voids Filled with Asphalt (VFA) AASHTO R 35
- Dust to Binder Ratio AASHTO R 35
- Gyratory Tests AASHTO T 312
- Thickness, Mat Density, Cores AASHTO T 166, 209 Determine thickness by coring the in place compacted Material and measuring the thickness to the nearest 1/4 inch using a measuring tape.
- Density (Nuclear): As needed to control operations per AASHTO T 310.
- Temperature: See Part 3.3.C (PLACING ASPHALT PAVEMENT Target temperature)
- 3. Provide an AMRL accredited independent testing agency to perform field testing of installed products to include compaction, smoothness, thickness, and test samples that shall verify quality control requirements. Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. A copy of the certifications shall be submitted to the LANL STR and/or the LANL the Utilities and Institutional Facilities Roads System Engineer upon request.
- 4. Provide unobstructed access to all work areas and cooperate with the appointed testing agencies laboratory technician.
- 5. Submit test results within 3 working days of test to LANL STR and/or the LANL Utilities & Institutional Facilities Roads System Engineer.
- 6. Testing Frequency for HMA:
 - a. Section 1 Miscellaneous Asphalt Paving:

Perform testing as required below for Major Paving, or as specified by the LANL Construction Inspector.

b. Section 2 Major Asphalt Paving:

Thickness: Take measurements at a randomly selected locations, or as directed by the LANL Construction Inspector.

Mat Density Cores: Density calculation will use the daily average of specific gravity as validated by F-test and T-test in the daily calculation.

Field Density: Baseline testing shall be one test per 100 linear foot. If after the first 500 feet of testing, consistent passing results are documented, the LANL Construction Inspector may increase the frequency of tests to every 500 linear feet.

Anytime during the testing process consistent failures are encountered, the LANL Construction Inspector shall re-evaluate the testing frequency. Contact the LANL STR and/or the Utilities & Institutional Facilities Roads System Engineer immediately of any changes in testing frequency.

HMA Materials: Minimum one (1) test per 500 tons.

Minimum of one (1) test per day and three (3) tests per sublot except for maximum specific gravity. Obtain a minimum of two (2) tests per day for maximum specific gravity. If sublot size is reduced to 1500 tons or less, perform testing at a rate of one (1) test per 500 tons with a minimum of one (1) per day.

c. Subcontractor Quality Control for Compaction; subcontractor shall monitor the compaction process by determining the density of the hot-mix asphalt with a portable nuclear densometer in accordance with ASTM D 2950. Density testing will be conducted as needed to control operations. The Independent Testing Laboratory shall provide certification that the portable nuclear densometer has been calibrated and readings are accurate.

B. Final Acceptance

1. Section 1 Miscellaneous Asphalt Paving:

Final acceptance of minor and/or miscellaneous paving shall be provided by the LANL Construction Inspector and/or the Utilities & Institutional Facilities Roads System Engineer. Final acceptance shall be based on visual examination, verification of line and grade, and testing if determined necessary per section 3.8.A.1 of the specification.

Visual inspection, a pass or fail of the HMA shall be documented by the LANL Construction Inspector. Contact the LANL STR immediately of any failed HMA.

Section 2 Major Asphalt Paving:

The subcontractor shall perform Quality Control sampling, testing, and inspection in accordance with NMDOT SSHBC Section 901, Table 901.7:3, "Minimum Process Control Guidelines for Aggregates and Base Course," Table 901.7:4, "Minimum Process Control Guidelines for Hot Mix Asphalt," and Table 901.7:5, "Minimum Process Control Guidelines for Portland Cement Concrete Pavement."

2. Acceptance of major paving shall be based on compliance with all applicable sections of the project specification.

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 32 1216 Rev. 5, dated August 19, 2016.

SECTION 32 9219

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation of seedbed.
- B. Seeding.
- C. Mulching and erosion control blankets.
- D. Watering and maintenance.

1.2 RELATED SECTIONS

- A. Section 01 5705, Temporary Controls and Compliance Requirements
- B. Section 31 2000, Earth Moving

1.3 SUBMITTALS

- A. Submit the following in accordance with project submittal procedures:
 - 1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer and erosion control blankets.
 - 2. Certification substantiating that material complies with specified requirements. Submit certified seed bag tags and copies of seed invoices identified by project name.
 - 3. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with LANL approval after documentation of delays.

1.4 QUALITY ASSURANCE

- A. Subcontractor Qualifications:
 - 1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.
- B. Material Quality Control:
 - 1. Provide seed mixture in containers sealed and labeled by seed dealer. Container label shall show origin of seed and pure live seed (PLS) content, species and percentages in seed mix; lot number; test information including,

purity, germination, percentage seed crop, percentage inert, percentage noxious/restricted weeds; net weight; test date; date of packaging; and location of packaging. The seed dealer may premix the seed, documentation shall be provided the same as if the seeds were sold or bagged separately. Seed analysis shall be no older than five months for seed shipped interstate, and no older than nine months for seed shipped intrastate.

- 2. Furnish seed labeled in accordance with the requirements of federal seed laws and New Mexico Department of Agriculture seed labeling laws. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the United States Department of Agriculture; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.
- 3. In addition, ensure seed mix and its application comply with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged materials in original sealed and labeled containers from seed dealer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.
- B. Temperature of the seed in storage shall not exceed the supplier's recommended maximum temperature.
- PART 2 PRODUCTS
- 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS
 - A. Comply with Section 01 2500, Substitution Procedures.
- 2.2 SEED
 - A. Obtain native grass seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.
 - B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.
 - C. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix or for final stabilization.

- E. Develop seed mixture from the following guidelines. Choose a minimum of 5 grass species from the list. Should wildflowers be included in the mix, use a ratio of 80 90 percent grasses and 10- 20 percent wildflowers. Choose 3 –5 species from the forb and wildflowers list. These species are applicable for both undeveloped and urban-interface areas. All seeding operations must include fertilizer. The seed dealer may premix the seed.
 - 1. Pre-mixed Sources:
 - a. Plants of the Southwest, "Dryland Blend"
 - b. Curtis & Curtis Inc, "Homesteaders Choice Mix" or "Santa Fe Trail Mix"

Common Name	Scientific Name	% of Mix
Grasses		
Blue grama*	Bouteloua gracilis	5 – 10%
Galleta grass*	Hilaria jamesii	5- 10%
Mutton grass	Poa fendleriana	10-15%
Sideoats grama*	Bouteloua curtipendula	10-15%
Arizona fescue†	Festuca arizonica	10 – 15%
Prairie junegrass [†]	Koeleria macrantha	5 – 10%
Bottlebrush squirreltail*	Elymus elymoides	15 – 20%
Little bluestem [†]	Schizachyrium scoparium	10 – 15%
Indian ricegrass*	Oryzopsis hymenoides	10 – 15%
Mountain brome [†]	Bormus marginatus	10 – 15%
Sand dropseed*	Sporobolus cryptandrus	1 - 8%
Thickspike wheatgrass	Agropyron dasystachyum	20 – 25%
Needle and Thread grass*	Stipa comata	5 – 10%
New Mexico needlegrass*	Stipa neomexicana	10 - 15%
Sheep fescue	Festuca ovina	10 – 15%
Smooth Brome	Bromus inermis	15 – 20%
Stream Bank Wheatgrass	Elymus lanceolatus ssp. psammophilus	20 – 25%
Forbs/ Wildflowers		
Firewheel	Gaillardia pulchella	2%
Evening primrose	Oenothera caespitosa	1%
Gooseberry leaf globemallow	Sphaeralcea grossulariafolia	1.5%
Scarlet gilia	lpomopsis aggregata	1%
Plains aster	Aster biglovii	1%
Western yarrow	Achillea millifolium	1⁄2%
Fringed sage	Artemisia frigida	1%
Blue flax	Linum perenne lewisii	4%

NATIVE PERENNIAL MIX

Common Name	Scientific Name	% of Mix
Scarlet bulgler	Penstemon barbatus	2%
Palmer penstemon	Penstemon palmerii	2%
Prairie coneflower	Ratibida columnifera	1%
Showy golden-eye	Heliomerus multiflora	1%
Purple geranium	Geranium caespitosum	5%

*Species particularly suited for especially dry sites

[†]Species particularly suited for higher elevations (above 7000 ft.)

2.3 STRAW MULCH

A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65 percent of the herbage by weight of each bale of straw shall be 10 inches in length or longer. Rotted, brittle or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation.

2.4 FLEXIBLE GROWTH AND FLEXIBLE CONTROL MEDIUMS

- A. Provide Flexible Growth Medium (FGM) such as Flexterra[™]/CocoFlex ET[™] or a Flexible Control Medium (FCM) such as EcoFlex[™] composed of longstrand, thermally processed wood fibers, crimped, interlocking fibers and performance enhancing additives. The FGM or FCM requires no curing period and upon application forms an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.
- B. The FGM or FCM[™] shall be hydraulically applied to the soil as a viscous mixture, creating a continuous three-dimensional blanket that adheres to the soil surface. Upon drying, the matrix shall form a high-strength, porous and erosion-resistant mat that shall not inhibit the germination and growth of plants in and beneath the layer. The matrix shall retain its form despite re-wetting. The FCM[™] shall be 100% biodegradable over time, non-toxic to fish and wildlife, and it shall not contain any non-photo-degradable synthetic fibers.

2.7 ROLLED EROSION CONTROL PRODUCTS

- A. For all non-channel applications provide the following:
 - 1. Slopes less than 2:1:
- B. For all channel applications provide the following:
 - 1. For channels subject to flow producing an unvegetated shear stress of 3 lbs/ft² or less and a vegetated shear stress of 8 lbs/ft² or less:

Permanent	A machine-produced composite turf reinforcement
Fernanent	A machine-produced composite turi reimorcement
composite turf	mat comprised of a 100% UV stabilized
reinforcement mat	polypropylene fiber matrix incorporated into a
(C-TRM)	permanent three-dimensional turf reinforcement
	matting. The matting shall be of consistent
	thickness with synthetic fibers evenly distributed
	over the entire area of the mat. The matting shall be
	covered on the top with black heavyweight UV
	stabilized polypropylene netting having ultraviolet
	additives to prevent breakdown and an approximate
	0.50 x 0.50 inch (1.27 x 1.27 cm) mesh size
	The bottom net shall also be UV stabilized
	polypropylene, with a 0.625 x 0.625 inch (1.57 x
	1.57 cm) mesh size. The matting shall be sewn
	together on 1.50 inch (3.81 cm) centers with UV
	stabilized polypropylene thread. to form a
	permanent three-dimensional turf reinforcement
	matting, such as North American Green P300.

2. For channels subject to flow producing an unvegetated shear stress of 4 lbs/ft² or greater and a vegetated shear stress of 12 lbs/ft² or less:

Permanent	A machine-produced composite turf reinforcement
reinforcement mat	100% polypropylene fiber matrix incorporated into
(C-TRM)	permanent three-dimensional turf reinforcement
	matting. The matrix shall be evenly distributed
	across the entire width of the matting and stitch
	bonded between a super heavy duty UV stabilized
	pottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm)
	dramatically corrugated (crimped) intermediate
	netting with 0.50 x 0.50 inch $(1.27 \times 1.27 \text{ cm})$
	openings, and covered by a super heavy duty UV
	stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27
	cm) openings. The corrugated netting shall form
	prominent closely spaced ridges across the entire
	width of the mat. The three nettings shall be
	stitched together on 1.50 inch (3.81 cm) centers
	permanent three dimensional turf reinforcement
	matting such as North American Green C350 or
	P550.

C. Staples: U-shaped, 11 gauge or heavier steel wire, minimum leg length of 6 inches after bending, with a throat approximately 2 inches wide.

2.8 AMENDMENTS / SOIL ADDITIONS

 A. Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Gro-Power, Osmocote, or approved equal to minimize deficiencies of the topsoil. Micronizing fertilizer is acceptable for use in the spring and summer months. All seeding operations must include fertilizer.

- B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.
- C. Sand: Clean, washed, and free of toxic materials.

PART 3 EXECUTION

3.1 PREPARATION

- A. Preparation of the Seedbed:
 - 1. Prepare seedbed to a maximum depth of 4 inches by tilling with a disc, harrow or chiseling tool. Uproot all competitive vegetation during seedbed preparation and work soil uniformly, leaving surface rough to reduce surface erosion and to retain water runoff. Remove large clods and stones, or other foreign material that would interfere with seeding equipment and erosion control blankets.
 - 2. Perform tillage across slope and along the contour adequately break up soil. Do not till up and down slopes, as this will create excessive surface erosion problems.
 - 3. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition.
 - 4. To minimize dust problems for adjoining areas, when wind speeds are over 10 mph, dust control measures shall be implemented.
 - 5. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a one week period.
- B. Soil Amendments/Additions: Uniformly apply slow release organic fertilizer to prepared seedbed in accordance with manufacturer recommended rates.
- C. Prepare seedbed again if prior to seeding rain or some other factor has affected the prepared surfaces and will prevent seeding to the proper depth.
- D. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.2 APPLICATION OF SEED

- A. General:
 - 1. Avoid seeding between October 1 and April 15. Provide for temporary soil stabilization measures between these dates. Do not seed during windy weather, or when topsoil is dry, saturated or frozen.
 - 2. Equip seed boxes used for drill and broadcast seeding with an agitator.
 - 3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.

- 4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.
- 5. Seeding equipment shall be calibrated as appropriate to distribute seed at the specified rates.
- 6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.
- 7. Use markers to ensure that no gaps will exist between passes of seeding equipment.
- 8. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.
- B. Drill Seeding:

When drill seeding, plant seed mix at a rate of 30 - 35 PLS lbs/acre. Uniformly apply prescribed mix over area to be seeded as follows:

- 1. Accomplish seeding operations, where practical, by drilling in a direction across slope and along the contour.
- 2. Plant seeds approximately 1/4 inch deep.
- 3. Do not exceed 4 inches distance between drilled furrows. If furrow openers on drill exceed 4 inches, drill area twice to obtain a 4-inch distance between furrows.
- 4. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.
- 5. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
- 6. Prohibit vehicles from traveling over the seeded areas.
- C. Broadcast Seeding:

When broadcast seeding, plant seed mix at a rate of 32 - 37 PLS lbs/acre.

- 1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.
- 2. Immediately following seeding operation, thoroughly rake seedbed to provide approximately 1/4 inch of soil cover over of the seed.
- 3. If hydraulically applying mulch as part of the broadcast seeding process, use a 2-step process. Apply seed with a tracer. Once seed is applied,

apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.

- 4. Prohibit vehicles from traveling over the seeded areas.
- 3.3 STRAW MULCH: Slopes Flatter than 3:1, Non-Irrigated Projects
 - A. Apply straw mulch at a minimum rate of 1.5 tons per acre of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80 percent ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 inches. Do not mulch when wind velocity exceeds 10 mph.
 - B. Straw mulch shall only be used where use of crimping equipment is practical. Place mulch in manner noted above and anchor the straw into the soil to a minimum depth of 2 inches and not to exceed 3 inches. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges, and spaced no more than 9 inches apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in 2 (opposite) directions. Do not use Sheep's Foot Rollers, heavy equipment tracks, and standard disc cultivators for crimping.
 - C. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lb. of wood fiber with a minimum 150 lbs. to 200 lbs of tackifier to anchor straw mulch. Apply mixture at a rate of 250 300 lbs/acre.
 - D. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material.
 - E. Application:

Use a fan-type nozzle (50-degree tip) whenever possible for best soil surface coverage. Apply FGM from opposing directions to soil surface, reducing the "shadow effect" and assuring a minimum of 95% of soil surface coverage. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 100 feet (30 m). Install materials at the following minimum application rates:

CONDITION ENGLISH SI

≤ 3H to 1V	3000 lb/ac	3400 kg/ha
>3H to 1V and \leq 2H to	1V 3500 lb/ac	3900 kg/ha
>2H to 1V and \leq 1H to	1V 4000 lb/ac	4500 kg/ha
>1H to 1V	4500 lb/ac	5100 kg/ha
Below ECB or TRM	1500 lb/ac	1700 kg/ha
As infill for TRM	3500 lb/ac	3900 kg/ha

3.4 MATERIAL SHOULD NOT BE APPLIED IN CHANNELS, SWALES OR OTHER AREAS WHERE CONCENTRATED FLOWS ARE ANTICIPATED, UNLESS INSTALLED IN

CONJUNCTION WITH A TEMPORARY EROSION CONTROL BLANKET OR NON-DEGRADABLE TURF REINFORCEMENT MAT. AFTER APPLICATION, THOROUGHLY FLUSH THE TANK, PUMPS AND HOSES TO REMOVE ALL FGM MATERIAL. WASH ALL MATERIAL FROM THE EXTERIOR OF THE MACHINE AND REMOVE ANY SLURRY SPILLS. FGM WILL BE MORE DIFFICULT TO REMOVE ONCE IT DRIES.WATERING

- A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free of oil, acid, salt or other substances harmful to plants) to previously seeded and mulched areas.
- B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.
- C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.

3.5 MAINTENANCE

- A. Begin maintenance immediately after planting. Keep re-vegetated areas free of noxious weeds.
- B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.11 ACCEPTANCE.
- C. Reseed void areas greater than 6 square feet or repetitive voids greater than 2 square feet amounting to more than 10 percent of any area that appears the growing season following installation.

3.6 CLEANUP AND PROTECTION

- A. After completion of work, clear site of excess soil, waste material, debris and objects that may hinder maintenance and detract from neat appearance of site.
- B. Protect seeded areas, work and materials from damage due to vehicles, pedestrians, and operations by other subcontractors. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.
- C. Upon completion of all seeding operations, clean the portion of the project site used for storing materials and equipment of all debris. Remove all superfluous materials and equipment from the project site. Sweep walks and pavement clean upon completion of work in this section.

3.7 ACCEPTANCE

A. Seeded areas will be reviewed for acceptance by LANL when final stabilization has been achieved. Final stabilization is defined as "All soil disturbing activities at

the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed." Stabilization shall be in conformance with the Storm Water Pollution Prevention Plan (SWPPP), as applicable.

B. In the event that all other work required by the Subcontract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 32 9219 Rev. 3, dated December 23, 2009.

SECTION 32 9223

SODDING

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Preparation of subsoil
 - B. Soil amendments
 - C. Fertilizing
 - D. Sod installation
 - E. Maintenance

1.2 SUBMITTALS

- A. Submit the following in accordance per Project submittal procedures:
 - 1. Sod certification for grass species and name and location of sod source.
 - 2. Sodding schedule, including dates and type of work to be performed. Once accepted, revise schedule only as approved in writing, after documentation of delays.
 - 3. Sample of materials for approval prior to ordering and name of supplier of soil amendments materials.

1.3 QUALITY ASSURANCE

- A. Sod: Minimum age 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- B. Sod Producer: Company specializing in sod production and harvesting with minimum 5 years experience, and certified by the State of New Mexico.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Time delivery so that sod will be placed within 48 hours after stripping. Protect against drying and breaking of rolled strips.
- B. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.

1.5 SITE CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become

available, working within seasonal limitations for each kind of landscape work required.

- B. Hand excavate, as required. Maintain grade stakes set by LANL until removal is mutually agreed upon with LANL Subcontract Technical Representative (STR).
- C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions consult LANL STR before planting.
- D. Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of final acceptance.

PART 2 PRODUCTS

2.1 SOIL AMENDMENTS

- A. Provide minimum 2-year-old decomposed sawdust containing no debris or other deleterious materials, maximum size of 1/4 inch in any one dimension.
- B. Spread starter fertilizer at a rate of 4 lbs per 1,000 square feet, prior to placing sod.
- C. Provide clean sand, topsoil, or mixture installed on prepared subgrade as a bed and top dressing for solid grass sod. Thickness and soil amendments to be incorporated as shown on the Drawings.

2.2 GRASS MATERIALS

- A. Provide strongly rooted sod, not less than 18 months old and free of weeds and undesirable native grasses and machine cut to pad thickness of 3/4 inch (plus or minus 1/4 inch), excluding top growth and thatch. Provide sod capable of growth and development when planted. Cut sod pieces a minimum of 18 inches wide.
- B. Provide sod primarily composed of tall fescue varieties. Do not use bluegrass. Tall fescue sod blend shall be as follows:

1/3 Monarch Tall Fescue 1/3 Olympic Tall Fescue 1/3 Apache Tall Fescue

PART 3 EXECUTION

- 3.1 PREPARATION
 - A. Preparation for Sodding
 - Where sod is to be planted in area that has not been altered or disturbed by excavating, grading or stripping, prepare area as follows: Strip existing grass, vegetation and turf. Dispose of such material in area(s) designated by LANL STR. Do not turn over into soil being prepared for sod. Till area to be sodded to 4 inch depth.

- 2. Bring excavated or embankment areas to be sodded to an even grade, and shaped to provide drainage. Compact evenly to prevent uneven settlement after installation and watering.
- 3. Clean areas to be sodded of roots, plants, clods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- 4. Spread pre-mixed soil material to an even 2 inch minimum depth over subgrade. Rototill pre-mixed soil into the top 4 inches of subgrade, thoroughly mixing in cross directions. Drag to even grade, then roll for firmness with a minimum 300-pound roller.
- 5. Rake tilled area and remove stones over 1 inch in any dimension, sticks, roots, rubbish and other extraneous matter.
- 6. Limit preparation to area which will be planted within 48 hours after preparation.
- 7. Restore grading to specified condition if eroded or otherwise disturbed after fine grading and prior to sodding.
- B. Delay application of fertilizer, if sod planting will not follow within 24 hours.

3.2 SODDING OPERATIONS

- A. Lay sod within 48 hours from time of stripping. Do not plant dormant sod or on frozen ground.
- B. If soil is dry, moisten areas before sodding. Water thoroughly and allow surface moisture to dry. Do not create a muddy soil condition.
- C. Lay sod to form a solid mass with tightly fitted joints. Lay sod over moistened soil, lightly raking the soil ahead of each sod strip. Butt ends and sides of sod strips; do not overlap. Stagger strips to off-set joints in adjacent courses. Lay sod parallel to contours of slope. Work from boards to avoid damage to subsoil or sod. Tamp firmly and evenly by hand to ensure contact with subsoil. Work sifted topsoil or sand into minor cracks between pieces of sod; remove excess to avoid smothering grass. Roll entire area with weighted hand roller.
- D. Water sod thoroughly with a fine spray immediately after planting.
- E. Refer to Drawings for anchorage details when sod is laid on a slope.

3.3 MAINTENANCE

- A. Begin maintenance immediately after planting.
- B. Maintain lawns for not less than the period stated below, and longer as required to establish an acceptable lawn.
 - 1. Sodded lawns to be maintained not less than 30 days after final acceptance, or through the September 15 growing season, whichever is longer.

2. Maintain lawns by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas. Irrigate sodded areas by means of the automatic underground irrigation system as often as necessary to promote healthy grass growth until a thick, even stand of grass has been obtained. Mow the lawn when the grass is over 2-1/2 inches high for first cutting.

3.4 CLEANUP AND PROTECTION

- A. During the work, keep pavements clean and work area in an orderly condition.
- B. Protect work and materials from damage due to sodding operations, operations by other subcontractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.

3.5 INSPECTION AND ACCEPTANCE

A. When inspected work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by LANL and found to be acceptable. Remove rejected sod and materials promptly from project site.

END OF SECTION

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 32 9223 Rev. 3, dated September 28, 2009.

SECTION 33 1000

WATER UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site water distribution piping system (potable and fire water) beyond the building wall.

1.2 RELATED SECTIONS

- A. Section 33 1001 Fusible Polyvinylchloride Pipe (PVC) Pipe And Installation For Pressure Systems With Horizontal Directional Drill (HDD) Instructions
- B. Section 01 4455 Onsite Welding & Joining Requirements
- C. Section 33 1300 Disinfecting of Water Utility Distribution

1.3 LANL PERFORMED WORK

A. LANL Utilities and Institutional Facilities (U&I) will perform final tie-in into existing water piping systems using Subcontractor-supplied material.

1.4 LANL FURNISHED AND INSTALLED EQUIPMENT

A. LANL will furnish and install post indicator valve padlocks.

1.5 ACTION SUBMITTALS

- A. Submit the following:
 - 1. Catalog data on pipe materials, pipe fittings, valves, and accessories and directional drilling pull (weak link) device and casing seals.
 - 2. Installation instructions for valves and accessories.
 - 3. Existing system pressure calculations to support new water pipe design and selection.
 - 4. Certification of welders and qualified welding procedure.
 - 5. Submittals for the Horizontal Direction Drilling.
 - 6. Tracing wire continuity test report.
 - 7. Catalog data on identification tape and tracing wire.

1.6 QUALITY ASSURANCE

- A. Welders Certifications, Qualified Procedure Standards, and Weld Inspection/Testing.
 - 1. Plastic Pipe: Comply with LANL ESM, Chapter 13 Welding, Joining & NDE.

- a. On-site and joining welding shall comply with LANL ESM, Chapter 13 Welding, Joining & NDE; and Master Specification 01 4455, Onsite Welding & Joining Requirements.
 - 1. Use LANL Welding Procedures.
 - 2. Welders shall be qualified at LANL by LANL.
- b. Off-site welding and joining shall comply with ESM, Chapter 13 Welding, Joining & NDE; and Master Specification 01 4444, *Offsite Welding & Joining Requirements.*
- 2. Weld Inspection: Comply with ESM, Chapter 13 Welding, Joining & NDE for PE pipe.
- 3. Electro-fusion of Poly-Vinyl Chloride pipe shall be completed in accordance with section 33 1001 of these project specifications. Provisions of Specification 01 4455 Onsite Welding & Joining Requirements shall apply.
- B. LANL Subcontract Technical Representative (STR) shall submit the approved material and accessory catalog data, and certification of welders and qualified welding procedure to the LANL U&I water system engineer and the LANL construction inspector for verification of construction items and certifications during field quality assurance.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures*.
- 2.2 WATER BEYOND BUILDING WALL
 - A. Ductile Iron Pipe: AWWA C151.
 - 1. Joints: Bell and spigot, AWWA C111 rubber gaskets.
 - 2. Fittings: AWWA C110, Ductile-Iron or Gray-Iron, Class 350 or AWWA C153, Ductile-Iron Compact Fittings, Class 350.
 - 3. Pipe and Fittings: Cement mortar lined with bituminous outside coating.
 - B. Copper Tubing: ASTM B88, Type K, hard drawn or annealed.
 - 1. Joints: AWS A5.8, BCuP silver braze.
 - 2. Fittings: ANSI/ASME B16.22, wrought copper and copper alloy solder-joint.
 - C. PVC Pipe: AWWA C900, DR18, pressure class 235.
 - 1. Joints:
 - a. Bell and spigot joint ASTM D3139 rubber gaskets ASTM F477.

- b. Fused Joint
- 2. Fittings: AWWA C110, Ductile-Iron or Gray-Iron, Class 350 or AWWA C153, Ductile-Iron Compact Fittings, Class 350.
- D. Polyethylene Pipe and Fittings: AWWA C901 and ASTM D 3035 (3 inch or less) and AWWA C906 and ASTM F714 (4 inch to 63 inch), Class 150, pressure rating 150
 - 1. Manufacturer: Performance Pipe DriscoPlex 4000 FM, Ductile Iron Pipe Size.
 - 2. Pipe: Polyethylene, high density, AWWA (C901), (C906), PPI-PE 4710, ASTM D3350 cell classification number PE 445574C. Certifications by Factory Mutual Approvals Standard (FMA) Class Number 1613 and National Sanitation Foundation (NSF).
 - 3. Fittings: Polyethylene, high density, AWWA (C901), (C906), ASTM D3261, PPI-PE 4710, ASTM D3350 cell classification number PE 445574C. Certifications by Factory Mutual Approvals (FMA) and National Sanitation Foundation (NSF) NSF/ANSI 61. The pipe manufacturer shall supply fittings and adapters.
 - 4. Joints: Heat fusion per ASTM D2657 and manufacturer's written instruction.

2.3 FLANGES, UNIONS, AND COUPLINGS

- A. Copper Tubing:
 - 1. Class 150 bronze unions with soldered joints.
- B. Mechanical or Push-On Type Pipe, and Fittings Below Grade.
 - 1. UL listed or FM approved.
 - 2. Ductile Iron Pipe: Megalug Series 1100, malleable/ductile iron joint retainer/restraint gland with polymer, epoxy or bituminous outside coating and 1/2 inch minimum diameter asphalt coated tie rods.
 - 3. PVC Pipe: for ductile iron joint use a compression connection and restraint system or retainer/restraint gland, Mueller AquaGrip System, Megalug Series 2000PV.
 - 4. HDPE Pipe: for ductile iron joint use restraint devices designed to resist pull out forces. Internal pipe wall stiffeners must be used when restraining HDPE. Megalug Series 2000PV.
- C. High Density Polyethylene
 - 1. Flanges: Flanged joints shall be standard manufacturers flange adaptor that is butt fused to the pipe. Backup ring shall be ductile iron. Flange gaskets shall be installed.

2. Transitions: MJ Adaptors shall be standard manufacturers adaptor that is butt fused to the pipe for connecting to mechanical joint pipe, fittings, and appurtenances. Manufacturers' complete assembly shall be supplied; including stainless steel stiffener, extended gland bolts and nuts, gland and gasket.

2.4 VALVES, ABOVE GRADE

- A. Ball Valves up to 2 inches:
 - 1. Manufacturer: Nibco, Series 585-70.
 - 2. MSS SP-110, 600 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blowout proof stem, lever handle, solder or threaded ends.
- B. Butterfly Valves over 2 inches:
 - 1. Manufacturer: Nibco, Series LD 2000.
 - 2. MSS SP-67, 200 psi CWP, ductile iron body, aluminum bronze disc, resilient replaceable EPDM seat, lug style, extended neck, lever handle, for use between ANSI Class 125/150 flanges.
- C. Globe Valves up to 2 inches:
 - 1. Manufacturer: Nibco, Series 211.
 - 2. MSS SP-80, Class 125 bronze body, bronze trim, hand wheel, bronze disc, solder or threaded ends.
- D. Gate Valves up to 2 inches:
 - 1. Manufacturer: Nibco, Series 111.
 - 2. MSS SP-80, Class 125 bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge disc, solders or threaded ends.

2.5 VALVES, BELOW GRADE

- A. Gate Valves less than 2 inches:
 - 1. Manufacturer: Nibco, Series T-176-A.
 - 2. MSS SP-80, Class 300 bronze body, bronze trim, non-rising stem, hand wheel, inside screw, solid wedge disc, threaded ends.
- B. Gate Valves 2 inches and over:
 - 1. Manufacturer: Mueller, No. A-2360-8, 2 through 3 inch threaded, 2 inch square wrench nut or No. A-2361-20 with accessories, use No. A-2361-23 when using retainer/restraint gland, or A-2361-77 AquaGrip System for PVC pipe, 4 inch and larger, 2 inch square wrench nut.
 - 2. AWWA C509 for 2 and 3 inch, AWWA C515 for 4 through 12 inch, 250 psig and 350 psig pressure, UL listed or FM approved, non-rising stem, open left, threaded inlet and threaded outlet or mechanical joint inlet and outlet with

mechanical joint with accessories unassembled, less accessories, or with appropriate transition gasket.

- C. Tapping Valves 2 inches and over:
 - 1. Manufacturer: Mueller, No. T-2360-16 with accessories, use No. T-2360-19 when using retainer/restraint gland, 2 through 3 inch, 2 inch square wrench nut or Mueller, No. T-2361-16 with accessories, use No. T-2361-19 when using retainer/restraint gland, 4 inch and larger. No substitution.
 - 2. AWWA C509 for 2 and 3 inch, AWWA C515 for 4 through 12 inch, 250 psig and 350 psig pressure, UL listed or FM approved, resilient wedge, non-rising stem, open left, ANSI Class 125/150 inlet flange, mechanical joint outlet with mechanical joint with accessories or less accessories, 2 inch square wrench nut.

2.6 WATER PRESSURE REDUCING VALVES (PRV)

- A. Manufacturer: CLA-VAL, No. 90-01, No Substitution.
- B. Single seated, hydraulically operated, pilot controlled, diaphragm type valve, 175 psi pressure rating, 180 degree F maximum water temperature and 15 to 75 psi adjustment range. Pilot control; direct acting, adjustable, spring loaded, and normally open. Valve construction; globe, ductile iron main valve body and cover, bronze main valve trim, and cast bronze pilot control with stainless steel trim. Repairs must be done without removing valve from line.
- C. Capacity/Size:
 - 1. Main PRV:
 - a. Flow: minimum 35 gpm; maximum 4900 gpm
 - b. Size: 10 inches with ANSI Class 150 flanged ends.
 - 2. Low Flow PRV:
 - a. Flow: minimum 4 gpm; maximum 800 gpm
 - b. Size: 4 inches with ANSI Class 150 flanged ends.

2.7 FIRE HYDRANTS

- A. Manufacturer: Mueller, Super Centurion 250, Style A423. No Substitution.
- B. UL listed or FM approved, dry barrel, 5 1/4 inch main valve opening, 3-way with 4 1/2 inch pumper nozzle and two 2 1/2 inch hose nozzles, ground level break flange, and mechanical joint inlet connection or Mueller AquaGrip System. Hydrant factory painted yellow.

2.8 PRESSURE GAUGE

- A. Manufacturer: Reotemp Instruments.
- B. ANSI B40.1, Grade A, 1 percent full scale accuracy, minimum 2 1/2 inch dial, phenolic or steel case, phosphor bronze bourdon tube and 1/4 inch NPT brass bottom connection. Furnish with brass ball valve.
 - 1. Range: 200 psi

2.9 SERVICE SADDLE

- A. Manufacturer: Mueller, DR1A & S Series and DR2A & S Series for A-C and plastic.
- B. Ductile iron, stainless steel strap, iron pipe outlet thread, and o-ring gasket.
- C. Strap shape to be per manufacture recommendation for the existing pipe material.

2.10 TAPPING SLEEVE

- A. Manufacturer: Romac Industries, No. FTS 419, No Substitution.
- B. Fabricated steel, ANSI Class 150 outlet flange, suitable for PVC, steel, ductile iron, and cast iron pipe, outlet flange size and sleeve O.D. to suit piping system, 4 inch and larger.

2.11 COUPLING

- A. Manufacturer: Tyler Union, American Cast Iron Pipe Company, Star Pipe Products, solid sleeves, long style, MJ x MJ with appropriate sized gasket material. AWWA C153, Ductile-Iron Compact Fittings, Class 350.
- B. Steel, size suitable for pipeline material and diameter.

2.12 VALVE BOX

- A. Manufacturer: Tyler, Series 6860.
- B. Cast iron, 5 1/4 inch shaft, screw type, lid marked "water".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not install underground piping when bedding is wet or frozen.
- B. Verify that excavations are to required grade.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside of piping before assembly.

C. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction, or at the end of each workday, protect open ends with temporary plugs or caps.

3.3 PIPING TIE-IN

- A. Tie-in to existing piping systems will be performed by LANL U&I group. Excavation, backfill, and materials required for tie-in shall be provided by Subcontractor. The tie-in will be inspected by the LANL STR and the LANL U&I Group water system representative.
- B. New tie-ins shall be a minimum size of 2 inches when tying into existing piping systems that are 4 inches and larger. If required, a pipe size reduction shall be made after the valve.
- C. New tie-ins to existing piping systems 4 inches and larger shall be made by using a tee cut into the existing pipe and a valve on the new service line. If the existing line cannot be removed from service a tapping tee and tapping valve can be used.
- D. LANL STR will notify LANL U&I group at least 15 working days in advance to schedule tie-in.
- E. Before tie-ins are scheduled, the LANL STR will ensure materials required for tie-in are on site, service lines have been tested and disinfected, material submittals and all test reports have been approved by LANL U&I Group, and bell hole excavation meets access and OSHA requirements.

3.4 BURIED PIPING

- A. Refer to Drawings and Section 31 2000, *Earth Moving*, for earth cover, bedding, tracer wire, wire continuity test, warning tape, documenting new or exposed existing utility location, etc., requirements.
- B. Minimum cover over pipe shall be 48 inches measured from finish grade to top of pipe.

3.5 INSTALLATION

- A. Comply with Uniform Plumbing Code (IAMPO) and applicable AWWA publications.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in a straight line, in an orderly manner, and maintain gradient.
- D. Set hydrants plumb and locate pumper nozzle perpendicular to and facing roadway.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Sleeve and caulk pipes penetrating exterior walls below grade to provide a waterproof installation.
- G. Disinfect water distribution system per Section 33 1300.
- H. Pressure test piping system per Section 22 0813.

- I. Fire hydrants tied into a non-potable dedicated fire loop shall have the hydrant bonnet painted black, and labeled "Non-Potable Water, Do Not Drink" per Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment*. Refer to Drawings for hydrant location.
- J. Comply with AWWA M23, PVC Pipe Design Installation, for installation of PVC piping under roads.

3.6 POLYETHYLENE PIPING INSTALLATION

- A. Lay coiled and small diameter piping on trench bottom in such a manner as to snake piping ("S" curves) in trench along the piping run. This will insure that sufficient piping material is available for expansion and contraction. Lay piping in trench and allow for temperature stabilization to minimize thermal expansion and contraction.
- B. Cold (field) bending allowable bend radius is determined by pipe diameter and dimension ratio. Minimum bend radius shall be per manufacturers written instructions. Bends shall not be made where fittings are in the bend.
- C. Provide minimum of 5 feet of cover over piping installed under any roadways and vehicle parking areas.
- D. Perform butt heat-fusion joining in accordance with ASTM D2657 and the manufacturer's written instructions. See PART 1, Quality Assurance.
- E. Make connections to PE-to-DI or PVC pipe and mechanical connections, valves, and appurtenances with transition fittings that are butt fused onto the PE pipe. Provide complete assemblies and install per manufacturers written instruction.
- F. Thrust blocks and restraint shall be installed at fire hydrants, tees and change in direction per the manufacturer's written instructions.

3.7 HORIZONTAL DIRECTIONAL DRILLING OR PIPE BURSTING

- A. Crossing of paved streets or roadways or other areas, if approved by LANL U&I group representative, may be accomplished by horizontal directional drilling (HDD) or pipe bursting, whenever practical. The HDD bore shall be kept to a maximum of 2 inches larger than the pipe. Care shall be exercised to ensure the paved surface is not damaged during the drilling operation.
- B. Top of HDD shall have a minimum below grade bury depth of 48 inches and a minimum bury depth of 60 inches below any paved surface. Depth shall not exceed excavation by standard, conventional means and shall be approved by LANL U&I group representative.
- C. Contractor shall install fusible Poly-Vinyl Chloride (PVC) Pipe in accordance with Section 33 1001 of these specifications.

END OF SECTION

THE FOLLOWING REFERENCE IS FOR LANL USE ONLY

This project specification is based on LANL Master Specification 33 1000 Rev. 7, dated June 29, 2015.

EPC-DO: 18-052

SECTION 33 1001

FUSIBLE POLYVINYLCHLORIDE (PVC) PIPE AND INSTALLATION FOR PRESSURE SYSTEMS WITH HORIZONTAL DIRECTIONAL DRILL (HDD) INSTRUCTIONS

PART 1 – GENERAL

1.01 DESCRIPTION

- A SCOPE
 - 1. This section specifies fusible polyvinylchloride pipe, including standards for dimensionality, testing, quality, acceptable fusion practice, safe handling, storage and installation of the pipe by conventional means, horizontal directional drilling, directional boring, or guided boring technology.

B REQUIREMENTS:

- Contractor shall provide a structurally sound, leak-proof, monolithic polyvinylchloride pipe for all piping identified for installation by horizontal directional drilling. Individual pipe lengths shall be assembled by butt-fusion unless otherwise specified. Connecting fittings shall be fused or mechanically joined to the piping as specified. Contractor shall also be responsible for all installation processes including drilling, back-reaming, management and disposal of all drilling fluid, dewatering flow around his work, and leak testing the fusible polyvinylchloride pipe and fittings in accordance with these specifications.
- 2. Contractor shall be responsible for all installation processes and procedures associated with the installation by horizontal directional drilling in accordance with this specification.
- C PIPE DESCRIPTION
 - 1. Pipe Supplier shall furnish fusible polyvinylchloride pipe conforming to all standards and procedures, and meeting all testing and material properties as described in this specification.
 - 18 inch and 12 inch effluent reuse line: Purple FPVC C-900 and FPVC C-905 of equal or greater (ID) and pressure rating to 18-inch and 12-inch DR11 HDPE.

1.02 QUALITY ASSURANCE

A REFERENCES:

- 1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
- 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of design, bid, or construction, whichever is earliest. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
- 3. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/AWWA C110/A21.10	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
ANSI/AWWA C111/A21.11	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
ANSI/AWWA C153/A21.53	AWWA Standard for Ductile-Iron Compact Fittings for Water Service
AWWA C605	Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C651	Standard for Disinfecting Water Mains
AWWA C900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm Through 300mm), for Water Distribution

Reference	Title
AWWA C905	Standard for Polyvinyl Chloride (PVC Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm Through 1200mm), for Water Distribution and Transmission
AWWA M23	AWWA Manual of Supply Practices PVC Pipe—Design and Installation, Second Edition
ASTM C923	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2152	Test Method for Degree of Fusion of Extruded
	Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F679	Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F1057	Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique
ASTM F1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
UNI-B-6	Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
UNI-PUB-08	Tapping Guide for PVC Pressure Pipe
NSF-14	Plastics Piping System Components and Related Materials
NSF-61	Drinking Water System ComponentsHealth Effects
PPI TR-2	PVC Range Composition Listing of Qualified Ingredients

B MANUFACTURER REQUIREMENTS

1. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.

C FUSION TECHNICIAN REQUIREMENTS

- 1. Fusion Technician shall be fully qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.
- D SPECIFIED PIPE SUPPLIERS
 - Fusible polyvinylchloride pipe shall be used as manufactured under the trade names Fusible C-900®, Fusible C-905®, and FPVC®, for Underground Solutions, Inc., Poway, CA, (858) 679-9551, or Engineer Approved Equivalent. Fusion process shall be as patented by Underground Solutions, Inc., Poway, CA, Patent No. 6,982,051, or Engineer Approved Equivalent.

E WARRANTY

- 1. A one-year warranty for the pipe shall be included, and shall cover the cost of replacement pipe and freight to project site, should the pipe have any defects in material or workmanship.
- 2. In addition to the standard pipe warranty, the fusing contractor shall provide in writing a warranty for a period of one year for all the fusion joints, including formation, installation, and pressure testing.
- 3. Warranty periods shall begin on the date of installation and product acceptance after all applicable testing.

F PRE-CONSTRUCTION SUBMITTALS

1. A list of commensurate projects, completed in place and accepted, shall be furnished. A minimum of three projects is required. Project names, descriptions, and contact information for the end users of the projects shall be provided. Projects must match the following:

- 1) On-grade horizontal directional drilling from a surface launch orientation.
- 2) Similar size and class pipe as this project.
- 3) Similar length of pipe as this project.

- 4) Similar ground conditions as this project.
- 2. The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:
 - 1) Pipe Size
 - 2) Dimensionality
 - 3) Pressure Class per applicable standard
 - 4) Color
 - 5) Recommended Minimum Bending Radius
 - 6) Recommended Maximum Safe Pull Force
 - 7) Fusion technician qualification indicating conformance with this specification
- 3. The following WORK PLAN AND INFORMATION is required from the contractor and/or horizontal directional drilling Contractor. This WORK PLAN AND INFORMATION shall also be supplied to the Owner or Engineer, should it be requested:
 - 1) Work plan shall include for each HDD installation any excavation locations and dimensions, interfering utilities, bore dimensions and locations including bend radii used, and traffic control schematics.
 - 2) A project safety and contingency plan which shall include but shall not be limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, water, wastewater and any other subsurface utility in the area.
 - 3) At least two weeks prior to the start of work, an HDD schedule identifying daily work hours and working dates for each installation.

G POST-CONSTRUCTION SUBMITTALS

- 1. The following AS-RECORDED DATA is required from the contractor and/or fusion provider to the owner or Engineer upon request:
 - 1) Approved datalogger device reports

- 2) Fusion joint documentation containing the following information:
 - a) Pipe Size and Thickness
 - b) Machine Size
 - c) Fusion Technician Identification
 - d) Job Identification
 - e) Fusion Joint Number
 - f) Fusion, Heating, and Drag Pressure Settings
 - g) Heat Plate Temperature
 - h) Time Stamp
 - i) Heating and Cool Down Time of Fusion
 - j) Ambient Temperature
- 3) As-recorded Information
 - a) The as-recorded plan and profile will reflect the actual installed alignment, and reflect the horizontal offset from the baseline and depth of cover.
 - b) All fittings, valves, or other appurtenances will also be referenced and shown.
 - c) A daily project log, along with tracking log sheets, should they be used, shall be provided. Tracking log sheet data, should it be employed, shall include any and all that apply, including inclination, depth, azimuth, and hydraulic pull-back and rotational force measured.

PART 2 - PRODUCTS

2.01 FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR POTABLE WATER

A Fusible polyvinylchloride pipe shall conform to AWWA C900, AWWA C905, ASTM
D2241 or ASTM D1785 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.

- B Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
- C Fusible polyvinylchloride pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified.
- D Fusible polyvinylchloride pipe shall be blue in color for potable water use.
- E Pipe shall be marked as follows:
 - 1. Nominal pipe size
 - 2. PVC
 - 3. Dimension Ratio, Standard Dimension Ratio, or Schedule
 - 4. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable
 - 5. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable
 - 6. NSF-61 mark verifying suitability for potable water service
 - 7. Extrusion production-record code
 - 8. Trademark or trade name
 - 9. Cell Classification 12454 and/or PVC material code 1120 may also be included
- F Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2.02 FUSION JOINTS

A Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be

assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.

2.03 CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS

- A Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.
- B DUCTILE IRON MECHANICAL AND FLANGED FITTINGS

Acceptable fittings for use with fusible polyvinylchloride pipe shall include standard ductile iron fittings conforming to AWWA/ANSI C110/A21.10, or AWWA/ANSI C153/A21.53 and AWWA/ANSI C111/A21.11.

- 1. Connections to fusible polyvinylchloride pipe may be made using a restrained or non-restrained retainer gland product for PVC pipe, as well as for MJ or flanged fittings.
- 2. Bends, tees and other ductile iron fittings shall be restrained with the use of thrust blocking or other means as indicated in the construction documents.
- 3. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.
- C FUSIBLE POLYVINYL CHLORIDE SWEEPS OR BENDS
 - 1. Fusible polyvinyl chloride sweeps or bends shall conform to the same sizing convention, diameter, dimensional tolerances and pressure class of the pipe being joined using the sweep or bend.
 - 2. Fusible polyvinyl chloride sweeps or bends shall be manufactured from the same fusible polyvinyl chloride pipe being used for the installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation. There shall be no gasketed connections utilized with a fusible polyvinyl chloride sweep.
 - 3. Standard fusible polyvinyl chloride sweep or bend angles shall not be greater than 22.5 degrees, and shall be used in nominal diameters ranging from 4 inch through 16 inch.

D SLEEVE-TYPE COUPLINGS

1. Sleeve-type mechanical couplings shall be manufactured for use with PVC pressure pipe, and may be restrained or unrestrained as indicated in the

construction documents.

- 2. Sleeve-type couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.
- E EXPANSION AND FLEXIBLE COUPLINGS
 - 1. Expansion-type mechanical couplings shall be manufactured for use with PVC pipe, and may be restrained or unrestrained as indicated in the construction documents.
 - 2. Expansion-type mechanical couplings shall be rated at the same or greater pressure carrying capacity as the pipe itself.
- F CONNECTION HARDWARE

Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.

- 2.04 DRILLING SYSTEM EQUIPMENT
 - A GENERAL
 - 1. The directional drilling equipment, as a minimum, shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pull-back of the pipe(s), a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project. All required equipment shall be included in the emergency and contingency plan as submitted per these specifications.
 - B DRILLING RIG
 - 1. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a drill head. The machine shall be anchored to withstand the pulling, pushing and rotating forces required to complete the project.
 - 2. The drilling rig hydraulic system shall be of sufficient pressure and volume to power drilling operations. The hydraulic system shall be free from leaks.

- 3. The drilling rig shall have a system to monitor pull-back hydraulic pressure during pull-back operations.
- C DRILL HEAD
 - 1. The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steer-able drill head and any subsequent pre-reaming heads.
 - 2. The system must be able to control the depth and direction of the drilling operation.
 - 3. Drill head shall contain all necessary cutters and fluid jets for the operation, and shall be of the appropriate design for the ground medium being drilled.
- D DRILLING FLUID SYSTEM
 - 1. DRILLING FLUID (DRILLING MUD)
 - a) Drilling fluid shall be composed of clean water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean source and shall meet the mixing requirements of the mixture manufacturer(s).
 - b) The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods. No hazardous additives may be used.
 - c) Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).
 - d) Drilling fluid shall be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions.
 - e) No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid unless they have been submitted per this specification.
 - 2. MIXING SYSTEM
 - a) A drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
 - b) The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.

- c) The mixing system shall continually agitate the drilling fluid during drilling operations.
- 3. DRILLING FLUID DELIVERY AND RECOVERY SYSTEM
 - a) The drilling fluid pumping system shall have a minimum capacity to supply drilling fluid in accordance with the drilling equipment pull-back rating at a constant required pressure.
 - b) The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.
 - c) Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.
 - d) A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.

E DRILLING CONTROL SYSTEM

- 1. Calibration of the electronic detection and control system shall be verified prior to the start of the bore.
- 2. The drilling head shall be remotely steer-able by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three dimensions:
 - a) Offset from the baseline,
 - b) Distance along the baseline, and
 - c) Depth of cover.
- 3. Point of rotation of the head shall also be monitored.
- 4. For gravity application and on-grade drilling, sonde/beacon or approved equipment applicable for grade increments of 1/10th of one percent shall be used.

2.05 PIPE PULL HEADS

- A Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
- B Pipe pull heads shall be specifically designed for use with fusible polyvinylchloride pipe, and shall be as recommended by the pipe supplier.

2.06 PIPE ROLLERS

- A Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.
- B A sufficient quantity of rollers and spacing, per the pipe supplier's guidelines shall be used to assure adequate support and excessive sagging of the product pipe.

PART 3 – EXECUTION

3.01 DELIVERY AND OFF-LOADING

- A All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the owner or engineer.
- B Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify owner or engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.
- C Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed.
- D Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- E During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- F If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from

trucks.

3.02 HANDLING AND STORAGE

- A Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the owner or engineer.
- B Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the owner or engineer.
- C Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.
- D Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
- E If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- F Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.03 FUSION PROCESS

- A GENERAL
 - 1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.
 - 2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

- 3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
- 4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:
 - a) HEAT PLATE Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.
 - b) CARRIAGE Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
 - c) GENERAL MACHINE Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
 - d) DATA LOGGING DEVICE An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
- 5. Other equipment specifically required for the fusion process shall include the following:
 - a) Pipe rollers shall be used for support of pipe to either side of the machine
 - b) A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
 - c) An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
 - d) Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

- e) Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.
- B JOINT RECORDING

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.04 DRILLING OPERATIONS

- A GENERAL
 - 1. Bore path and alignment are as indicated in the contract documents. The path of the bore may be modified based on field and equipment conditions. Entry and exit locations and control-point elevations shall be maintained as indicated in the contract documents.
 - 2. Bend radii shown in the contract documents are minimum allowable radii and shall not be reduced.

B LOCATION AND PROTECTION OF UNDERGROUND UTILITIES

- 1. Correct location of all underground utilities that may impact the HDD installation is the responsibility of the Contractor, regardless of any locations shown on the drawings or previous surveys completed.
- 2. Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
- 3. All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of HDD installation as determined for the project specific site conditions. It is the Contractor and HDD system operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material.

C SITE LOCATION PREPARATION

1. Work site as indicated on drawings shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to

be made

2. Contractor shall confine all activities to designated work areas.

D DRILLING LAYOUT AND TOLERANCES

- 1. The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations within the areas indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.
- 2. Instrumentation shall be provided and maintained at all times that accurately locates the pilot hole, measures drill-string axial and torsional loads and measures drilling fluid discharge rate and pressure.
- 3. Entry and exit areas shall be drilled so as not to exceed the bending limitations of the pipe as recommended by the pipe supplier.

E PILOT HOLE BORE

- 1. Pilot hole shall be drilled along bore path. In the event that the pilot bore does deviate from the bore path, it may require contractor to pull-back and re-drill from the location along bore path before the deviation.
- 2. The Contractor shall limit curvature in any direction to reduce force on the pipe during pull-back. The minimum radius of curvature shall be no less than that specified by the pipe supplier and as indicated on the drawings.

F REAMING

1. After successfully completing the pilot hole, the bore hole shall be reamed to a diameter which meets the requirements of the pipe being installed. The following table is offered as an estimated guide:

Nominal Pipe Diameter	Bore Hole Diameter
< 8 inches	Pipe Dia. + 4 inches
8 inches to 24 inches	Pipe Dia. X 1.5
> 24 inches	Pipe Dia. + 12 inches

- 2. Multiple reaming passes shall be used at the discretion of the Contractor and shall conform to this specification.
- 3. In the event of a drilling fluid fracture, returns loss or other loss of drilling fluid, the Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss.
- 3.05 PIPE PULL-BACK AND INSERTION
 - A Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous length.
 - B Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not bend past the pipe supplier's minimum allowable bend radius, buckle, or otherwise become damaged. Damaged portions of the pipe shall be removed and replaced.
 - C The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the bore hole.
 - 1. The pipe shall be guided into the bore hole to avoid deformation of, or damage to, the pipe.
 - 2. The fusible polyvinylchloride pipe may be continuously or partially supported on rollers or other Owner and Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during installation.
 - 3. A swivel shall be used between the reaming head and the fusible polyvinylchloride pipe to minimize torsion stress on the pipe assembly.
 - D Buoyancy modification shall be at the sole discretion of the Contractor, and shall not exceed the pipe supplier's guidelines in regards to maximum pull force or minimum bend radius of the pipe. Damage caused by buoyancy modifications shall be the responsibility of the Contractor.
 - E Once pull-back operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole.
 - F The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Any damages caused by the Contractor's operations shall be corrected by the Contractor.

G When pulling in pipe the pulling force shall be monitored and kept below the Allowable Tensile Load (ATL) value of the pipe size and material per manufacturer's recommendation. Both pipe ends shall be monitored for continuous, smooth movement. Pulling load from the equipment shall be monitored and the pipe lead end shall be equipped with a weak link device to disengage at the ATL or below. Manufacturer's procedures and design parameters shall be followed, in addition to ASTM F1962.

3.06 INSTALLATION CLEANUP

- A Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted per the construction documents and jurisdictional standards. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these specifications and all applicable jurisdictional laws.
- B Contractor shall verify that all utilities, structures, and surface features in the project area are sound.
- 3.07 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS
 - A Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the contractor shall:
 - 1. Field verify location, size, piping material, and piping system of the existing pipe.
 - 2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
 - 3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.
 - B Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.08 PIPE SYSTEM CONNECTIONS

A Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection

manufacturer's guidelines.

B If possible, pipe installed via HDD shall be filled with water prior to making any connections to the existing system or other portions of the project.

3.09 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS

- A Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per Uni-Pub-8.
- B All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.
- C Equipment used for tapping shall be made specifically for tapping PVC pipe:
 - 1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
 - 2. Manually operated or power operated drilling machines may be used.
- D Taps may be performed while the pipeline is filled with water and under pressure ('wet' tap,) or when the pipeline is not filled with water and not under pressure ('dry' tap).

3.10 TESTING

- A Testing shall comply with all applicable jurisdictional building codes, statutes, standards, regulations, and laws.
- B HYDROSTATIC TESTING AND LEAKAGE TESTING FOR PRESSURE PIPING
 - 1. Hydrostatic and leakage testing for piping systems that contain mechanical jointing as well as fused PVC jointing shall comply with AWWA C605.
 - 2. Unless agreed to or otherwise designated by the owner or engineer, for a simultaneous hydrostatic and leakage test following installation, a pressure equal to 150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation shall be applied. The duration of the pressure test shall be for two (2) hours.

- 3. If hydrostatic testing and leakage testing are performed at separate times, follow procedures as outlined in AWWA C605.
- 4. In preparation for pressure testing the following parameters must be followed:
 - All air must be vented from the pipeline prior to pressurization. This may be accomplished with the use of the air relief valves or corporation stop valves, vent piping in the testing hardware or end caps, or any other method which adequately allows air to escape the pipeline at all high points. Venting may also be accomplished by 'flushing' the pipeline in accordance with the parameters and procedures as described in AWWA C605.
 - 2) The pipeline must be fully restrained prior to pressurization. This includes complete installation of all mechanical restraints per the restraint manufacturer's guidelines, whether permanent or temporary to the final installation. This also includes the installation and curing of any and all required thrust blocking. All appurtenances included in the pressure test, including valves, blow-offs, and air-relief valves shall be checked for proper installation and restraint prior to beginning the test.
 - 3) Temporary pipeline alignments that are being tested, such as those that are partially installed in their permanent location shall be configured to minimize the amount of potentially trapped air in the pipeline.

C LEAKAGE TESTING FOR NON-PRESSURE PIPING

- 1. Gravity sanitary sewers that contain mechanical jointing in addition to fused PVC joints may need to be tested for excessive leakage.
- 2. Gravity sanitary sewer leakage testing may include appropriate water or low pressure air testing. The leakage outward or inward (exfiltration or infiltration) shall not exceed 25 gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of two feet. The air test, if used, shall be conducted in accordance with one of the following Standards:
 - 1) ASTM F1417
 - 2) UNI-B-6
- 3. The testing method selected shall properly consider the existing groundwater elevations during the test.
- D DEFLECTION TESTING FOR NON-PRESSURE PIPING

- 1. After completion of the backfill, the engineer or owner may require that a deflection test be performed.
- 2. Deflection tests should be conducted using a go/no-go mandrel. The mandrel's outside dimension shall be sized to permit no more than 7.5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. If the internal beading of the fused joints for the pipe is not required to be removed, the mandrel shall account for this clearance as well. The mandrel shall be approved by the owner or engineer prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements.
- E DISINFECTION OF THE PIPELINE FOR POTABLE WATER PIPING
 - 1. After installation, the pipeline, having passed all required testing, shall be disinfected prior to being put into service. Unless otherwise directed by the owner or engineer, the pipeline will be disinfected per AWWA C651.
- F PARTIAL TESTING
 - 1. Segments of the pipe may be tested separately in accordance with standard testing procedure, as approved by the owner and engineer. Testing of each HDD installation prior to connection to the system or other piping is preferred.

END OF SECTION

EPC-DO: 18-052

SECTION 33 1300

DISINFECTION OF POTABLE WATER PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Disinfection requirements for the following new, repaired, or modified systems:
 - 1. Potable water distribution piping on Project site
- B. Dechlorination procedures for chlorinated water discharges

Note: Disinfection of non-potable water piping including fire protection piping downstream of alarm check valve or fire line backflow preventer is not required.

1.2 LANL PERFORMED WORK

A. Water quality testing: LANL Subcontract Technical Representative (STR) will coordinate water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. LANL Utilities and Institutional Group (U&I) will approve use of disinfected piping when test results demonstrate conformance with water quality requirements as described in Section 1.5.D, furnishing disinfection report to Subcontractor.

1.3 REFERENCES

- A. American Water Works Association, C651 Disinfecting Water Mains.
- B. New Mexico Administrative Code, Title 20.7.10 Drinking Water, Section 400.

1.4 ACTION SUBMITTALS

- A. Submit the following test results:
 - 1. Free chlorine concentration during disinfection
 - 2. Bacteriological test (coliform bacteria.)
 - 3. Residual free chlorine concentration, after flushing out chlorinated water.

B. Test Reports: Submit test results within 5 working days of successful test to LANL STR and LANL Utilities and Institutional water system representative.

1.5 DESCRIPTION

- A. Disinfection Requirements
 - 1. Protect interiors of pipes, fittings, and valves against contamination during construction.
 - a. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material.
 - b. Close openings of pipeline when pipe-laying is stopped at end of workday or for other reasons, such as rest breaks or meal periods.
 - 2. Do not disinfect any pipe until source of potable water supply used for flushing or disinfection is approved by LANL STR.
 - 3. LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality as described in Section 1.5.D. Samples for testing are not compliance samples and should be marked as "special purpose."
 - 4. Do not place piping in service until notified by LANL STR that water quality test results are approved by LANL, as described in Section 1.5.D.
 - 5. Re-flush and retest disinfected potable water piping that has been allowed to stand stagnant for more than 30 days before being placed in service.
 - 6. Disinfect piping within building with service taps and fixtures installed. Flow chlorinated water and flush water through lavatories, sinks, drinking fountains, showers, and hose bibs.
- B. Water Discharge Requirements Subcontractor
 - 1. Refer to Section 01 3545, Water Discharge Requirements.
 - 2. Neutralize chlorinated water used for disinfection prior to discharge as described in "Dechlorination of Discharges (Neutralization)" Section 3.4.
 - 3. To discharge chlorinated/dechlorinated water, notify LANL STR, as described in Section 1.5.D, to arrange for a total chlorine concentration test.
 - 4. Obtain approval from LANL STR prior to ANY discharges.
- C. Water Discharge Requirements LANL STR
 - 1. Refer to Section 01 3545, Water Discharge Requirements.

- D. Water Quality Testing Requirements -- Subcontractor
 - 1. Notify LANL STR at least 5 working days in advance to arrange for a bacterial quality or free or total chlorine concentration test.
 - 2. Requirements for demonstration of water quality conformance:
 - a. Total residual chlorine concentration of less than 1 mg/L (1 ppm).
 - b. The absence of any coliform bacteria.
 - c. At discretion of LANL STR, a heterotrophic plate count (HPC) showing bacteria less than 500 colony-forming units (cfu) per mL sample.
- E. Water Quality Testing Requirements LANL STR
 - 1. LANL STR will make advance arrangements for a total chlorine concentration test, bacterial quality test, or for monitoring batch-treated discharge for pH and chlorine.
 - 2. LANL STR shall verify that water samples taken for piping in the LANL water distribution system (public water system) is accomplished by a Water Sampler Technician certified in accordance with New Mexico NMAC 20.7.4.12.C; it is recommended that a qualified sampler collect all the testing samples.

PART 2 PRODUCTS

- 2.1. MATERIAL SAFETY DATA SHEETS
 - A. Maintain on site Material Safety Data Sheets (MSDS) for chemical products, including disinfection and dechlorination products.
- 2.2. ACCEPTABLE DISINFECTANTS
 - A. Sodium hypochlorite solution (bleach) per AWWA B300 contains approximately 5-6 percent available chlorine, or 50,000 to 60,000 ppm. Thus, a 1:1000 dilution of bleach in water results in a chlorine concentration of about 50 ppm. Use care in control of conditions and length of storage to minimize its deterioration.
 - B. Calcium hypochlorite Ca(OCI)₂ granules and tablets per AWWA B300. This contains approximately 65 percent available chlorine by weight. It will not readily dissolve in water with a temperature of less than 41 deg F. Store in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase into piping is not permitted. Do not use calcium hypochlorite intended for swimming pools (e.g., HTH), as this material has been sequestered and is extremely difficult to eliminate from the pipe.
 - C. Disinfection with pure chlorine gas or liquid is not permitted.
- 2.3. ACCEPTABLE DECHLORINATION (NEUTRALIZING) AGENTS

- A. Use Vitamin C salt (sodium ascorbate, Vita-D-Chlor brand or equal) for discharges to a live stream. Sodium thiosulfate (technical grade, prismatic rice) is acceptable for discharges elsewhere.
- B. Sulfur dioxide gas use is not permitted.

2.4. PRECAUTIONS

- A. Calcium hypochlorite is corrosive and is a strong oxidizer. Reducing agents (e.g., sodium ascorbate or thiosulfate), concentrated acids, and organic compounds (e.g. antifreeze, gasoline), can oxidize, burn or explode if they come into contact with solid-phase calcium hypochlorite.
- B. Do not use calcium hypochlorite on solvent-welded plastic pipe or on screwedjoint steel pipe because of danger of fire or explosion from reaction with joint compounds (exception: PFTE "Teflon" tape).
- C. Disinfecting solutions containing chlorine shall not exceed 12% active chlorine; greater concentrations can chemically attack and degrade polyethylene.

PART 3 EXECUTION

3.1. DISINFECTION OF NEW WATER MAINS

- A. Preliminary flushing
 - 1. Prior to disinfection, fill main with water to eliminate air pockets.
 - 2. Follow Section 01 3545, Water Discharge Requirements, when discharging water.
 - 3. Flush new mains, including fire service mains and lead-in connections to fire system risers, thoroughly before connection is made to system piping in order to remove foreign materials that might have entered the main during the course of the installation or that might have been present in existing piping.
 - 4. The minimum rate of flow shall greater than the water demand rate of the system, which is determined by the system design. Where the main supplies a fire supply sprinkler system (common at LANL), flow shall provide an NFPA 24 velocity of 10 ft/s (3 m/s) even if the demand rate may be less. Flow/velocity table below.
 - 5. Follow AWWA C651, "Disinfecting Water Mains," using Continuous Feed Method where practical.

Exception: For mains supplying fire systems, when the flow rate as listed in table below cannot be verified or met, supply piping shall be flushed at the maximum flow rate available to the system under fire conditions. This maximum rate shall be calculated by the water sprinkler system designer for each situation with the existing system limitations, if any, taken into account. The designer shall then submit the water demand rate of the new system to FIRE Group so they can set

both the minimum rate of flow and the parameters for the test and flow rates. If such designer is not involved in the project, then FIRE will determine flush rate.

Flow Required to Produce a Velocity of 10 Ft per Second (3 m/s) in Pipes (NFPA 24)

Nominal Pipe Size	Flow Rate		
(in.)	(gpm)	(L/min)	
4	390	1476	
6	880	3331	
8	1560	5905	
10	2440	9235	
12	3520	13323	

- 6. For all systems, the flushing operation shall be continued for a sufficient time to ensure thorough cleaning.
- 7. Obtain verification from LANL STR that system has been thoroughly cleaned (flushed) and is ready for chlorination.
- 8. Perform piping pressure test before disinfection to avoid possible discharge of heavily chlorinated water due to pipe or joint failure during a pressure test.
- B. Chlorination of the Main
 - Inject chlorinated water, with a free chlorine concentration of not less than 25 mg/L, into main at a point no more than 10 feet downstream from beginning of new main. Verify free chlorine concentration of not less than 25 mg/L by an initial free chlorine concentration test as described in Section 1.5.D.
 - 2. Leave chlorinated water in main for at least 24 hours during which time valves and hydrants in system shall be operated to ensure disinfection of the appurtenances.
 - 3. At end of 24-hour period, treated water in all portions of main shall have a free chlorine concentration of not less than 10 mg/L. Verify this by a residual free chlorine concentration test as described in Section 1.5.D.
 - 4. After residual free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm).
 - 5. After final flushing, contact LANL STR to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.5.D.

6. After final total chlorine concentration and bacteriological quality tests have been completed, LANL STR will furnish disinfection report to Subcontractor and LANL Utilities and Institutional water system representative. If water quality tests do not show conformance with water quality requirements as described in Section 1.5.D, repeat 1, 2, 3, 4, and 5 until test results demonstrate conformance.

3.2. DISINFECTION OF NEW INTERIOR POTABLE WATER SYSTEM

- A. Flush until discolored water is eliminated and water flows clear, discharging per Section 01 3545, Water Discharge Requirements.
- B. Chlorination of piping
 - 1. Use chlorinated water, with free chlorine concentration of not less than 25 mg/L. Verify this by an initial free chlorine concentration test as described in Section 1.5.D.
 - 2. Retain chlorinated water in piping for at least 24 hours, during which time lavatories, sinks, drinking fountains, showers, and hose bibs shall be operated to ensure disinfection of appurtenances.
 - 3. At end of 24-hour period, treated water in all portions of piping shall have a free chlorine concentration of not less than 10 mg/L. Subcontractor shall verify this minimum concentration by a residual free chlorine concentration test as described in Section 1.5.D.
 - 4. After residual free chlorine concentration test has been completed, flush system with potable water until total chlorine concentration in piping is less than 1 mg/L (1 ppm), discharging as follows.
 - a. If total quantity of chlorinated waters is less than 20 gallons, it may be discharged directly to sanitary wastewater collection system without regard to chlorine concentration or Section 01 3545.
 - b. If total quantity of chlorinated water for disinfection is over 20 gallons, then:
 - 1. Neutralize and test disinfection water prior to discharge as described in Section 1.4 and "Dechlorination of Discharges (Neutralization)" Section 3.4 below, and
 - 2. Discharge to environment or sanitary sewer per Section 01 3545, Water Discharge Requirements.
- 3.3. DISINFECTION DURING AND FOLLOWING REPAIR OR MINOR MODIFICATION OF EXISTING MAINS OR INTERIOR PIPING
 - A. Before Repair
 - 1. Where practical, isolate a section of affected line and shut off all service connections.

- 2. Swab or spray the inside of new pipe and fittings with a minimum of 1 percent (10,000 ppm) hypochlorite solution before they are installed. Disinfect tools to be used in same manner.
- B. Flushing after Repair
 - 1. Prior to disinfection, flush affected line to clean out contamination introduced during repairs. If possible, flush from both directions. Flush until discolored water is eliminated and water flows clear. If line segment cannot be isolated, thoroughly flush the segment to a tank or through a fire hydrant. Follow requirements in Section 01 3545, Water Discharge Requirements, for notification and possible dechlorination requirements.
 - 2. Obtain verification from LANL STR that affected line has been thoroughly cleaned (flushed) and is ready for chlorination.
- C. Apply chlorine to water to expose interior surfaces of affected segment at the chlorine concentration and contact times as follows; verify total chlorine concentration by an initial total chlorine concentration test as described in Section 1.5.D:

Chlorine Concentration (mg/L, ppm)	Contact Time
300	15 minutes
250	1 hour
200	1.5 hours
150	2 hours
100	3 hours

- D. Retain chlorinated water in main, or piping, for above prescribed contact time. At the end of prescribed time period, flush affected line with potable water until total chlorine concentration in main is less than 1 mg/L (1 ppm).
- E. After flushing, contact LANL STR to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.5.D.
- F. After final total chlorine concentration and bacteriological quality tests have been completed, LANL STR will furnish disinfection report to Subcontractor. If water quality tests do not show conformance with water quality requirements as described in Section, 1.5.D, repeat E, F, and G above until test results demonstrate conformance.
- 3.4. DECHLORINATION OF DISCHARGES (NEUTRALIZATION)
 - A. Provide mixing tank to allow dechlorination of water prior to discharge. Stir in neutralizer crystals allowed per Part 2 manually.

- B. If this is not practical or safe, contact LANL STR for coordination and to arrange for direct injection into chlorinated water discharge pipe using a metering pump or venturi injector.
- C. Approximate dosage rate of neutralizer may be calculated from the following table:

Free Chlorine Residual	Sodium Ascorbate	<u>Sodium</u>
Concentration	(Vita-D-Chior)	Iniosuitate
10 mg/L	2.2 lb/10,000 gal	1.2 lb/10,000 gal
50 mg/L	11 lb/10,000 gal	6 lb/10,000 gal
500 mg/L	110 lb/10,000 gal	60 lb/10,000 gal

D. Do not dose neutralizing chemical beyond the minimum required to neutralize the chlorine actually present in discharge. *Allowable residual chloride varies depending on discharge avenue (watercourse, flat land, or sanitary wastewater system);* see Section 01 3545 for requirements.

END OF SECTION

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 22 0816, Rev. 4, dated September 25, 2012.

SECTION 40 7113.13

ELECTROMAGNETIC FLOW MEASURING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Electromagnetic flow meters for permanent installations both above and below ground. The meters shall utilize bipolar pulse DC coil excitation to measure voltage induced by the flow of conductive liquid through a magnetic flux. The voltage shall be linearly proportional to flow velocity from 0.033 to 33 feet per second.

B. Related Sections:

1. Control and Information System Scope and General Requirements

2. Powered Instruments, General

1.02 SUBMITTALS

A. Furnish complete Product Data, Shop Drawings, Test Reports, Operating Manuals, Record Drawings, Manufacturer's certifications, Manufacturer's Field Reports

- B. Product Data:
 - 1. Dimensional Drawings.
 - 2. Materials of Construction:
 - a. Sensor.
 - b. Liner
 - c. Electrodes
 - d. Process Connection.
 - 3. Measurement accuracy.
 - 4. Range and range ability.
 - 5. Enclosure Rating.
 - 6. Classification Rating.
 - 7. Power:
 - a. Voltage.
 - b. Wattage.
 - 8. Output options.

1.03 QUALITY ASSURANCE

A. Manufacture instruments in facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store all instruments in a dedicated structure with space conditioning to meet the recommended storage requirements provided by the Manufacturer.

B. Any instruments that are not stored in strict conformance with the Manufacturer's recommendation shall be replaced.

1.05 PROJECT OR SITE CONDITIONS

A. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, process and ambient temperature, and humidity conditions.

1.06 CALIBRATION AND WARRANTY

A. The meter shall have standard one year warranty from date of shipment. If the meter is commissioned by a factory certified technician, the warranty is extended to three years from the date of shipment.

1.07 MAINTENANCE

A. Provide all parts or materials necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

1.08 LIFECYCLE MANAGEMENT

A. Instrument documentation, like original calibration certificates, manuals and product status information shall be accessible via a web enabled system with a license. The instrument specific information shall be accessed via serial number. When services are provided by an authorized service provider, the service information (ex. subsequent field calibrations) shall be archived and accessible via this web enabled system.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. One of the following:
 - 1. Endress+Hauser Promag W 500 with digital remote

2.02 MANUFACTURED UNITS

A. The flow meter shall be a flanged sensor (by application and instrument schedule) and transmitter mounted separately (remote) from the sensor.

- 1. The flow meter shall be microprocessor based and possess a method in which to store the sensor calibration and transmitter setup information in non-volatile memory. The electronics shall be interchangeable for meters sizes 1" 78"
- 2. The sensor shall be the proper size to measure the design flow rate of the piping and measure bi-directional flow as a standard.
- The sensor shall consist of a stainless steel flow tube with ANSI B16.5 or AWWA C207 carbon steel or stainless steel flanges. The flanges shall carry Class 150 or 300 for 24" and smaller, and AWWA Class D for 28" and larger as specified.
- 4. The system shall simultaneously produce multiple process variables (ex. volume flow and conductivity) while in operation.
- 5. The sensor liner and electrode material shall be chosen to be compatible with the process fluid. All fluids require a minimum conductivity of 5 μS/cm.
- 6. The sensor tube shall be lined with polyurethane or hard rubber in accordance with NSF-61 based upon the size of the flow meter and the process media conditions.
- 7. The sensor shall house two measuring electrodes, a grounding electrode, and one for physical empty pipe detection. The electrodes shall be made of 316L SS, Alloy C22, or Tantalum as specified.
- 8. The external sensor housing shall enclose the coil assemblies and internal wiring. The materials shall be designed and constructed to prevent moisture ingress and promote corrosion resistance.
- 9. The electrode circuit shall have a minimum impedance of 10¹² Ohms to overcome moderate coating buildup.
- 10. The system shall include an electrical circuit for cleaning electrodes from magnetite buildup as specified.
- 11. The sensor shall be rated for NEMA 4X as standard.
 - a. An optional sensor rating for NEMA 6P/IP68 service shall allow for permanent immersion in water depths of 10 feet OR 30 feet for 48 hours.
- 12. If NEMA 6P is specified in the instrument schedule, the system shall include custom length cables which are attached to the sensor at the factory.
- 13. In the event of industrial treatment or corrosive/brackish environments, the flow sensor shall be painted and certified according to ISO-12944 corrosion class. Third party modification or sensor preparations shall not be accepted without type test

documentation to support the exposure conditions, depth, and duration of resistance.

14. The system shall be a remote design insensitive to external vibrations and immune from external piping forces due to robust design.

B. The transmitter shall be a three-stage microprocessor controller mounted remotely. The transmitter shall operate on DC (24 V) via a dedicated or universal power supply as specified. The transmitter housing will carry a NEMA 4X rating and shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments.

- 1. The measurement signals from the sensor shall be conducted up to 1000-feet to the transmitter via standard twisted pair shielded conductors.
- 2. The transmitter shall allow local or remote programming that can be operated via an optical display or WLAN connection without opening the compartment.
- 3. The transmitter display shall indicate simultaneous flow rate and total flow with three Totalizers (eg. forward, reverse and net total) and user-selectable engineering units, readout of diagnostic remedy messages, and support at least 19 standard languages.
- 4. The transmitter shall safeguard against entering of invalid data for the particular meter size and all programming parameters shall be access-code protected and retained in the embedded HistoROM.
- 5. The transmitter primary output shall be specified, as:

EtherNet/IP

Up to three (3) secondary configurable analog I/O slots (freely programmable to 4-20mA in/output, 0-10 kHz pulse/frequency, or status input)

- 6. The transmitter output(s) shall be integral to the electromagnetic flowmeter transmitter electronics; an external third party signal converter is not acceptable.
- 7. The transmitter output selected must be supported by Add-on Instructions (AOI), faceplates, device drivers, instructions and preengineered code.
- 8. The transmitter shall internally retain all setup parameters, calibration parameters and accumulated measurements in non-volatile memory in the event of power failure.
- 9. The transmitter shall be protected against voltage spikes from the power source with internal transient protection.

- 10. The transmitter and sensor must support an onboard, ISO traceable means of attested in-situ verification utilizing redundant references to validate measurement quality over the lifespan.
- 11. The transmitter shall provide access to service and monitoring parameters designed to identify transient or permanent process influences.
- 12. The transmitter shall support commissioning and maintenance options via a service interface for operation via an internal web server, accessible via a standard RJ-45 cable.

C. Remote configuration shall be capable of being performed thorough the network with common off the shelf tools, software, interfaces or gateways. Generic profiles or special tools and hardware will not be acceptable.

2.03 ACCESSORIES

A. Stainless steel tag - labeled to match the contract documents.

B. Provide grounding rings, as per manufacturer's recommendations, if required.

2.04 SOURCE QUALITY CONTROL & CALIBRATION

A. Electromagnetic flow meters shall be factory calibrated on an ISO 17025 accredited test stand with certified accuracy traceable to NIST per "General Requirements for the Competence of Testing and Calibration Laboratories"

B. Evidence of accreditation must originate from a national verification agency such as A2LA.

C. Each meter shall ship with a certificate of a 2-point calibration report exceeding stated standard accuracy of 0.5% or 0.2% of rate as specified.

a. An optional calibration for 0.5% or 0.2% flat specification across the measuring range as identified in the manufacturer's technical documentation.

D. A real-time computer generated printout of the actual calibration data points shall indicate apparent and actual flows. The flow calibration data shall be confirmed by the manufacturer and shipped with the meters to the project site.

E. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.

F. The manufacturer shall provide ISA data sheet ISA-TR20.00.01 as latest revision of form 20F2321. The manufacturer shall complete the form with all known data and model codes and dash out the inapplicable fields. Incomplete data sheets submitted will result in a rejected submittal.

2.05 SAFETY

A. All electrical equipment shall meet the requirements of ANSI/NFPA 70, National Electric Code latest addition.

B. All devices shall be certified for use in hazardous areas, independent of the output protocol selected.

C. At a minimum, the device shall allow installation in a Class I, Division 2, Group A to D as a non-incendive design.

D. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment.

E. Electrical equipment housing shall conform to NEMA 4X classification.

F. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as cCSAus, FM, or UL for the specified electrical area classification.

G. Device failure modes, self-monitoring characteristics and remedy diagnosis shall follow NAMUR standards NE 43 and NE 107.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process condition.

B. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

3.02 INSTALLATION

- A. As shown on installation details and mechanical Drawings.
- B. As recommended by the manufacturer's installation and operation manual.
- C. Specific attention should be given to the following technical requirements:
 - 1. Verify ground rings (if required) have been installed according to the manufacturer's recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.

3.03 FIELD QUALITY CONTROL

- A. Each instrument shall be tested before commissioning and the ENGINEER shall witness the interface capability in the control system and associated registers.
 - 1. Each instrument shall provide direct programming capability through the network

- 2. Each instrument shall provide direct control of totalizer reset functions through the network
- 3. Each instrument shall be supported with a device profile permitting direct integration
- B. The ENGINEER shall witness all instrument verifications in the field.
- C. Manufacturers Field Services are available for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP) – the warranty against manufacturing defects is three years.
 - 1. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
 - 2. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 - 3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested.
 - 4. Manufacturer representative shall generate a configuration report for each meter.

3.04 ADJUSTING

A. Verify factory setup of all instruments in accordance with the Manufacturer's instructions.

3.05 PROTECTION

A. All instruments shall be fully protected after installation and before commissioning. Replace any instruments damaged before commissioning:

1. The ENGINEER shall be the sole party responsible for determining the corrective measures

EPC-DO: 18-052

ENCLOSURE 4

Construction Schedule

EPC-DO: 18-052

LA-UR-17-31305

Date:

JAN 3 1 2018



SEP Waterline Replacement and Metering Project Memo

Area: LANL

Date: 1/29/18

Schedule Milestones for SEP Waterline Replacement and Metering Project

The final construction schedule for the SEP Waterline Replacement and Metering project will be developed in conjunction with the RFP process and the selected construction subcontractor. Milestone dates that are to guide this process include the following:

- 4 2/28/18 Request for Proposal (RFP) Advertised
- ✤ 3/28/18 Bids from construction subcontractors due
- 5/1/18 Notice of Award of Subcontractor
- 4 11/30/18 Substantial Construction Complete
- 4 12/31/18 Closeout report to NMED submitted

Construction milestones are for progress tracking between DOE and NMED and not enforceable. DOE may adjust the construction milestone dates.

Ben Bateman

Project Manager bbateman@lanl.gov Phone: 505-667-3430 Cell: 505-309-1906

Authorized Derivative Classification Review				
Donald C.				
Yardman	108444	01-30-2018	UNCLASSIFIED	
(Reviewed By)	(Z#)	(Review Date)	(Classification)	

ENCLOSURE 5

Engineer Estimate

EPC-DO: 18-052

LA-UR-17-31305

JAN 3 1 2018

Date:



Settlement Water Line Replacement and Metering Engineer's Estimate

Donald C.	Authorized Derivative Classification Review		
Yardman	108444	01-30-2018	UNCLASSIFIED
(Reviewed By)	(Z#)	(Review Date)	(Classification)
PHASE A (BASE BID):

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		MOBILIZATION/DEMOBILIZATION (NOT TO	LS	1	\$33,540.89	\$33,540.89
		EXCEED 5% OF SUBTOTAL)				
		CONSTRUCTION SURVEY AND STAKING, PER	LS	1	\$8,787.71	\$8,787.71
		CONTRACT SPECIAL PROVISIONS, CIP.				
		CONSTRUCTION TRAFFIC CONTROL AND	LS	1	\$37,000.00	\$37,000.00
		BARRICADING, COMPLETE.				
		MATERIAL TESTING ALLOWANCE	ALLOW	1	\$6,000.00	\$6,000.00
		NPDES COMPLIANCE	LS	1	\$4,226.15	\$4,226.15
		CONSTRUCTION PROJECT SIGN, PER CONTRACT	EA	1	\$1,000.00	\$1,000.00
		SPECIAL PROVISIONS, CIP				
		ASPHALT PAVEMENT REMOVAL & DISPOSAL,	SY	352	\$10.00	\$3,523.00
		SAWCUT, 2"-6" THICK (ASSUMING 6' WIDE CUT IN				
		TRENCH AREAS)	l			
		REPLACE CITY STREET PAVEMENT TRENCH	SY	11	\$50.00	\$550.00
		WIDTH, MATCH EXISTING PER DETAIL SHEET C-				
		502, MIN OF TYPE HMA SP III, 3" (ASSUMING 6'				
		WIDE CUT IN TRENCH AREAS)				
		MINOR PAVEMENT, REMOVE AND REPLACE	SY	341	\$25.00	\$8,532.50
		REMOVE AND REPLACE CONCRETE CURB AND	LF	0	\$30.00	\$0.00
		GUTTER,CIP.				
		SEEDING, CLASS "A", NATIVE, CIP.	AC	1	\$6,700.00	\$7,773.95
		BASE COURSE 4"	SY	352	\$10.00	\$3,523.00
		10" DUCTILE IRON WL PIPE	LF	165	\$38.00	\$6,270.00
		10" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	6276	\$34.00	\$213,384.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
		8" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH	LF	15	\$28.00	\$420.00
		& COMPACTED BACKFILL TO 4' DEPTH, CIP.				-
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"	LB	7260	\$4.50	\$32,670.00
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				· ·
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	5	\$1,500.00	\$7,500.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	25	\$500.00	\$12,500.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		2" COMBINATION AIR RELEASE VALVE, PER	EA	4	\$3,800.00	\$15,200.00
		DETAIL DRAWING. CIP.			+ - , ·	····
						1

Enclosure 5

Settlement Water Line **Replacement and Metering**

			L	A-UR-17-3130
Engineer's Estima	te			
100% Design Subm	ittai	_		4
10" TRANSITION COUPLING	EA	6	\$800.00	\$4,800.00
10" GATE VALVE, MJ X MJ, CIP	EA	12	\$2,250.00	\$27,000.00
VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	12	\$750.00	\$9,000.00
C-501, CIP.				
REMOVE EXISTING FIRE HYDRANT & SALVAGE	EA	4	\$700.00	\$2,800.00
6" FIRE HYDRANT, W/ GATE, TEE, AND PIPING,	EA	3	\$3,500.00	\$10,500.00
PER DETL ON SHEET C-502, INSTALL CIP.				
BOLLARD, CIP	EA	6	\$350.00	\$2,100.00
CONCRETE THRUST BLOCKING, CIP.	CY	3	\$600.00	\$1,733.33
MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	1	\$80.00	\$80.00
PVC, 4"-8"				
MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	115	\$120.00	\$13,800.00
PVC, 10"-12"				
JOINT RESTRAINING HARNESS PUSH ON BELLS, DI	EA	51	\$188.00	\$9,588.00
& PVC, 10"-12"				
HORIZONTAL DIRECTIONAL DRILL, 10" FPVC	LF	1194	\$140.00	\$167,160.00
CARRIER PIPE INCLUDED				
HORIZONTAL DIRECTIONAL DRILL, 8" FPVC	LF	207	\$130.00	\$26,910.00
CARRIER PIPE INCLUDED				
JACKING AND BORING, STEEL PIPE CASING 18",	LF	165	\$500.00	\$82,500.00
INCL SPACERS AND END SEALS, CIP				
LANSCE METER				
10" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	50	\$34.00	\$1,700.00
TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
CIP.				
DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"	LB	1000	\$4.50	\$4,500.00
WATERLINE, INCL. JOINTING MATERIAL, CIP.				
10" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,250.00	\$6,750.00
VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
C-501, CIP.				
MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$120.00	\$1,200.00
PVC, 10"-12"				
10" MAGNETIC FLOW METER	EA	1	\$9 <i>,</i> 805.95	\$9,805.95
				2

SUBTOTAL: \$818,616.49 NMGRT @7.3125%: \$59,861.33

\$32,038.00

\$878,477.82 TOTAL:

\$32,038.00

PHAS	PHASE B									
BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL				
ITEM	ID									
		MOBILIZATION/DEMOBILIZATION (NOT TO	LS	1	\$22,011.96	\$22,011.96				
		EXCEED 5% OF SUBTOTAL)								

LS

1

SITE POWER AND METER CONTROLS, CIP.

Enclosure 5

Settlement Water Line Replacement and Metering

Engineer's Estimate
100% Design Submittal

CONSTRUCTION SURVEY AND STAKING, PER	LS	1	\$5,767.13	\$5,767.13
CONTRACT SPECIAL PROVISIONS, CIP.				
CONSTRUCTION TRAFFIC CONTROL AND	LS	1	\$22,000.00	\$22,000.00
BARRICADING, COMPLETE.				
MATERIAL TESTING ALLOWANCE	ALLOW	1	\$6,000.00	\$6,000.00
NPDES COMPLIANCE	LS	1	\$2,773.51	\$2,773.51
CONSTRUCTION PROJECT SIGN, PER CONTRACT	EA	1	\$1,000.00	\$1,000.00
SPECIAL PROVISIONS, CIP				
MINOR PAVEMENT, REMOVE AND REPLACE	SY	483	\$25.00	\$12,077.50
REMOVE AND REPLACE CONCRETE CURB AND	LF	0	\$30.00	\$0.00
GUTTER,CIP.				
SEEDING, CLASS "A", NATIVE, CIP.	SY	0	\$6,700.00	\$624.47
BASE COURSE 4"	SY	483	\$10.00	\$4,831.00
10" DUCTILE IRON WL PIPE	LF	100	\$38.00	\$3,800.00
12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	166	\$40.00	\$6,640.00
TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
CIP.				
10" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	1005	\$34.00	\$34,170.00
TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
CIP.				
DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"	LB	12504	\$4.50	\$56 <i>,</i> 268.00
WATERLINE, INCL. JOINTING MATERIAL, CIP.				
NON-PRESSURIZED CONNECTION TO EXISTING	EA	21	\$1,500.00	\$31,500.00
WATER LINE, ALL SIZES, COMPL.				
CUT AND REMOVE EXISTING NON-ASBESTOS	LF	105	\$500.00	\$52,500.00
WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
TRENCH & COMPACTED BACKFILL, CIP.				
2" COMBINATION AIR RELEASE VALVE, PER	EA	3	\$3,800.00	\$11,400.00
DETAIL DRAWING, CIP.				
12" TRANSITION COUPLING, CIP.	EA	4	\$831.06	\$3,324.24
10" TRANSITION COUPLING	EA	18	\$800.00	\$14,400.00
10" GATE VALVE, MJ X MJ, CIP	EA	19	\$2,250.00	\$42,750.00
12" GATE VALVE, MJ X MJ, CIP	EA	4	\$2,500.00	\$10,000.00
VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	23	\$750.00	\$17,250.00
C-501, CIP.				
6" FIRE HYDRANT, W/ GATE, TEE, AND PIPING,	EA	2	\$3,500.00	\$7,000.00
PER DETL ON SHEET C-502, INSTALL CIP.				
MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	177	\$120.00	\$21,240.00
PVC, 10"-12"				
JOINT RESTRAINING HARNESS PUSH ON BELLS, DI	EA	2	\$100.00	\$200.00
& PVC, 4"-8"				
JOINT RESTRAINING HARNESS PUSH ON BELLS, DI	EA	13	\$188.00	\$2,444.00
& PVC, 10"-12"				

Enclosure 5

Settlement Water Line Replacement and Metering Engineer's Estimate

100% Design Submittal

HORIZONTAL DIRECTIONAL DRILL, 12" FPVC LF 208 \$150.00 \$33 CARRIER PIPE INCLUDED HORIZONTAL DIRECTIONAL DRILL, 10" FPVC LF 183 \$140.00 \$22 CARRIER PIPE INCLUDED JACKING AND BORING, STEEL PIPE CASING 20", INCL SPACERS AND END SEALS, CIP LF 100 \$500.00 \$50 INCL SPACERS AND END SEALS, CIP I 100 \$500.00 \$50 INCL SPACERS AND END SEALS, CIP I 46 \$34.00 \$ IO" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP. LB 1000 \$4.50 \$ IO I MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP. LB 1000 \$4.50 \$ IO" TRANSITION COUPLING EA 1 \$800.00 \$ \$ IO" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$ \$ VALVE BOX, INSTALL PER DETAIL DRAWING SHEET EA 10 \$120.00 \$ \$ VALVE BOX, INSTALL PER DETAIL DRAWING GLAND, DI & PVC, 10"-12" EA 10 \$120.00 \$ MECHANIC	
CARRIER PIPE INCLUDEDImage: Constraint of the system of the s	1,200.00
HORIZONTAL DIRECTIONAL DRILL, 10" FPVC CARRIER PIPE INCLUDEDLF183\$140.00\$29JACKING AND BORING, STEEL PIPE CASING 20", INCL SPACERS AND END SEALS, CIPLF100\$500.00\$50TA-3 METERIIIIII10" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.LF46\$34.00\$10DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP.LB1000\$4.50\$1010" TRANSITION COUPLINGEA1\$800.00\$4.50\$10\$1010" GATE VALVE, MJ X MJ, CIPEA3\$2,250.00\$10\$10VALVE BOX, INSTALL PER DETAIL DRAWING SHEET C-501, CIP.EA10\$120.00\$10MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12"EA1\$9,805.95\$10METER VAULT, CIPEA1\$10,000.00\$11METER V	
CARRIER PIPE INCLUDEDImage: Carrier of the system of the syst	5,620.00
JACKING AND BORING, STEEL PIPE CASING 20", INCL SPACERS AND END SEALS, CIPLF100\$500.00\$50TA-3 METERIIIIIII10" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.LF46\$34.00\$1DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP.LB1000\$4.50\$410" TRANSITION COUPLINGEA1\$800.00\$1\$2,250.00\$110" GATE VALVE, MJ X MJ, CIPEA3\$2,250.00\$1\$1VALVE BOX, INSTALL PER DETAIL DRAWING SHEET C-501, CIP.EA10\$120.00\$1MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12"EA1\$9,805.95\$1METER VAULT, CIPEA1\$10,000.00\$11METER VAULT, CIPEA1\$1	
INCL SPACERS AND END SEALS, CIPImage: Constraint of the systemTA-3 METERImage: Constraint of the systemImage: Constraint of the system10" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.LF46\$34.00CIP.Image: Constraint of the systemImage: Constraint of the system\$4.50\$4.50DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP.LB1000\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.50Image: Constraint of the systemImage: Constraint of the systemImage: Constraint of the system\$4.	0,000.00
TA-3 METERImage: Constraint of the image: Cons	
10" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP. LF 46 \$34.00 \$ DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP. LB 1000 \$4.50 \$ 10" TRANSITION COUPLING EA 1 \$800.00 \$ 10" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$ VALVE BOX, INSTALL PER DETAIL DRAWING SHEET C-501, CIP. EA 10 \$100 \$120.00 \$ MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 1 \$9,805.95 \$ 10" MAGNETIC FLOW METER EA 1 \$10,000.00 \$11	
TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.Image: Compact of the second seco	1,564.00
CIP. LB 1000 \$4.50 \$4.50 DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP. LB 1000 \$4.50 \$4.50 10" TRANSITION COUPLING EA 1 \$800.00 \$4.50 \$5.50 10" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$5.50 VALVE BOX, INSTALL PER DETAIL DRAWING SHEET C-501, CIP. EA 3 \$750.00 \$5.50 MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 10 \$120.00 \$5.50 10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$5.50 METER VAULT, CIP EA 1 \$10,000.00 \$11.50	
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DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP.EA1\$800.0010" TRANSITION COUPLINGEA1\$800.00\$9000000000000000000000000000000000000	4,500.00
WATERLINE, INCL. JOINTING MATERIAL, CIP. EA 1 \$800.00 10" TRANSITION COUPLING EA 1 \$800.00 \$400 10" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$400 VALVE BOX, INSTALL PER DETAIL DRAWING SHEET EA 3 \$750.00 \$400 C-501, CIP. EA 10 \$120.00 \$400 MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 10 \$120.00 \$400 10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$400 \$400 METER VAULT, CIP EA 1 \$10,000.00 \$410 \$410,000.00 \$410	
10" TRANSITION COUPLING EA 1 \$800.00 10" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$4 VALVE BOX, INSTALL PER DETAIL DRAWING SHEET EA 3 \$750.00 \$5 C-501, CIP.	
10" GATE VALVE, MJ X MJ, CIP EA 3 \$2,250.00 \$4 VALVE BOX, INSTALL PER DETAIL DRAWING SHEET EA 3 \$750.00 \$4 C-501, CIP. A A \$100 \$120.00 \$4 MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 10 \$120.00 \$4 10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$4 METER VAULT, CIP EA 1 \$10,000.00 \$10 SITE POWER AND METER CONTROLS CIP L6 1 \$22,624.00 \$23	\$800.00
VALVE BOX, INSTALL PER DETAIL DRAWING SHEET EA 3 \$750.00 \$1 C-501, CIP. MECHANICAL JOINT RESTRAINING GLAND, DI & EA 10 \$120.00 \$1 PVC, 10"-12" 10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$1 METER VAULT, CIP EA 1 \$10,000.00 \$10	6,750.00
C-501, CIP. MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 10 \$120.00 <	2,250.00
MECHANICAL JOINT RESTRAINING GLAND, DI & PVC, 10"-12" EA 10 \$120.00	
PVC, 10"-12" EA 1 \$9,805.95 \$9 10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$9 METER VAULT, CIP EA 1 \$10,000.00 \$10	1,200.00
10" MAGNETIC FLOW METER EA 1 \$9,805.95 \$9 METER VAULT, CIP EA 1 \$10,000.00 \$10 SITE ROWER AND METER CONTROLS, CIP LG 1 \$22,624.00 \$23	
METER VAULT, CIP EA 1 \$10,000.00 \$10 SITE POWER AND METER CONTROLS CIP LC 1 \$22,624.00 \$22	9,805.95
	0,000.00
	2,634.00
SUBTOTAL: \$498	8,791.81

NMGRT @7.3125%: \$36,474.15

TOTAL: \$535,265.96

PHASE C

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		MOBILIZATION/DEMOBILIZATION (NOT TO	LS	1	\$38,427.63	\$38,427.63
		EXCEED 5% OF SUBTOTAL)				
		CONSTRUCTION SURVEY AND STAKING, PER	LS	1	\$10,068.04	\$10,068.04
		CONTRACT SPECIAL PROVISIONS, CIP.				
		CONSTRUCTION TRAFFIC CONTROL AND	LS	1	\$40,000.00	\$40,000.00
		BARRICADING, COMPLETE.				
		MATERIAL TESTING ALLOWANCE	ALLOW	1	\$6,000.00	\$6,000.00
		NPDES COMPLIANCE	LS	1	\$4,841.88	\$4,841.88
		CONSTRUCTION PROJECT SIGN, PER CONTRACT	EA	1	\$1,000.00	\$1,000.00
		SPECIAL PROVISIONS, CIP				
		ASPHALT PAVEMENT REMOVAL & DISPOSAL,	SY	2144	\$10.00	\$21,437.80
		SAWCUT, 2"-6" THICK (ASSUMING 6' WIDE CUT IN				
		TRENCH AREAS)				

Enclosure 5 Settlement Water Line

Replacement and Metering Engineer's Estimate

100% Design Submittal

	REPLACE CITY STREET PAVEMENT TRENCH	SY	713	\$50.00	\$35,653.00
	WIDTH, MATCH EXISTING PER DETAIL SHEET C-				
	502, MIN OF TYPE HMA SP III, 3" (ASSUMING 6'				
	WIDE CUT IN TRENCH AREAS)				
	MINOR PAVEMENT, REMOVE AND REPLACE	SY	1431	\$25.00	\$35,768.00
	REMOVE AND REPLACE CONCRETE CURB AND	LF	0	\$30.00	\$0.00
	GUTTER,CIP.				
	SEEDING, CLASS "A", NATIVE, CIP.	SY	1	\$6,700.00	\$4,964.10
	BASE COURSE 4"	SY	2144	\$10.00	\$21,437.80
	12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	6979	\$40.00	\$279,160.00
	TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
	CIP.				
	DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"	LB	14004	\$4.50	\$63,018.00
	WATERLINE, INCL. JOINTING MATERIAL, CIP.				
	NON-PRESSURIZED CONNECTION TO EXISTING	EA	20	\$1,500.00	\$30,000.00
	WATER LINE, ALL SIZES, COMPL.				
	CUT AND REMOVE EXISTING NON-ASBESTOS	LF	100	\$500.00	\$50,000.00
	WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
	TRENCH & COMPACTED BACKFILL, CIP.				
	2" COMBINATION AIR RELEASE VALVE, PER	EA	3	\$3,800.00	\$11,400.00
	DETAIL DRAWING, CIP.				
	12" TRANSITION COUPLING, CIP.	EA	_20	\$831.06	\$16,621.20
	10" GATE VALVE, MJ X MJ, CIP	EA	12	\$2,250.00	\$27,000.00
	12" GATE VALVE, MJ X MJ, CIP	EA	22	\$2,500.00	\$55,000.00
	VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	34	\$750.00	\$25,500.00
	C-501, CIP.				
	CONCRETE THRUST BLOCKING, CIP.	CY	13	\$600.00	\$7,866.67
	MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	186	\$120.00	\$22,320.00
	PVC, 10"-12"				
	JOINT RESTRAINING HARNESS PUSH ON BELLS, DI	EA	62	\$188.00	\$11,656.00
	& PVC, 10"-12"				
	HORIZONTAL DIRECTIONAL DRILL, 12" FPVC	LF	325	\$150.00	\$48,750.00
	CARRIER PIPE INCLUDED	_			
	TA-59				
	12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	4	\$40.00	\$160.00
	TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
	CIP.				
	12" TRANSITION COUPLING, CIP.	EA	2	\$831.06	\$1,662.12
	12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
	SITE POWER AND METER CONTROLS, CIP.	LS	1	\$26,425.00	\$26,425.00
			•	SUBTOTAL:	\$39,742.67

SUBTOTAL: \$867,890.12

NMGRT @7.3125%: \$63,464.46

TOTAL: \$931,354.58

PHAS	1ASE D							
BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL		
ITEM	ID		1 '					
			·					
		MOBILIZATION/DEMOBILIZATION (NOT TO	LS	1	\$16,716.65	\$16,716.65		
		EXCEED 5% OF SUBTOTAL)	L'			l		
		CONSTRUCTION SURVEY AND STAKING, PER	LS	1	\$4,379.76	\$4,379.76		
		CONTRACT SPECIAL PROVISIONS, CIP.	۱۲					
		CONSTRUCTION TRAFFIC CONTROL AND	LS	1	\$12,000.00	\$12,000.00		
		BARRICADING, COMPLETE.	'					
		MATERIAL TESTING ALLOWANCE	ALLOW	1	\$6,000.00	\$6,000.00		
		NPDES COMPLIANCE	LS	1	\$2,106.30	\$2,106.30		
		CONSTRUCTION PROJECT SIGN, PER CONTRACT	EA	1	\$1,000.00	\$1,000.00		
		SPECIAL PROVISIONS, CIP	'					
		ASPHALT PAVEMENT REMOVAL & DISPOSAL,	SY	849	\$10.00	\$8,494.00		
		SAWCUT, 2"-6" THICK (ASSUMING 6' WIDE CUT IN	1					
		TRENCH AREAS)	1					
	<u> </u>	REPLACE CITY STREET PAVEMENT TRENCH	SY	849	\$50.00	\$42,470.00		
		WIDTH. MATCH EXISTING PER DETAIL SHEET C-	1 '		-	· ·		
		502. MIN OF TYPE HMA SP III, 3" (ASSUMING 6'	1 '					
		WIDE CUT IN TRENCH AREAS)	1 '					
	<u> </u>	REMOVE AND REPLACE CONCRETE CURB AND	LF	0	\$30.00	\$0.00		
l I		GUTTER.CIP.	1 '		·	· ·		
	<u> </u>	BASE COURSE 4"	SY	849	\$10.00	\$8,494.00		
		10" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	1400	\$95.00	\$133,000.00		
ĺ		TRENCH & COMPACTED BACKFILL TO 6' DEPTH,	1 '		·			
ĺ		INCL. HAND EXCAVATION AND COMPACTION OF	1 '					
l I		EXISTING UTILITIES, CIP.	1 '					
	<u> </u>	DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"	LB	940	\$4.50	\$4,230.00		
		WATERLINE. INCL. JOINTING MATERIAL, CIP.	1 '	-	·			
		·····-, ·····	1 '					
	<u> </u>	NON-PRESSURIZED CONNECTION TO EXISTING	EA	11	\$1,500.00	\$16,500.00		
		WATER LINE. ALL SIZES, COMPL.	1 '		τ- / -	T = - , -		
	1	CUT AND REMOVE EXISTING NON-ASBESTOS	LF	55	\$500.00	\$27,500.00		
		WATFRI INE. UP TO 8" DIAMETER, EXCLUDING	1	-		· · · ,		
		TRENCH & COMPACTED BACKFILL, CIP.	1 '					
	<u> </u>	12" TRANSITION COUPLING. CIP.	EA	11	\$831.06	\$9.141.66		
	<u> </u>	8" GATF VALVE. MJ X MJ, CIP.	EA	3	\$1,200.00	\$3,600.00		
	<u> </u>	10" GATE VALVE. MJ X MJ, CIP	EA	19	\$2,250.00	\$42,750.00		
 	<u> </u>	VALVE BOX. INSTALL PER DETAIL DRAWING SHEET	EA	22	\$750.00	\$16.500.00		
		C-501 CIP			T	Y - v , - v = a		
	<u> </u>	CONCRETE THRUST BLOCKING. CIP.	СҮ	4	\$600.00	\$2.533.33		
 	<u> </u>	MECHANICAL IOINT RESTRAINING GLAND, DI &	FA	104	\$120.00	\$12,480,00		
		PVC 10"-12"			¥	φ 12 ,		

Enclosure 5 Settlement Water Line Replacement and Metering

Date January 19, 2018 LA-UR-17-31305

Engineer's Estimate 100% Design Submittal

JOINT RESTRAINING HARNESS PUSH ON BELLS, DI	EA	30	\$188.00	\$5,640.00
& PVC, 10"-12"				

SUBTOTAL: \$375,535.70

NMGRT @7.3125%: \$27,461.05

TOTAL: \$402,996.75

MERCURY 12"

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	87	\$40.00	\$3 <i>,</i> 480.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
			LB	2585	\$4.50	\$11,632.50
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"				
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		12" TRANSITION COUPLING, CIP.	EA	2	\$831.06	\$1,662.12
		12" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,500.00	\$7,500.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
		C-501, CIP.				
		MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	20	\$120.00	\$2,400.00
		PVC, 10"-12"				
		12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
		METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
		SITE POWER AND METER CONTROLS (2-METERS),	LS	1	\$35,487.00	\$35,487.00
		CIP				

SUBTOTAL: \$93,907.17

NMGRT @7.3125%: \$6,866.96

TOTAL: \$100,774.13

MERCURY 14"

BID ITEM	ITEM ID	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
		14" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.		68	\$40.00	\$2,720.00

-				
	LB	4095	\$4.50	\$18,427.50
DI MJ FITTINGS, MINIMUM CLASS 250, UP TO	O 12"			
WATERLINE, INCL. JOINTING MATERIAL, CIP.				
NON-PRESSURIZED CONNECTION TO EXISTIN	IG EA	2	\$1,500.00	\$3,000.00
WATER LINE, ALL SIZES, COMPL.				
CUT AND REMOVE EXISTING NON-ASBESTOS	6 LF	10	\$500.00	\$5,000.00
WATERLINE, UP TO 8" DIAMETER, EXCLUDIN	IG			
TRENCH & COMPACTED BACKFILL, CIP.				
14" TRANSITION COUPLING, CIP.	EA	2	\$972.00	\$1,944.00
14" BUTTERFLY VALVE, MJ X MJ, CIP.	EA	3	\$5,000.00	\$15,000.00
VALVE BOX, INSTALL PER DETAIL DRAWING S	SHEET EA	3	\$750.00	\$2,250.00
C-501, CIP.				
JERSEY BARRIER, CIP	EA	5	\$800.00	\$4,000.00
MECHANICAL JOINT RESTRAINING GLAND, D	I& EA	26	\$120.00	\$3,120.00
PVC, 10"-12"				
14" MAGNETIC FLOW METER	EA	1	\$17,560.95	\$17,560.95
METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
			SUBTOTAL:	\$83,022.45

NMGRT @7.3125%: \$6,071.02

TOTAL: \$89,093.47

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BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	46	\$40.00	\$1,840.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
			LB	1500	\$4.50	\$6,750.00
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"				
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		12" TRANSITION COUPLING, CIP.	EA	2	\$831.06	\$1,662.12
		12" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,500.00	\$7,500.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
		C-501, CIP.				
		MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$120.00	\$1,200.00
		PVC, 10"-12"				
		12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
		METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00

Enclosure 5 Settlement Water Line

Date January 19, 2018

LA-UR-17-31305

Replacement and Metering Engineer's Estimate

100% Design Submittal

NMGRT @7.3125%: \$5,742.99

TOTAL: \$84,279.66

ANNEVERSARY TANK

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		10" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	20	\$34.00	\$680.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		10" TRANSITION COUPLING	EA	2	\$800.00	\$1,600.00
		12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
		METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
		SITE POWER AND METER CONTROLS, CIP.	LS	1	\$26,448.00	\$26,448.00
					SUBTOTAL:	\$58.223.55

NMGRT @7.3125%: \$4,257.60

TOTAL: \$62,481.15

<u>TA-9</u>						
BID ITEM	ITEM ID	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
		12" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH & COMPACTED BACKFILL TO 4' DEPTH, CIP.	LF	46	\$40.00	\$1,840.00
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12" WATERLINE, INCL. JOINTING MATERIAL, CIP.	LB	1500	\$4.50	\$6,750.00
		NON-PRESSURIZED CONNECTION TO EXISTING WATER LINE, ALL SIZES, COMPL.	EA	2	\$1,500.00	\$3,000.00
		CUT AND REMOVE EXISTING NON-ASBESTOS WATERLINE, UP TO 8" DIAMETER, EXCLUDING TRENCH & COMPACTED BACKFILL, CIP.	LF	10	\$500.00	\$5,000.00
		12" TRANSITION COUPLING, CIP.	EA	2	\$831.06	\$1,662.12
		12" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,500.00	\$7,500.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET C-501, CIP.	EA	3	\$750.00	\$2,250.00

Enclosure 5 Settlement Water Line Replacement and Metering

Date January 19, 2018 LA-UR-17-31305

Engineer's Estimate

100% Design Submittal

MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$120.00	\$1,200.00
PVC, 10"-12"				
10" MAGNETIC FLOW METER	EA	1	\$9,805.95	\$9,805.95
METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
SITE POWER AND METER CONTROLS, CIP.	LS	1	\$27,240.00	\$27,240.00
			SUBTOTAL:	\$76,248.07

NMGRT @7.3125%: \$5,575.64

TOTAL: \$81,823.71

RULOB 1

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	46	\$40.00	\$1,840.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
			LB	1500	\$4.50	\$6,750.00
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"				
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		12" TRANSITION COUPLING, CIP.	EA	2	\$831.06	\$1,662.12
		12" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,500.00	\$7,500.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
		C-501, CIP.				
		JERSEY BARRIER, CIP	EA	5	\$800.00	\$4,000.00
		MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$120.00	\$1,200.00
		PVC, 10"-12"				
		12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
		METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
		SITE POWER AND METER CONTROLS (4-METERS),	LS	1	\$37,360.00	\$37,360.00
		CIP.				
					SUBTOTAL:	\$92,057.67
				NMG	RT @7.3125%:	\$6,731.72
				······	TOTAL:	\$98,789.39

RULOB 2

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					

			SUBTOTAL:	\$38,690.38
METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
8" MAGNETIC FLOW METER	EA	1	\$8,064.38	\$8,064.38
PVC, 4"-8"				
MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$80.00	\$800.00
BOLLARD, CIP	EA	5	\$350.00	\$1,750.00
C-501, CIP.			ľ	.,
VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
8" GATE VALVE, MJ X MJ, CIP.	EA	3	\$1,200.00	\$3,600.00
8" TRANSITION COUPLING, CIP.	EA	2	\$515.00	\$1,030.00
TRENCH & COMPACTED BACKFILL, CIP.				
WATERLINE, UP TO 8" DIAMETER, EXCLUDING				. ,
CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
WATER LINE, ALL SIZES, COMPL.				
NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
WATERLINE, INCL. JOINTING MATERIAL, CIP.				
DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"			ľ	. ,
, , , , , , , , , , , , , , , , , , ,	LB	424	\$4.50	\$1.908.00
& COMPACTED BACKFILL TO 4' DEPTH, CIP.				
8" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH				. ,
	LF	46	\$28.00	\$1,288.00

NMGRT @7.3125%: \$2,829.23

TOTAL: \$41,519.61

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
			LF	46	\$28.00	\$1,288.00
		8" WATERLINE PIPE, W/O FITTINGS, INCL. TRENCH				
		& COMPACTED BACKFILL TO 4' DEPTH, CIP.				
			LB	424	\$4.50	\$1,908.00
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"				
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		8" TRANSITION COUPLING, CIP.	EA	2	\$515.00	\$1,030.00
		8" GATE VALVE, MJ X MJ, CIP.	EA	3	\$1,200.00	\$3,600.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
		C-501, CIP.				
		BOLLARD, CIP	EA	5	\$350.00	\$1,750.00

Date January 19, 2018 LA-UR-17-31305

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	MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$80.00	\$800.00
	PVC, 4"-8"				
	8" MAGNETIC FLOW METER	EA	1	\$8,064.38	\$8,064.38
	METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00

\$38,690.38 SUBTOTAL:

NMGRT @7.3125%: \$2,829.23

> TOTAL: \$41,519.61

BID	ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
ITEM	ID					
		12" WATERLINE PIPE, W/O FITTINGS, INCL.	LF	46	\$40.00	\$1,840.00
		TRENCH & COMPACTED BACKFILL TO 4' DEPTH,				
		CIP.				
			LB	1000	\$4.50	\$4,500.00
		DI MJ FITTINGS, MINIMUM CLASS 250, UP TO 12"				
		WATERLINE, INCL. JOINTING MATERIAL, CIP.				
		NON-PRESSURIZED CONNECTION TO EXISTING	EA	2	\$1,500.00	\$3,000.00
		WATER LINE, ALL SIZES, COMPL.				
		CUT AND REMOVE EXISTING NON-ASBESTOS	LF	10	\$500.00	\$5,000.00
		WATERLINE, UP TO 8" DIAMETER, EXCLUDING				
		TRENCH & COMPACTED BACKFILL, CIP.				
		12" GATE VALVE, MJ X MJ, CIP	EA	3	\$2,500.00	\$7,500.00
		VALVE BOX, INSTALL PER DETAIL DRAWING SHEET	EA	3	\$750.00	\$2,250.00
		C-501, CIP.				
		JERSEY BARRIER, CIP	EA	5	\$800.00	\$4,000.00
		MECHANICAL JOINT RESTRAINING GLAND, DI &	EA	10	\$120.00	\$1,200.00
		PVC, 10"-12"				
		12" MAGNETIC FLOW METER	EA	1	\$11,495.55	\$11,495.55
		METER VAULT, CIP	EA	1	\$10,000.00	\$10,000.00
					SUBTOTAL:	\$50,785.55

NMGRT @7.3125%: \$3,713.69

> TOTAL: \$54,499.24

ENCLOSURE 6

LANS Response to NMED Review Letter of January 2, 2018

EPC-DO: 18-052

LA-UR-17-31305

Date:

JAN 3 1 2018

LANS Response to NMED Review Letter January 2, 2018

Specifications

NMED Question:

1. The documents submitted were incomplete. There were no contract documents submitted so a complete review was not possible. The final documents must include all the necessary "front end" documents to be completely reviewed.

LANL Response:

Plans and specifications have been updated and included in this submittal. Per agreement reached on January 23, 2018 final contract bid documents will be provided upon completion.

NMED Question:

- 2. There a quite a few technical specifications referred to as related requirements in the technical specifications that were missing from the set submitted. If a specification lists related requirements/sections they should be included in the project specifications in order to have a complete set of requirements. If they are not needed then they should not be referenced. The missing specifications referred to in the technical specifications are:
 - 01 2100 Allowances
 - 01 2300 Alternatives
 - 01 3100 Project Management and Coordination
 - 01 4000 Quality Requirements
 - 01 7 419 Construction Waste Management and Disposal
 - 03 3001 Formwork Requirements
 - 02 0548 Vibration and Seismic Controls
 - 26 4100 Lightning Protection System
 - 03 3001 Reinforced Concrete
 - 01 8734 Seismic Qualification of Nonstructural Components
 - 26 0548 Seismic Controls for Electrical Systems
 - 03 3053 Miscellaneous Cast-in-place concrete
 - 27 3000 Mounting Heights for receptacles
 - 26 2816 Enclosed Switches and Circuit Breakers
 - 01 5705 Temporary Controls and Compliance Requirements
 - 32 8400 Planting Irrigation
 - 22 0813 Pressure test piping system

LANL Response:

References to technical specifications have been reviewed and revised. Sections that are not needed have been removed, and sections that were needed have been included in the design package.

NMED Question:

3. There are a number of forms listed in the technical specifications as included that are missing.

The forms listed but not included are: Form 01 Substitution Request Form 01 Submittal transmittal Form Form 02 Delegated Design Review Form Form 03 Submittal Review Form

LANL Response:

All forms have been added to the technical specifications.

NMED Question:

4. There are several sections of the technical specifications that are not complete. All sections must be completed before the documents can be approved.

LANL Response:

All technical specification sections have been reviewed, red lines have been removed, commentary has been removed, and blanks have been filled-in.

NMED Question:

5. Pages numbers should be added to the technical specifications.

LANL Response

Page numbers are included for all technical specifications on the lower right corner of each page. Page numbering of technical specifications includes the spec number followed by the page number within that spec section (e.g. 01 3300-1.) This format is consistent with Construction Standards Institute (CSI) format, and agrees with LANL Master Spec format.

Plans

NMED Question:

1. Sheet G-0002 - The general notes should include the note about PRS that first appears on page 17. The Acronym is used on a number of sheets before it is finally defined on page 17.

LANL Response:

A list of acronyms found in the plans has been incorporated onto Sheet G-0002.

NMED Question:

2. In general a sheet showing acronyms/abbreviations would be helpful.

LANL Response:

A list of acronyms found in the plans has been incorporated onto Sheet G-0002.

NMED Question:

3. On many sheets the street names for E. Jemez Road and Pajarito Road are missing letters, and the words Approximate and Sequence are missing letters. It appears that J, Q, and X do not show up on the plan sheets.

LANL Response:

We believe that this was a printer setting error. We have reviewed street names in plans and do not see incidents of this. We believe that it has been corrected.

NMED Question:

4. Sheet C-1013 is missing keyed note 10.

LANL Response:

The general notes on Sheet G-0002 were re-numbered.

NMED Question:

5. Please make sure all electrical details are labelled as to location.

LANL Response:

References to electrical panel locations for each of the meters are shown on the Meter Station Site Plans.