



FINAL PLANS

Contract Drawings For

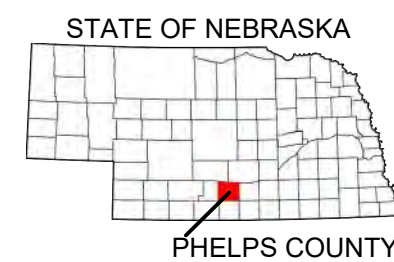
COTTONWOOD RANCH BROAD-SCALE RECHARGE

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Civil

Project No.
10057849

PHELPS COUNTY, NEBRASKA
MARCH 2018





GENERAL NOTES

- A) FINAL DRAWINGS
B) TECHNICAL SPECIFICATIONS
- THE CONTRACTOR SHALL COORDINATE ACCESS AND RESTRICT ALL CONSTRUCTION OPERATIONS TO THE PROPERTY OWNED OR MANAGED BY AND WITHIN TEMPORARY AND PERMANENT EASEMENTS OBTAINED BY THE PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
- A UNITED STATES ARMY CORPS OF ENGINEERS 404 PERMIT IS PENDING FOR THIS PROJECT. ANTICIPATED CONDITIONS ARE INCLUDED IN THE PROJECT SPECIFICATIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW THE PERMIT AND COMPLY WITH ALL ASPECTS OF THE PERMIT.
- ELEVATIONS SHOWN ARE REFERENCED TO NAVD 88.
- THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE PROJECT SITE IN A CLEAN AND SAFE MANNER. THE FINAL PAYMENT ESTIMATE WILL NOT BE PROCESSED UNTIL THE CONTRACTOR HAS SATISFACTORILY CLEANED THE SITE OF ALL RUBBISH, EXCESS MATERIAL, MUD AND DEBRIS, AND ALL PARTS OF THE WORK AREA HAVE BEEN LEFT IN A NEAT AND PRESENTABLE MANNER. HAUL AWAY DEBRIS RESULTING FROM CONSTRUCTION OPERATIONS OFF-SITE AND DISPOSE OF PROPERLY.
- UTILITIES ARE SHOWN AS A CONVENIENCE FOR THE CONTRACTOR AND SHALL BE FIELD VERIFIED. THE LOCATIONS OF ALL AERIAL AND UNDERGROUND UTILITIES ARE APPROXIMATE AND MAY NOT BE INDICATED IN THESE PLANS. UNDERGROUND UTILITIES, WHETHER INDICATED OR NOT, WILL BE LOCATED AND FLAGGED BY THE UTILITY COMPANIES AT THE CONTRACTOR'S REQUEST. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES BEFORE WORK IS STARTED TO VERIFY UTILITY LOCATIONS (DIGGERS HOTLINE OF NEBRASKA 1-800-331-6666). NO EXCAVATION WILL BE PERMITTED IN THE AREA UNTIL ALL UTILITIES HAVE BEEN LOCATED AND IDENTIFIED TO THE SATISFACTION OF ALL PARTIES AND THEN ONLY WITH EXTREME CARE TO AVOID ANY POSSIBILITY OF DAMAGE. THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER AND APPLICABLE UTILITY COMPANIES WHERE IMPACTS MAY OCCUR. ANY DAMAGE TO THE UTILITIES WILL BE AT THE CONTRACTORS EXPENSE.
- EROSION CONTROL IMPROVEMENTS ARE TO BE CONSTRUCTED ON THE SITE IN ACCORDANCE WITH THE ISSUED NPDES PERMIT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROMPT RECONSTRUCTION OF ANY EROSION CONTROL IMPROVEMENTS DISTURBED BY HIS OPERATIONS. ALL DISTURBED EROSION CONTROL IMPROVEMENTS SHALL BE FULLY RECONSTRUCTED AT THE END OF EACH WORKING DAY PRIOR TO LEAVING THE SITE. SEPARATE PAYMENT WILL NOT BE MADE FOR RECONSTRUCTION OF ANY EROSION CONTROL IMPROVEMENTS AND THIS WORK SHALL BE CONSIDERED SUBSIDIARY TO THOSE ITEMS FOR WHICH PAYMENT IS MADE. POSITIVE DRAINAGE IN ALL WORK AREAS SHALL BE MAINTAINED IN THE CONDITION THE CONSTRUCTION SITE WAS IN PRIOR TO CONTRACTORS ARRIVAL.
- NO CLOSURE OF ANY PUBLIC STREETS WILL BE ALLOWED AT ANY TIME DURING THIS PROJECT.
- FURNISH AND MAINTAIN ALL NECESSARY BARRICADES, WARNING SIGNS, LIGHTS AND FLAGMEN AS NECESSARY TO PROMOTE SAFE TRAFFIC OPERATIONS BOTH ON THE SITE AND ON PUBLIC ROADS IMPACTED BY SITE CONSTRUCTION TRAFFIC. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY APPROVALS OR PERMITS NEEDED FOR ANY ACTIVITIES THAT MAY IMPACT EXISTING ROADS.
- PROTECT BY WHATEVER MEANS REQUIRED ALL FENCES, SIGNS, STRUCTURES, DRIVES, ROADS, ETC. WHICH ARE NOT DESIGNATED FOR REMOVAL.
- THE CONTRACTOR IS RESPONSIBLE TO ENSURE ALL EXCAVATIONS ARE MADE IN ACCORDANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) CONSTRUCTION STANDARDS -29CFR PART 1926, SUBPART P-EXCAVATIONS AS PUBLISHED IN THE FEDERAL REGISTER, VOLUME 54, 209, OCTOBER 31, 1989, RULES AND REGULATIONS.
- THE CONTRACTOR SHALL DISPOSE OF ALL UNSUITABLE MATERIALS ENCOUNTERED IN THE REMOVAL AND GRADING OPERATIONS OFF THE PROJECT SITE, INCLUDING CONCRETE, ASPHALT, OIL MAT, BRICK, ROCK, ETC.. NO UNSUITABLE MATERIAL, AS DETERMINED BY THE ENGINEER, SHALL BE USED FOR BACKFILLING OR EMBANKMENT CONSTRUCTION.
- ANY ITEMS WITHIN THE PROJECT SITE THAT ARE NOT IDENTIFIED BUT NECESSARY FOR REMOVAL SHALL BE REMOVED AND PROPERLY DISPOSED OF OFF-SITE OR AS APPROVED BY THE ENGINEER.
- ALL DRAWING ELEVATIONS ARE FINAL ELEVATIONS OF FACILITIES AFTER CONSTRUCTION AND LONG TERM SETTLEMENT HAVE OCCURRED, UNLESS OTHERWISE NOTED.
- ELECTRONIC DESIGN FILES WILL BE PROVIDED TO THE CONTRACTOR FOR CONVENIENCE IN STAKING OF THE PROJECT. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF THE INFORMATION, AND TO COORDINATE WITH THE ENGINEER TO RESOLVE ANY DISCREPANCIES PRIOR TO BEGINNING CONSTRUCTION.
- THE CONTRACTOR SHALL RESTORE ALL EXISTING FACILITIES AND AREAS DISTURBED IN THE COURSE OF CONSTRUCTION TO A CONDITION EQUAL TO OR BETTER THAN EXISTING AND SHALL GRADE TO DRAIN AND SEEDED ALL UNSURFACED AREAS DISTURBED IN THE COURSE OF CONSTRUCTION INCLUDING CONTRACTOR WORK AREAS AND WASTE AREAS FOR EXCESS EXCAVATION.
- USE OF THE TERM "MAXIMUM" IN SLOPE CALLOUTS (I.E. MAXIMUM 3H:1V) IN THE DRAWINGS SHALL BE INTERPRETED AS "NO STEEPER THAN".
- FOR WORK AROUND WETLAND AREAS, AS SHOWN ON SHEET G-02:

 - FILL IN WETLAND AREAS NOT IDENTIFIED ON THE PLANS IS PROHIBITED (SEE SECTION 404 PERMIT IN SPECIFICATIONS)
 - AVOID WETLANDS TO EXTENT PRACTICABLE
 - IF AVOIDANCE IS NOT REASONABLE, USE WETLAND MATS WHEN CROSSING IN WET CONDITIONS. AFTER CONSTRUCTION, REMOVE WETLAND MATS AND RESTORE TO EXISTING CONTOURS. WHEN CROSSING IN DRY CONDITIONS, USE OF WETLAND MATS IS NOT REQUIRED. AFTER CONSTRUCTION, RESTORE TO EXISTING CONTOURS.
- CONSTRUCT 50-FT RADIUS AT ALL BERM PI LOCATIONS.
- PRRIP TO LOCATE AND MARK ALL MONITORING WELLS. CONTRACTOR TO PRESERVE ALL MONITORING WELLS. NO EXCAVATION WITHIN 10 FEET OF MONITORING WELLS. CONTRACTOR TO NOTIFY PRRIP IF AN UNMARKING MONITORING WELL IS ENCOUNTERED.
- EXISTING BERM EMBANKMENT UNDER PROPOSED BERMS AND WITHIN 100 FEET UPSTREAM OF PROPOSED BERMS IS TO BE REMOVED TO ORIGINAL GROUND. SUITABLE MATERIALS MAY BE USED FOR EMBANKMENT.

CELL DATA

CELL #	APPROXIMATE OPERATING WATER SURFACE ELEVATION	OVERFLOW CREST ELEVATION	BERM CREST ELEVATION
1	2291.6	2291.9	2293.4
2	2287.2	2287.5	2289.0
3	2287.2 ★	2287.5	2289.0
4	2286.1	2286.4	2287.9
5	2284.7	2284.9	2286.4
6	2283.1 ★	2283.3	2284.8
7	2281.2	2281.4	2282.9
8	2280.2	2280.5	2282.0

NOTE: IN THE EVENT OF DISCREPANCY THESE VALUES GOVERN.

- ★ UPSTREAM OF INTERIOR BERM CELL #3 2287.5
★ UPSTREAM OF INTERIOR BERM CELL #6 2284.8

SUMMARY OF QUANTITIES

ITEM #	DESCRIPTION	QUANTITY
1	MOBILIZATION & DEMOBILIZATION	1 LS
2	EROSION & SEDIMENT CONTROL	1 LS
3	CLEARING & GRUBBING	5.1 AC
4	STRIP, STOCKPILE, & REPLACE TOPSOIL	72,260 CY
5	BERM EMBANKMENT	174,203 CY
6	SEEPAGE MANAGEMENT BERM EMBANKMENT	12,820 CY
7	TOE DRAIN SYSTEM	1 LS
8	WATER LEVEL FLUME CONTROL STRUCTURES	7 EA
9	INLINE WATER LEVEL CONTROL STRUCTURE	1 EA
10	RIPRAP	4,523 CY
11	CRUSHED ROCK SURFACING	1,150 CY
12	ROAD DITCH DRAINAGE CONTROLS	1 LS
13	INTERNAL DRAIN CULVERTS	1 LS
14	SEEDING	196 AC
15	WATER SUPPLY PIPELINE SYSTEM	1 LS

LIST OF ABBREVIATIONS

	AND
AC	ACRE
ACI	AMERICAN CONCRETE INSTITUTE
AC-FT	ACRE-FEET
ADDL	ADDITIONAL
ASH	AUXILIARY SPILLWAY HYDROGRAPH
CLR	CLEAR
CONC	CONCRETE
CONT	CONTINUOUS
C.P.	CONTROL POINT
CY	CUBIC YARDS
D	DELTA
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DNR	DEPARTMENT OF NATURAL RESOURCES
E	EAST OR EASTING
EA	EACH
EL or ELEV	ELEVATION
EW	EACH WAY
EE	EACH END
EF	EACH FACE
EX	EXISTING
FBH	FREEBOARD HYDROGRAPH
FT	FEET
HDPE	HIGH DENSITY POLYETHYLENE
HEC-HMS	HYDROLOGIC ENGINEERING CENTER- HYDROLOGIC MODELING SYSTEM
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCH OR INCHES
IN/HR	INCHES PER HOUR
L	CURVE LENGTH
MAX	MAXIMUM
MIN	MINIMUM
MJ	MECHANICAL JOINT
N	NORTH OR NORTHING
NAD	NORTH AMERICAN DATUM
NAVD	NORTH AMERICAN VERTICAL DATUM
NDOT	NEBRASKA DEPARTMENT OF TRANSPORTATION
NIC	NOT IN CONTRACT
NO.	NUMBER
O.C.	ON CENTER
OD	OUTSIDE DIAMETER
OL	OUTLOT
P.C.	POINT OF CURVATURE
PE	PLAIN END
PI	POINT OF INTERSECTION
P.T.	POINT OF TANGENCY
PMP	PROBABLE MAXIMUM PRECIPITATION
R	RADIUS OR RANGE
S	SLOPE
SCH	SCHEDULE
SID	SANITARY IMPROVEMENT DISTRICT
SM	SQUARE MILES
SPA.	SPACING
SS	SANITARY SEWER
STA	STATION
STD	STANDARD
T	TANGENT OR TOWNSHIP
TOW	TOE OF WALL
TP	TYPICAL
U.S.	UNITED STATES
WS	WATER STOP
YR	YEAR

INDEX OF DRAWINGS

COVER

GENERAL

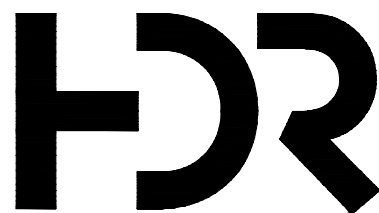
G-01	GENERAL INFORMATION
G-02	WETLANDS SITE PLAN

CIVIL

C-00	OVERALL SITE PLAN
C-01	CELL #1 & CELL #2 SITE PLAN & GEOMETRICS
C-02	CELL #3 SITE PLAN & GEOMETRICS
C-03	CELL #4 & CELL #5 SITE PLAN & GEOMETRICS
C-04	CELL #6 SITE PLAN & GEOMETRICS
C-05	CELL #7 & CELL #8 SITE PLAN & GEOMETRICS
C-06	CELL #1 OVERFLOW SPILLWAY
C-07	CELL #2 OVERFLOW SPILLWAY
C-08	CELL #3 OVERFLOW SPILLWAY
C-09	CELL #4 OVERFLOW SPILLWAY
C-10	CELL #5 OVERFLOW SPILLWAY
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C-18	TYPICAL SECTIONS
C-19	SWPPP (NOT INCLUDED)

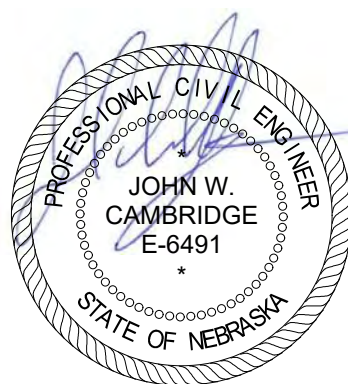
WATER SUPPLY LINE

C-20	NORTH DISCHARGE PIPING PLAN & PROFILE STA. 1+20 TO 14+00
C-21	NORTH DISCHARGE PIPING PLAN & PROFILE STA. 14+00 TO 28+00
C-22	NORTH DISCHARGE PIPING PLAN & PROFILE STA. 28+00 TO 29+25
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C-24	ENERGY DISSIPATOR
C-25	MISCELLANEOUS DETAILS
C-26	FENCING DETAILS
C-27	ELECTRICAL DETAILS
C-28	ELECTRICAL DETAILS
C-29	ELECTRICAL SCHEDULES



5	5-04-2018	FINAL DESIGN
4	3-29-2018	FINAL PENDING PIPELINE DESIGN
3	3-21-2018	REVISED FINAL FOR PROGRAM REVIEW
2	2-28-2018	FINAL FOR PROGRAM REVIEW
1	2-16-2018	90% PLAN REVIEW
-	-	-
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	PAT ENGELBERT
PROJECT NUMBER	10057849



04 MAY 2018

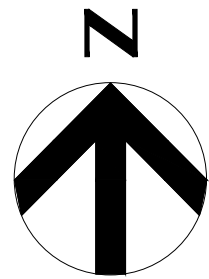
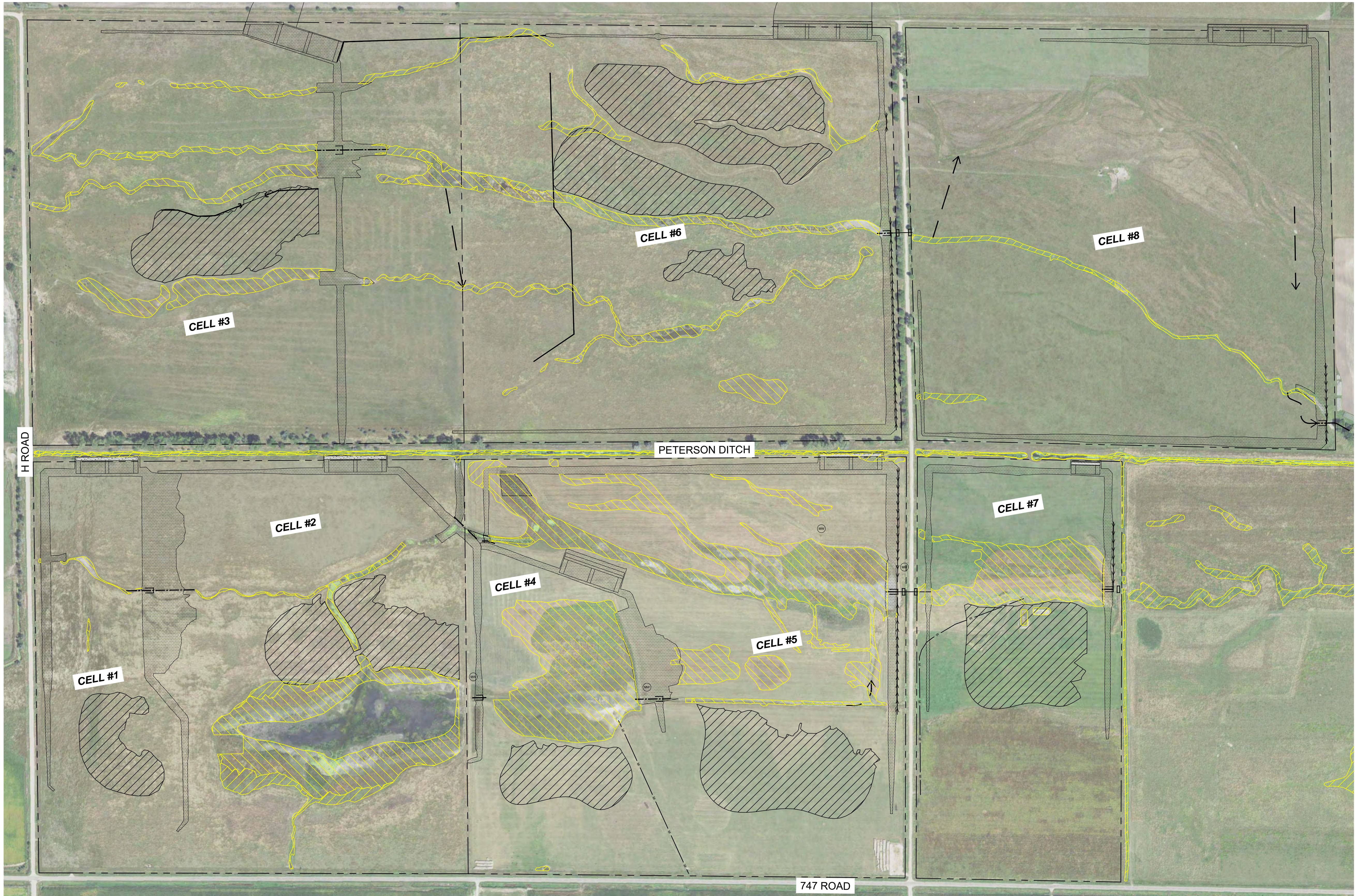
**PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT**

GENERAL INFORMATION

SHEET

G-01

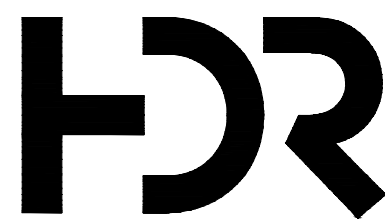
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LEGEND

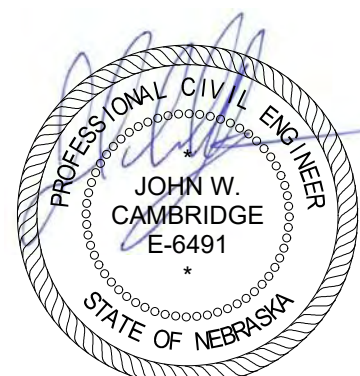
	FOOTPRINT OF PROPOSED BERMS
	FOOTPRINT OF PROPOSED BORROW AREAS
	WETLANDS
	EX. IRRIGATION PIPELINE



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COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

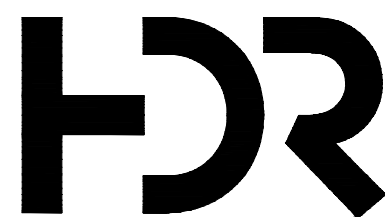
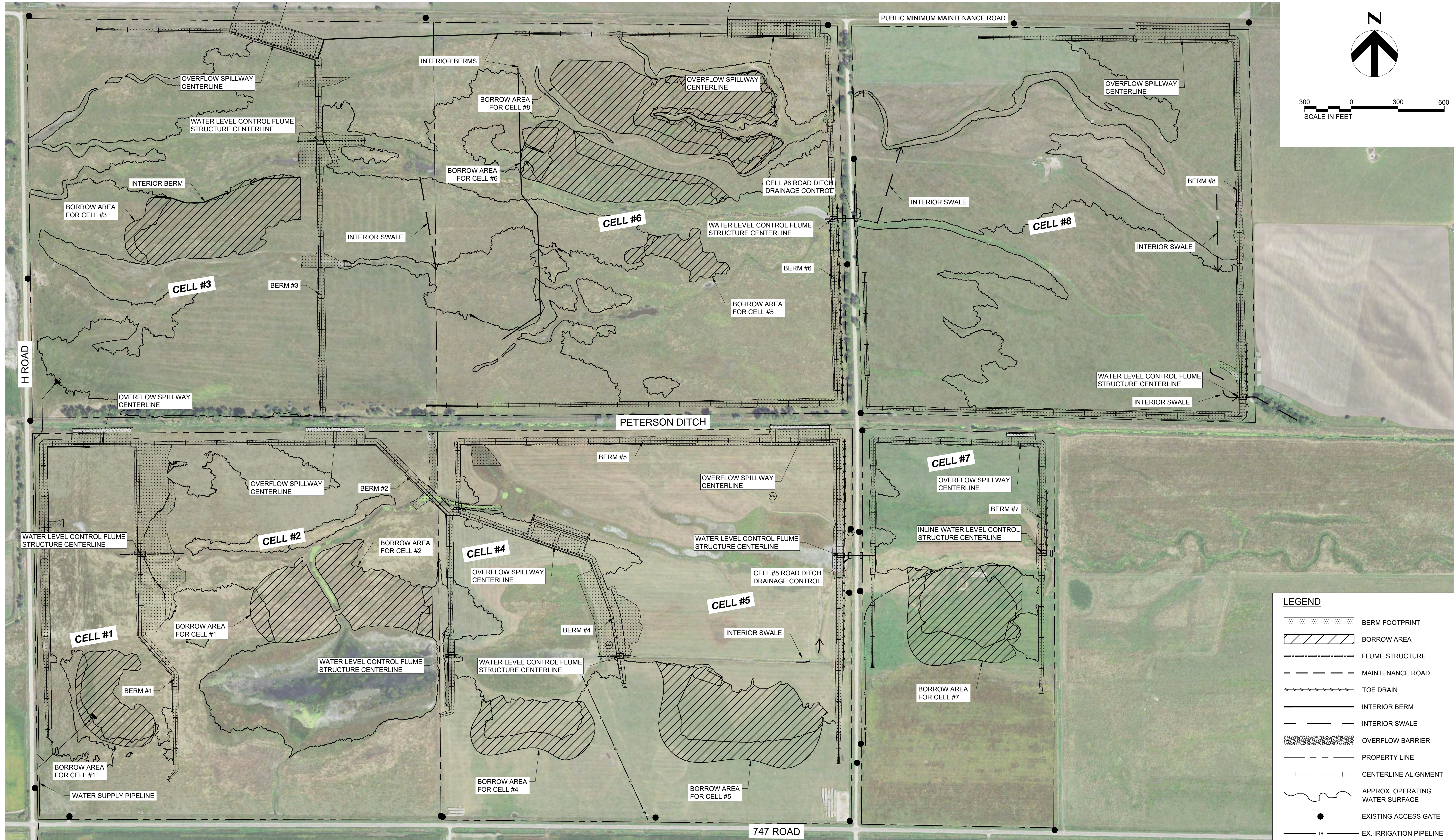
WETLANDS SITE PLAN

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SHEET
G-02

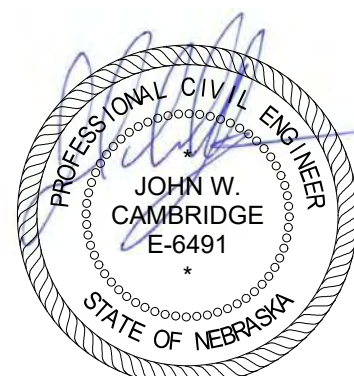
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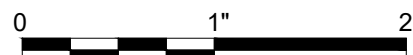
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COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
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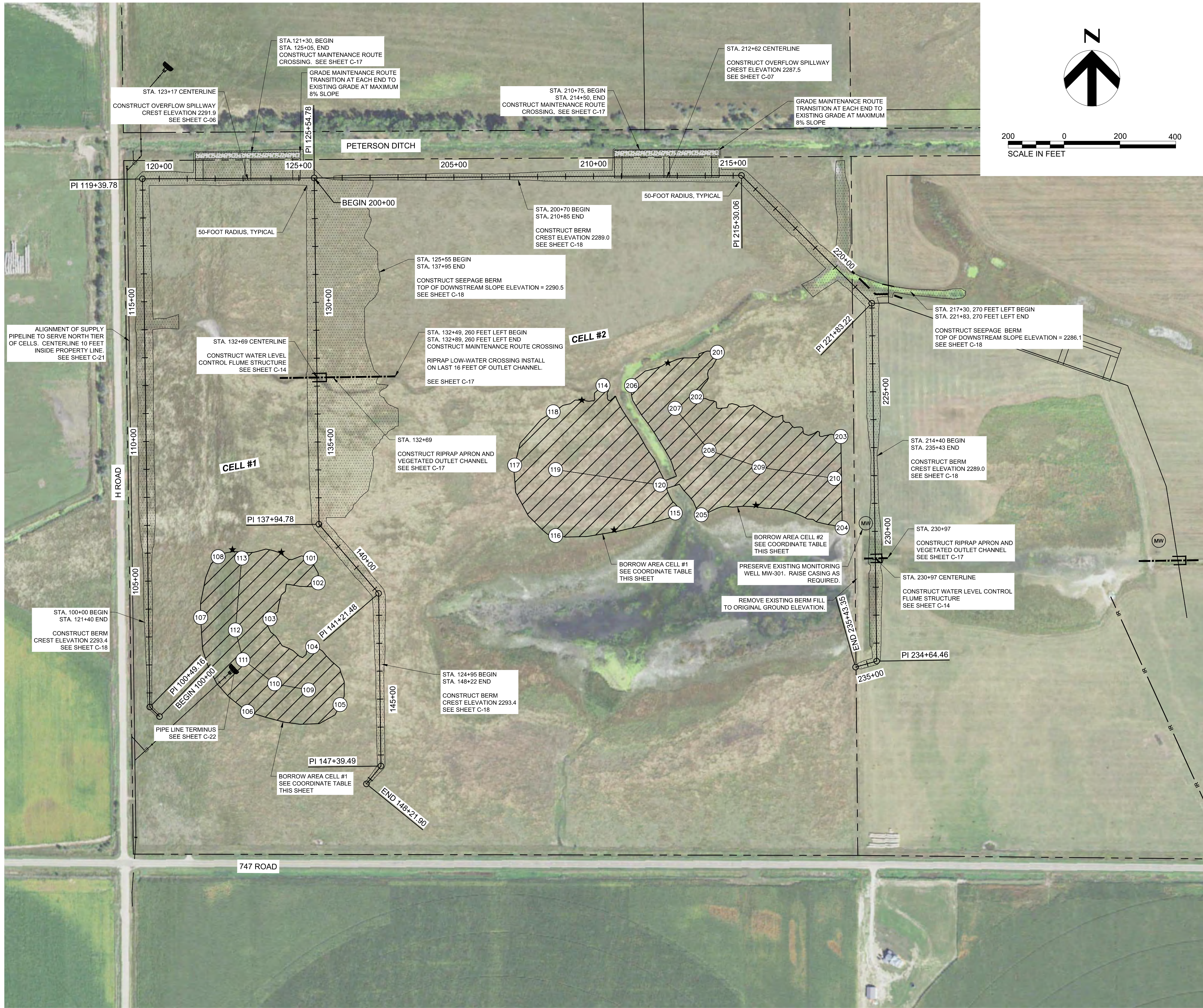
OVERALL SITE PLAN



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SHEET
C-00

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BERM #1 ALIGNMENT DATA			
NO.	STATION	NORTHING COORDINATE	EASTING COORDINATE
BEGIN	100+00.00	300846.71	1781094.85
PI	100+49.16	300880.98	1781059.61
PI	119+39.78	302771.42	1781033.40
PI	125+54.78	302774.98	1781648.39
PI	137+94.78	301535.10	1781665.58
PI	141+21.48	301287.77	1781879.03
PI	147+39.49	300669.82	1781887.59
END	148+21.90	300605.96	1781835.50

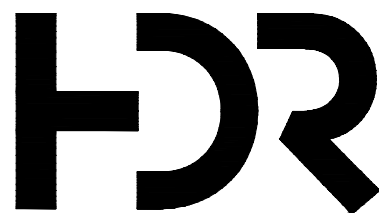
BERM #2 ALIGNMENT DATA			
NO.	STATION	NORTHING COORDINATE	EASTING COORDINATE
BEGIN	200+00.00	302774.98	1781648.39
PI	215+30.06	302783.86	1783178.43
PI	221+83.22	302326.57	1783644.80
PI	234+64.46	301045.45	1783662.56
END	235+43.35	301023.98	1783586.65

CELL #1 BORROW AREA				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
101	301414.25	1781635.12	2291.59	MATCH EX.
102	301325.64	1781662.76	2291.60	MATCH EX.
103	301196.98	1781490.21	2291.55	MATCH EX.
104	301096.97	1781642.85	2291.60	MATCH EX.
105	300889.62	1781741.11	2292.06	MATCH EX.
106	300864.95	1781409.82	2293.14	MATCH EX.
107	301201.42	1781241.98	2293.00	MATCH EX.
108	301419.16	1781304.74	2291.50	MATCH EX.
109	300942.33	1781628.05	2292.50	2290.60
110	300964.25	1781506.88	2292.37	2290.60
111	301050.19	1781393.52	2292.59	2290.60
112	301156.97	1781366.15	2292.37	2290.60
113	301414.16	1781389.04	2292.10	2290.60
114	302032.11	1782682.34	2287.20	MATCH EX.
115	301575.39	1782941.33	2287.16	MATCH EX.
116	301494.77	1782512.97	2287.28	MATCH EX.
117	301747.01	1782366.57	2289.50	MATCH EX.
118	301937.74	1782504.29	2287.27	MATCH EX.
119	301730.96	1782512.69	2289.41	2286.20
120	301675.84	1782887.51	2289.50	2286.20

CELL #2 BORROW AREA				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
201	302150.88	1783091.85	2287.22	MATCH EX.
202	301991.45	1783016.98	2287.20	MATCH EX.
203	301849.15	1783533.98	2287.21	MATCH EX.
204	301522.69	1783538.94	2287.25	MATCH EX.
205	301569.09	1783034.43	2287.09	MATCH EX.
206	302031.73	1782784.72	2287.15	MATCH EX.
207	301950.23	1782940.33	2288.71	2286.20
208	301799.89	1783061.93	2289.50	2286.20
209	301739.75	1783241.21	2289.00	2286.20
210	301699.35	1783512.05	2289.91	2286.20

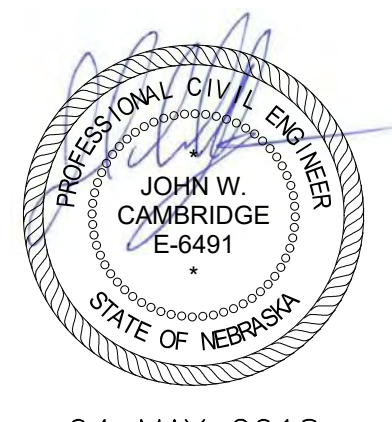
NOTE: GRADE BORROW AREAS TO PROVIDE UP TO FOUR CONNECTING CHANNEL "FINGERS" TO EACH ADJACENT POOL AREA AS DIRECTED BY ENGINEER. APPROXIMATE LOCATION DENOTED BY SYMBOL *. CHANNEL TO BE 0.5 FEET DEEP WITH A 20-FOOT BOTTOM WIDTH AND 4:1 SIDE SLOPES.

LEGEND	
	BERM FOOTPRINT
	BORROW AREA
	FLUME STRUCTURE
	MAINTENANCE ROAD
	TOE DRAIN
	INTERIOR BERM
	INTERIOR SWALE
	OVERFLOW BARRIER
	PROPERTY LINE
	CENTERLINE ALIGNMENT



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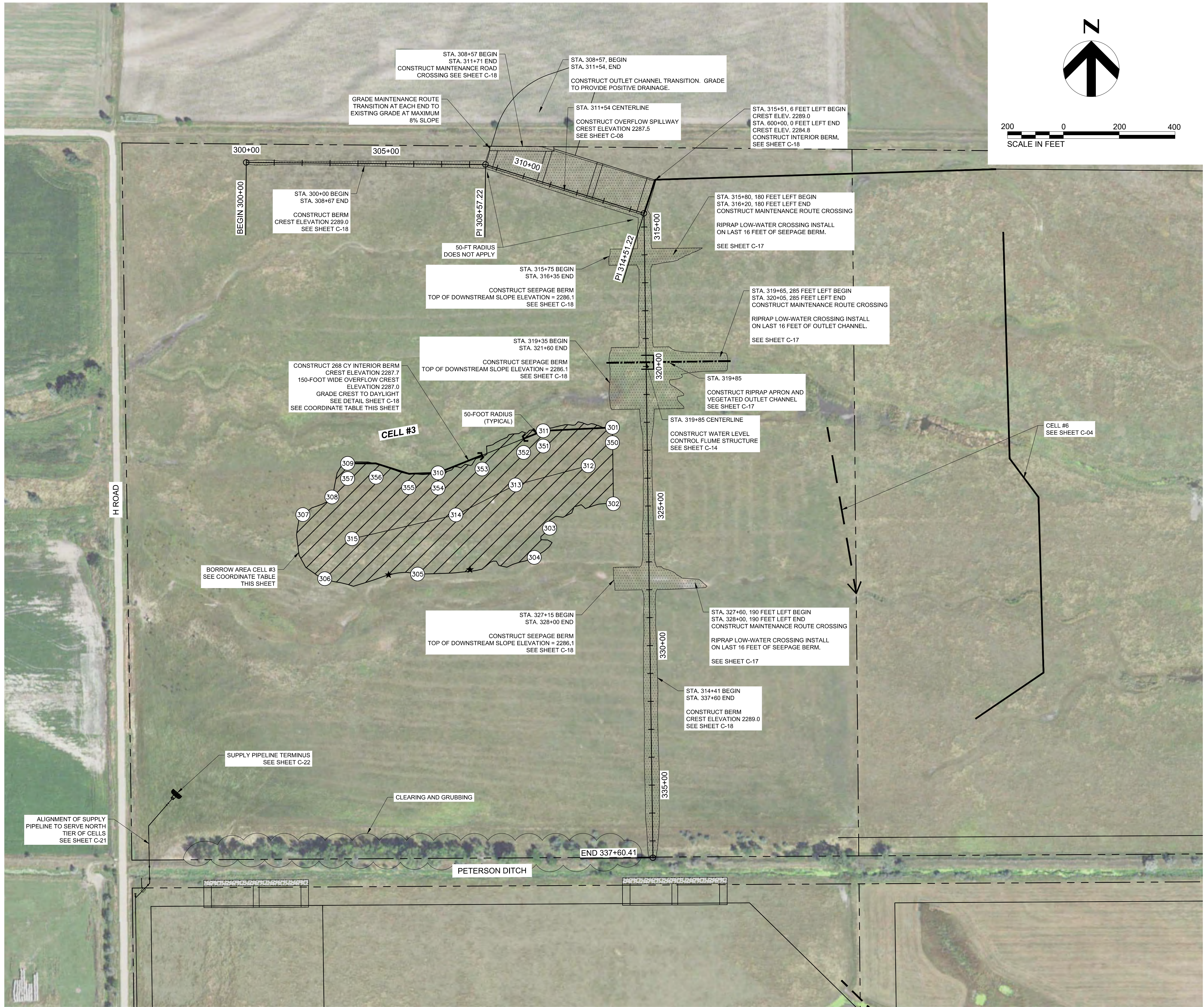
SITE PLAN & GEOMETRICS
CELL #1 & CELL #2



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SHEET
C-01

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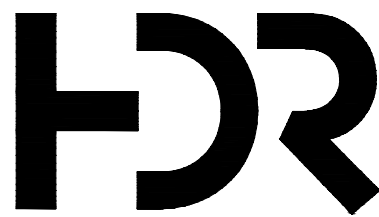
BERM #3 ALIGNMENT DATA			
NO.	STATION	NORTHING COORDINATE	EASTING COORDINATE
BEGIN	300+00.00	305437.03	1781375.33
PI	308+57.22	305429.46	1782232.51
PI	314+51.22	305254.49	1782800.15
END	337+60.41	302945.51	1782832.16

CELL #3 BORROW AREA				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
301	304487.53	1782687.12	2287.20	MATCH EX.
302	304214.05	1782690.70	2287.20	MATCH EX.
303	304126.44	1782462.35	2287.21	MATCH EX.
304	304021.74	1782407.39	2287.26	MATCH EX.
305	303961.86	1781989.23	2287.16	MATCH EX.
306	303945.29	1781656.51	2288.50	MATCH EX.
307	304174.79	1781578.33	2288.78	MATCH EX.
308	304238.09	1781682.13	2289.02	MATCH EX.
309	304358.63	1781738.58	2287.60	MATCH EX.
310	304324.71	1782062.48	2287.19	MATCH EX.
311	304475.28	1782439.19	2287.22	MATCH EX.
312	304350.02	1782600.68	2288.00	2286.20
313	304281.39	1782340.36	2288.15	2286.20
314	304174.00	1782126.21	2288.50	2286.20
315	304088.61	1781754.64	2288.00	2286.20

NOTE: GRADE BORROW AREAS TO PROVIDE UP TO FOUR CONNECTING CHANNEL "FINGERS" TO EACH ADJACENT POOL AREA AS DIRECTED BY ENGINEER. APPROXIMATE LOCATION DENOTED BY SYMBOL *. CHANNEL TO BE 0.5 FEET DEEP WITH A 20-FOOT BOTTOM WIDTH AND 4:1 SIDE SLOPES.

CELL #3 INTERIOR BERM				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
350	304487.53	1782687.12	2287.20	2287.7
351	304475.28	1782439.19	2287.22	2287.7
352	304447.21	1782368.95	2287.71	2287.7
353	304387.82	1782220.38	2287.14	2287.7
354	304324.71	1782062.48	2287.19	2287.7
355	304321.34	1781957.09	2287.18	2287.7
356	304358.32	1781840.09	2287.20	2287.7
357	304358.63	1781738.58	2287.60	2287.7

LEGEND	
	BERM FOOTPRINT
	BORROW AREA
	FLUME STRUCTURE
	MAINTENANCE ROAD
	TOE DRAIN
	INTERIOR BERM
	INTERIOR SWALE
	OVERFLOW BARRIER
	PROPERTY LINE
	CENTERLINE ALIGNMENT



ISSUE	DATE	DESCRIPTION
5	5-04-2018	FINAL DESIGN
4	3-29-2018	FINAL PENDING PIPELINE DESIGN
3	3-21-2018	REVISED FINAL FOR PROGRAM REVIEW
2	2-28-2018	FINAL FOR PROGRAM REVIEW
1	2-16-2018	90% PLAN REVIEW

PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

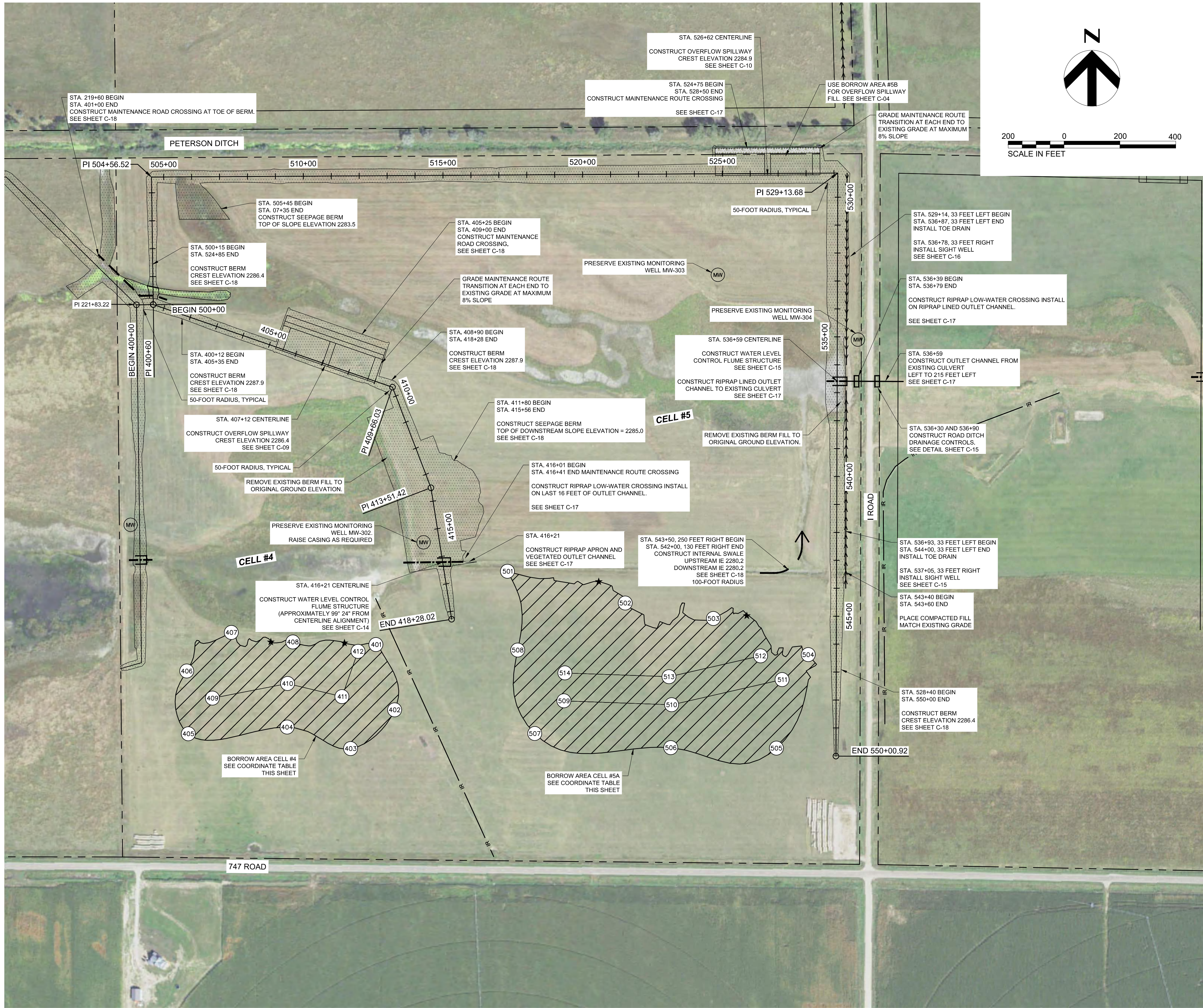
SITE PLAN & GEOMETRICS
CELL #3



FILENAME 00C-02.dwg
SCALE 1"=200'

SHEET
C-02

FILENAME: c:\pwworking\central01\0573856\00C-03.dwg PLOTTED: 5/4/2018 10:07 AM Buer, Steven



BERM #4 ALIGNMENT DATA			
NO.	STATION	NORTHING COORDINATE	EASTING COORDINATE
BEGIN	400+00.00	302326.57	1783644.80
PI	400+60.00	302327.40	1783704.79
PI	409+66.03	302031.57	1784561.17
PI	413+51.42	301671.64	1784698.92
END	418+28.02	301200.83	1784773.00

BERM #5 ALIGNMENT DATA			
NO.	STATION	NORTHING COORDINATE	EASTING COORDINATE
BEGIN	500+00.00	302327.40	1783704.79
PI	504+56.52	302783.87	1783698.46
PI	529+13.68	302798.13	1786155.59
END	550+00.92	300710.90	1786148.99

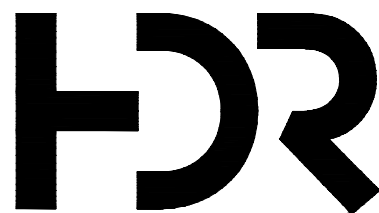
CELL #4 BORROW AREA				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
401	301110.25	1784502.10	2286.75	MATCH EX.
402	300876.63	1784568.95	2288.31	MATCH EX.
403	300737.99	1784411.30	2290.50	MATCH EX.
404	300814.77	1784183.91	2288.90	MATCH EX.
405	300790.91	1783830.46	2289.00	MATCH EX.
406	301015.41	1783824.49	2288.11	MATCH EX.
407	301153.69	1783984.46	2286.09	MATCH EX.
408	301119.60	1784204.49	2286.09	MATCH EX.
409	300918.50	1783916.63	2288.49	2285.10
410	300970.71	1784185.49	2288.50	2285.10
411	300923.94	1784380.33	2287.68	2285.10
412	301086.02	1784438.02	2286.50	2285.10

CELL #5A BORROW AREA				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
501	301372.58	1784973.06	2284.59	MATCH EX.
502	301258.89	1785394.74	2284.81	MATCH EX.
503	301203.57	1785710.24	2284.81	MATCH EX.
504	301074.08	1786049.90	2284.50	MATCH EX.
505	300739.50	1785935.97	2286.50	MATCH EX.
506	300741.13	1785557.77	2287.06	MATCH EX.
507	300791.77	1785070.69	2290.30	MATCH EX.
508	301090.56	1785009.62	2287.15	MATCH EX.
509	300908.85	1785175.02	2288.06	2283.70
510	300894.76	1785560.61	2286.15	2283.70
511	300984.85	1785956.27	2285.25	2283.70
512	301069.87	1785879.23	2285.36	2283.70
513	300995.18	1785551.17	2285.54	2283.70
514	301008.79	1785178.68	2287.72	2283.70

NOTE: GRADE BORROW AREAS TO PROVIDE UP TO FOUR CONNECTING CHANNEL "FINGERS" TO EACH ADJACENT POOL AREA AS DIRECTED BY ENGINEER. APPROXIMATE LOCATION DENOTED BY SYMBOL *. CHANNEL TO BE 0.5 FEET DEEP WITH A 20-FOOT BOTTOM WIDTH AND 4:1 SIDE SLOPES.

LEGEND	
	BERM FOOTPRINT
	BORROW AREA
	FLUME STRUCTURE
	MAINTENANCE ROAD
	TOE DRAIN
	INTERIOR BERM
	INTERIOR SWALE
	OVERFLOW BARRIER
	PROPERTY LINE
	CENTERLINE ALIGNMENT
	EX. IRRIGATION PIPELINE

NOTE: SEE SHEET C-04 FOR CELL #5 ADDITIONAL BORROW AREA



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PROJECT MANAGER PAT ENGELBERT	
PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

SITE PLAN & GEOMETRICS
CELL #4 & CELL #5

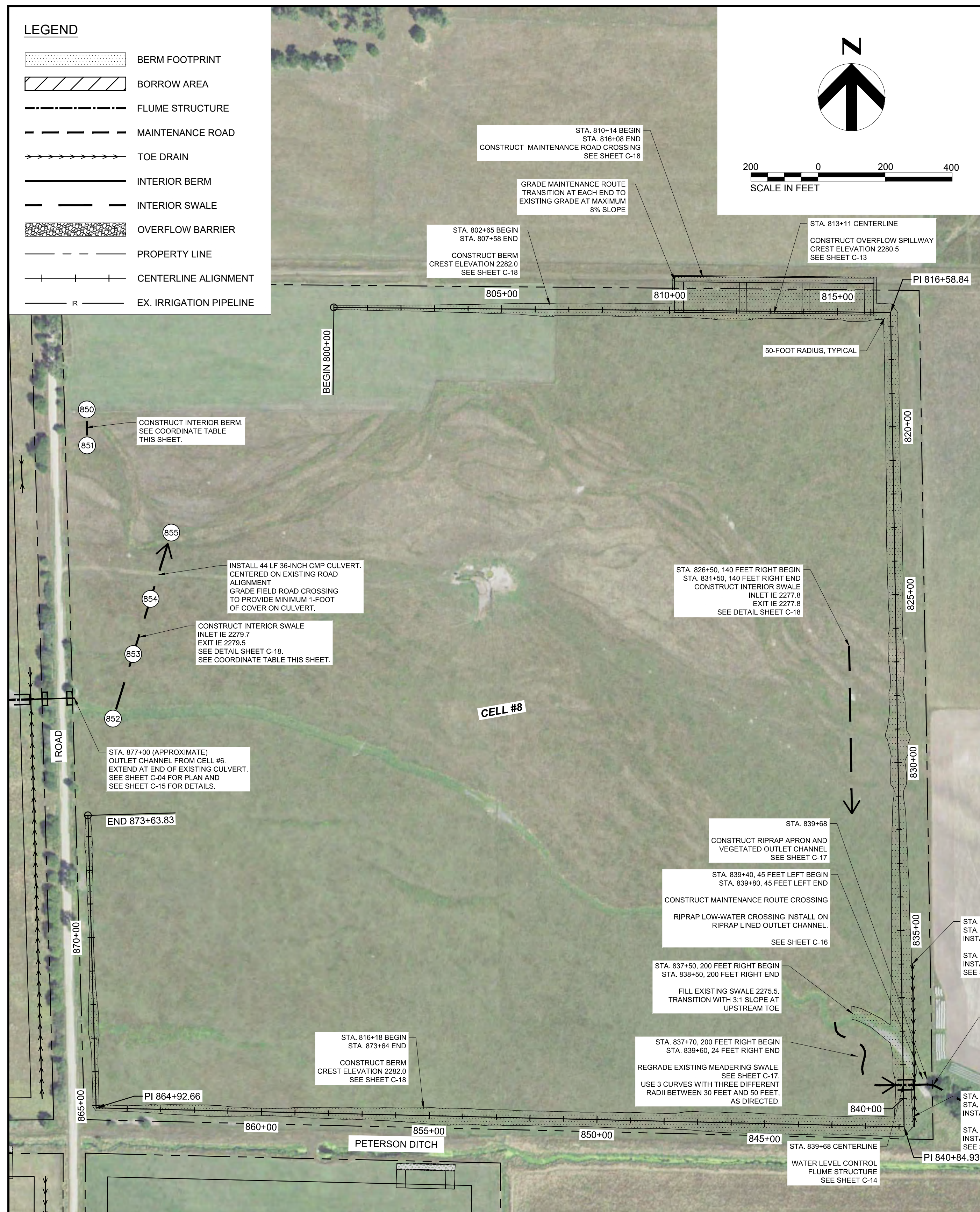


FILENAME 00C-03.dwg
SCALE 1"=200'

SHEET
C-03



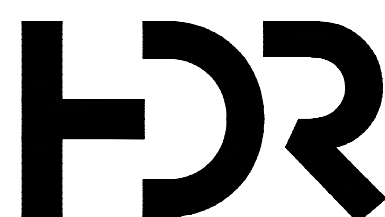
SHEET
C-04



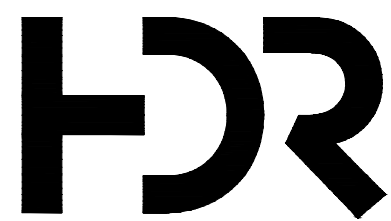
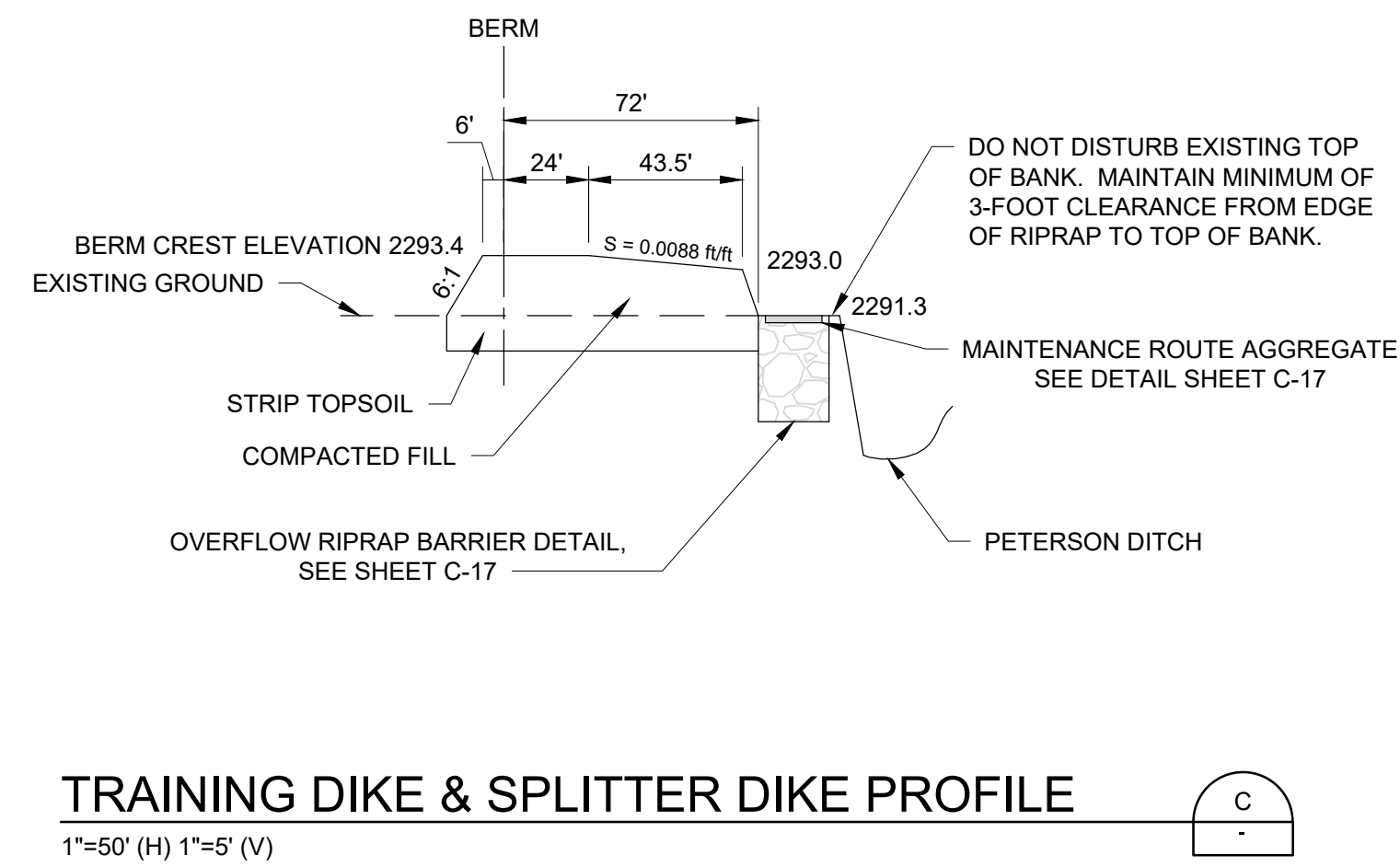
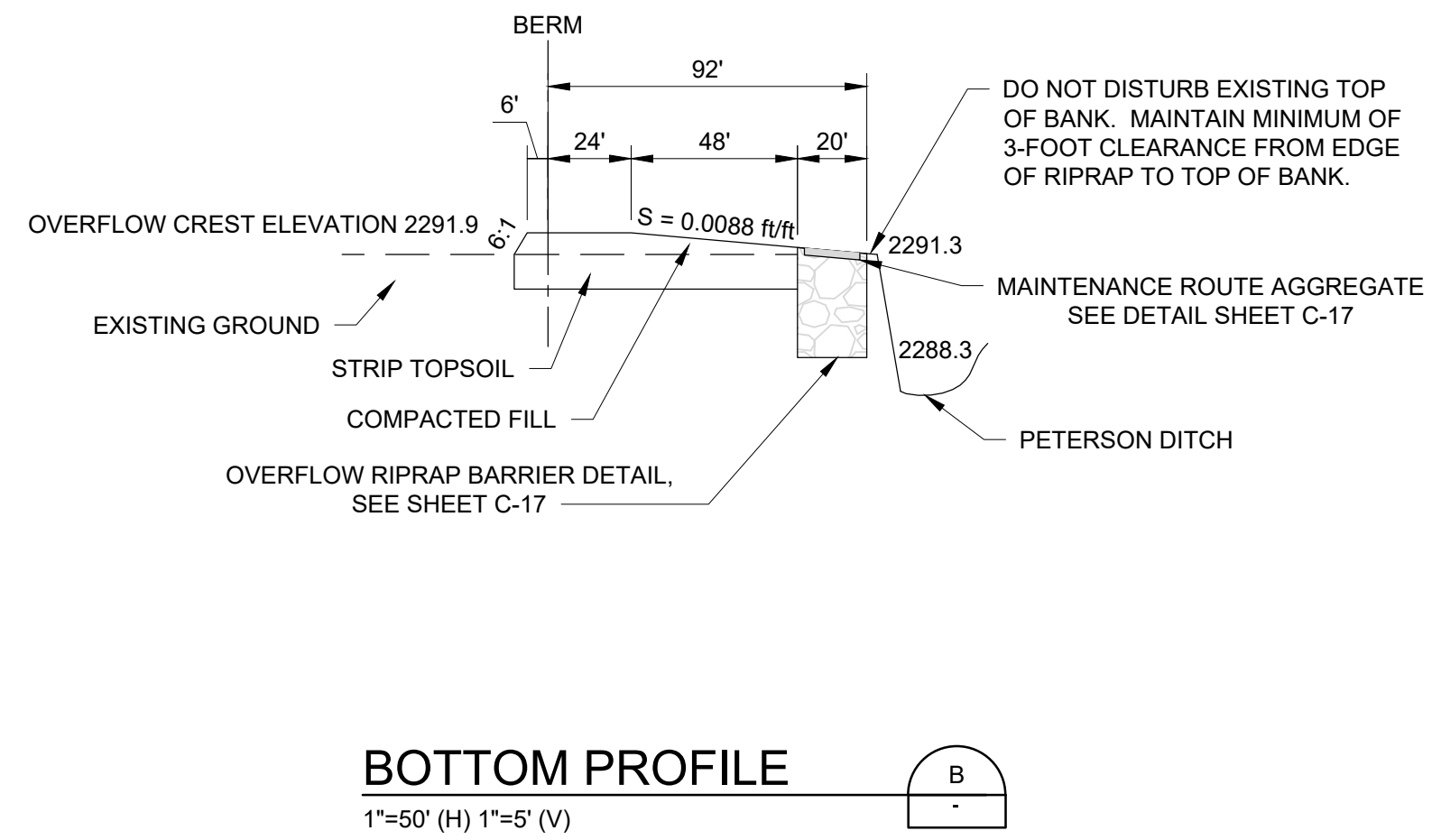
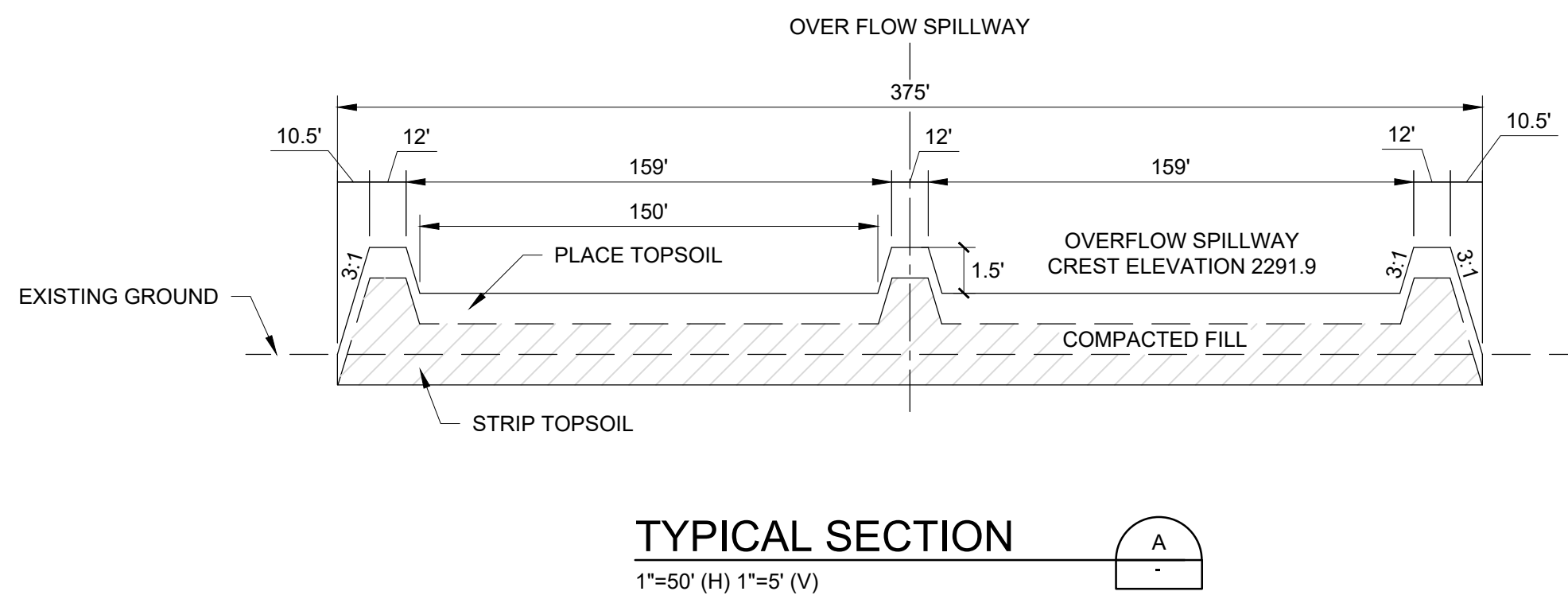
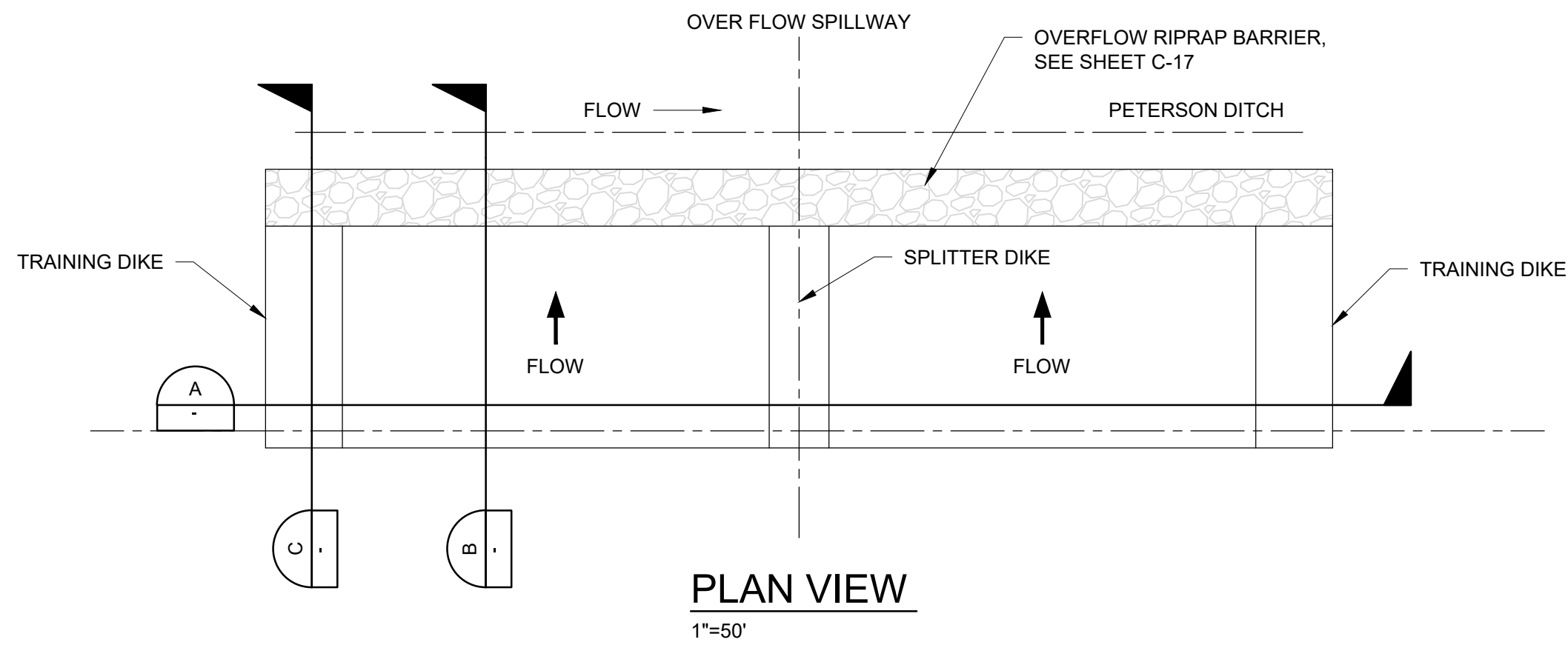
CELL #8 INTERIOR SWALE				
PT #	NORTHING	EASTING	EXISTING ELEVATION	PROPOSED ELEVATION
852	304190.29	1786399.26	2280.20	2279.7
853	304354.58	1786450.76	2281.78	2279.65
854	304518.88	1786502.26	2282.33	2279.55
855	304683.17	1786553.77	2280.20	2279.5

SHEET

C-05



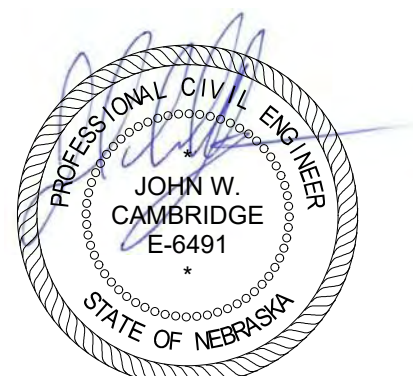
FILENAME: c:\pwworking\central\01\0573856\00C-06.dwg PLOTTED: 5/4/2018 10:09 AM Buer, Steven



ISSUE	DATE	DESCRIPTION
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4	3-29-2018	FINAL PENDING PIPELINE DESIGN
3	3-21-2018	REVISED FINAL FOR PROGRAM REVIEW
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1	2-16-2018	90% PLAN REVIEW
-	-	-

PROJECT MANAGER PAT ENGELBERT

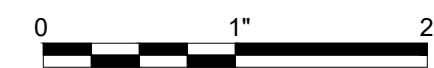
PROJECT NUMBER	10057849



04 MAY 2018

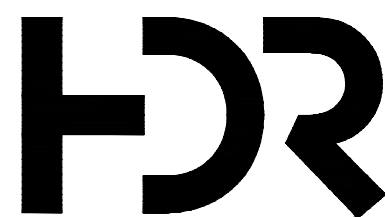
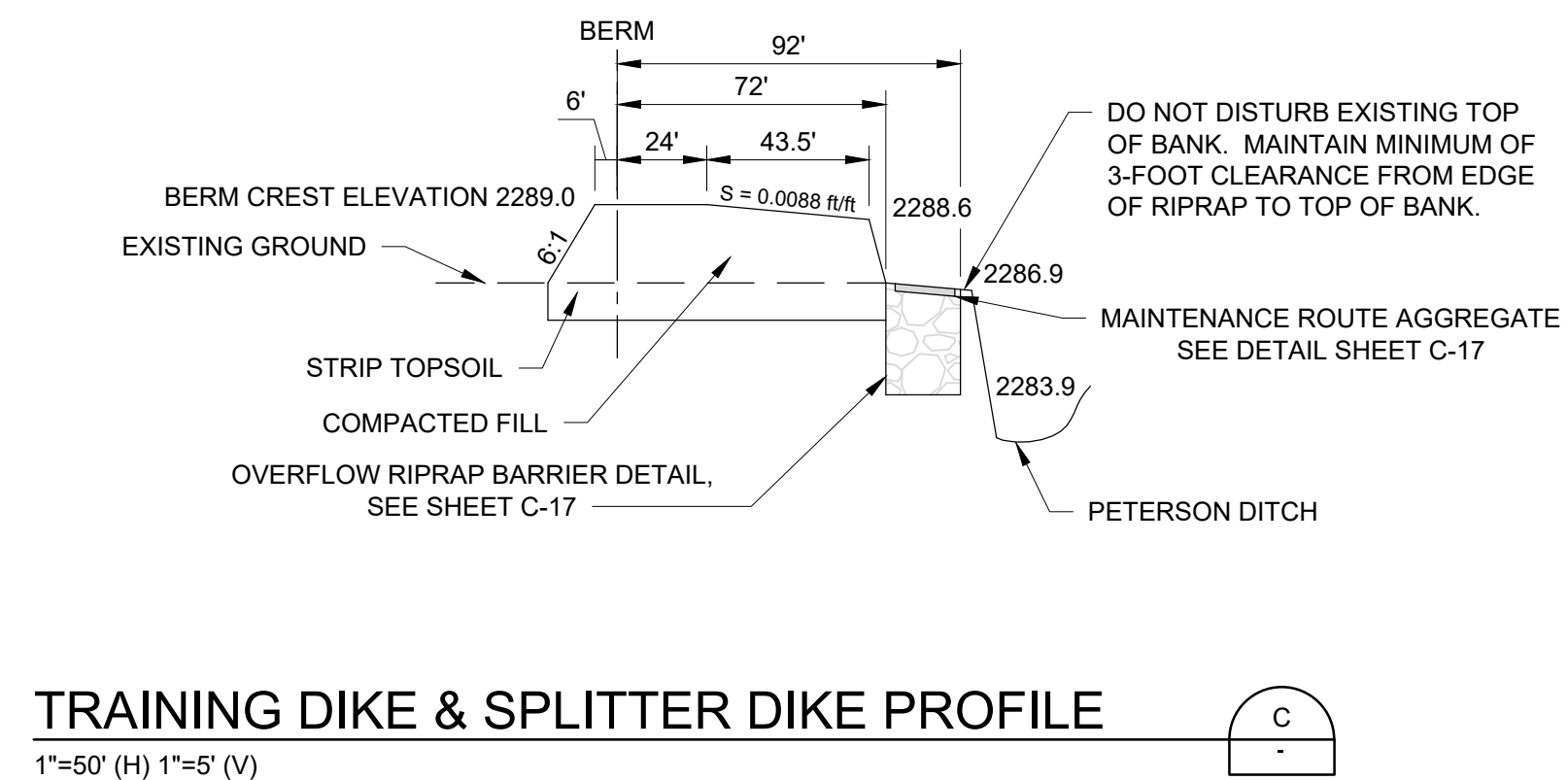
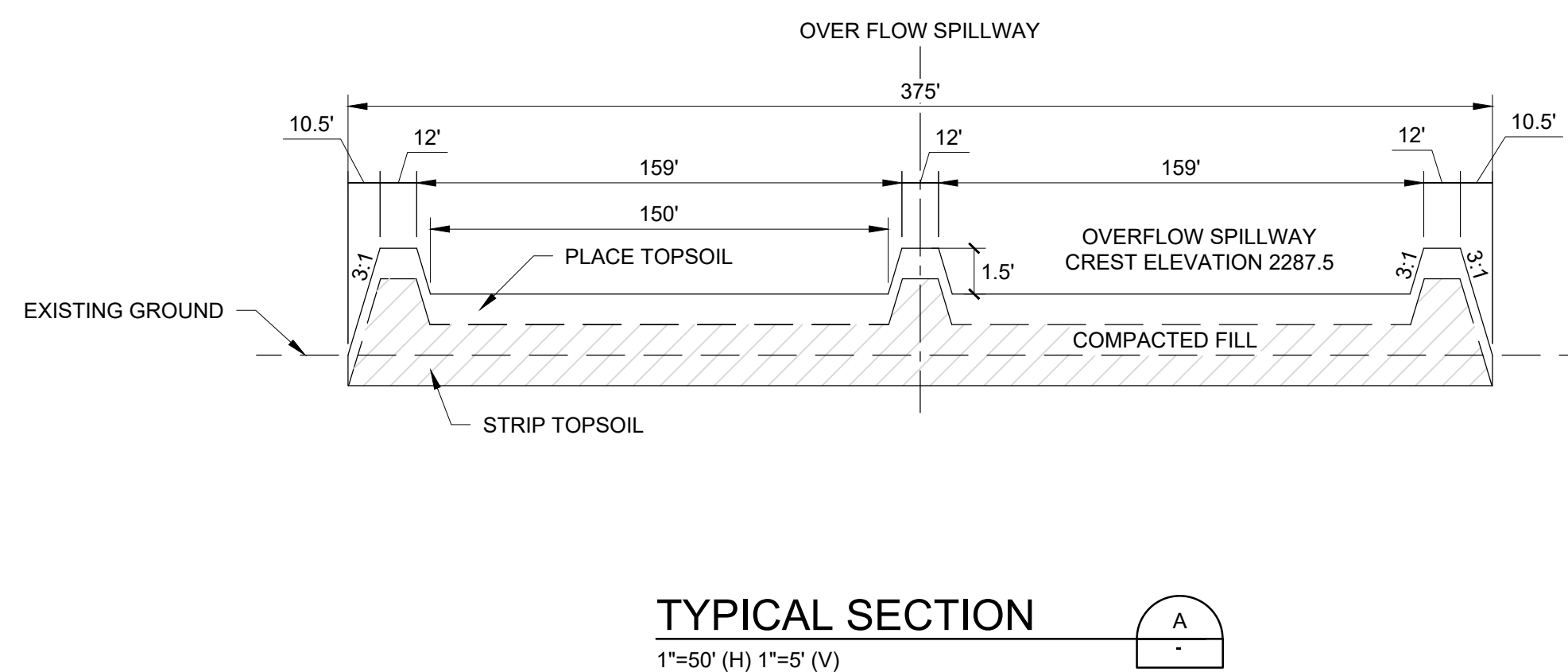
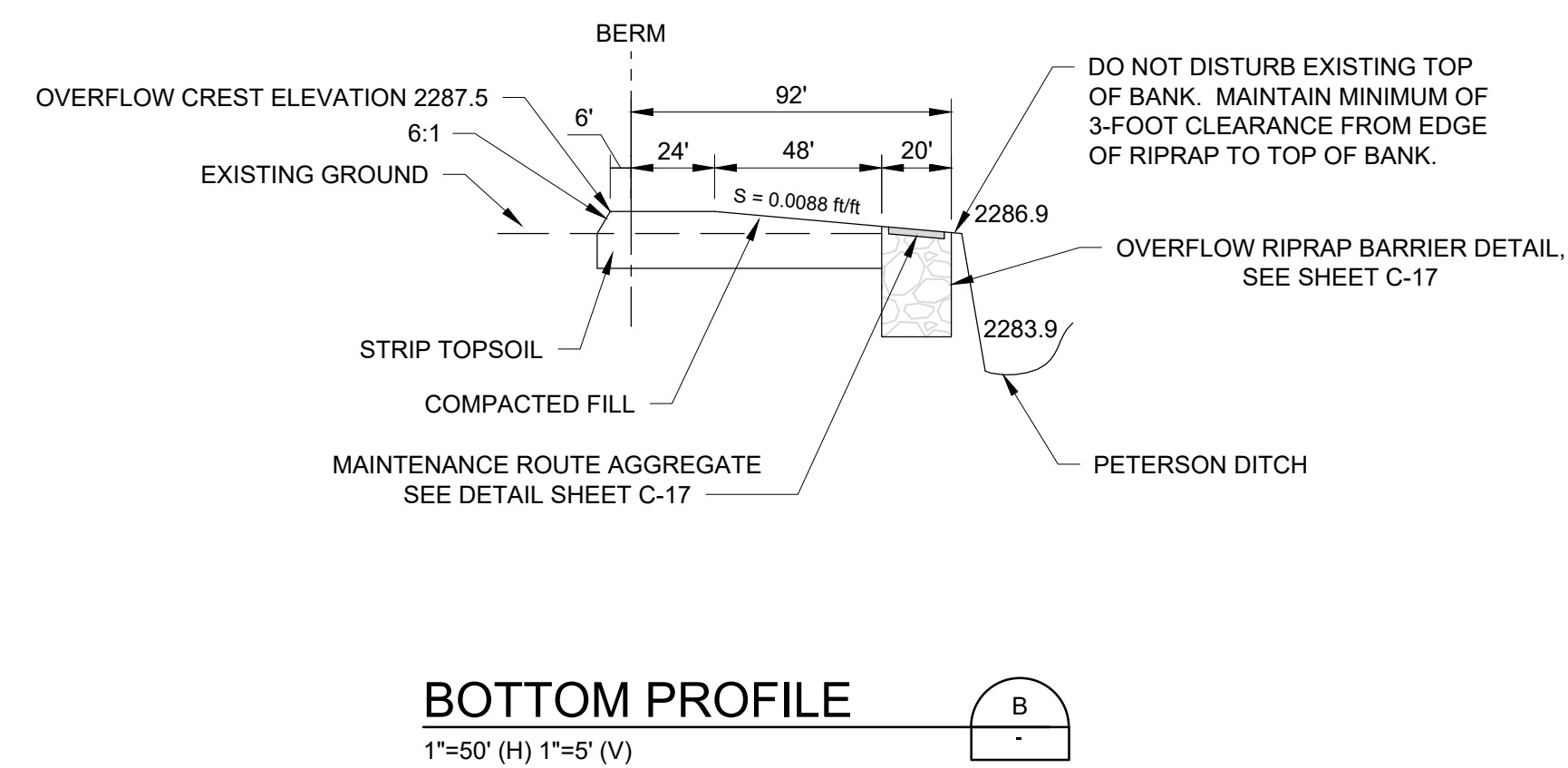
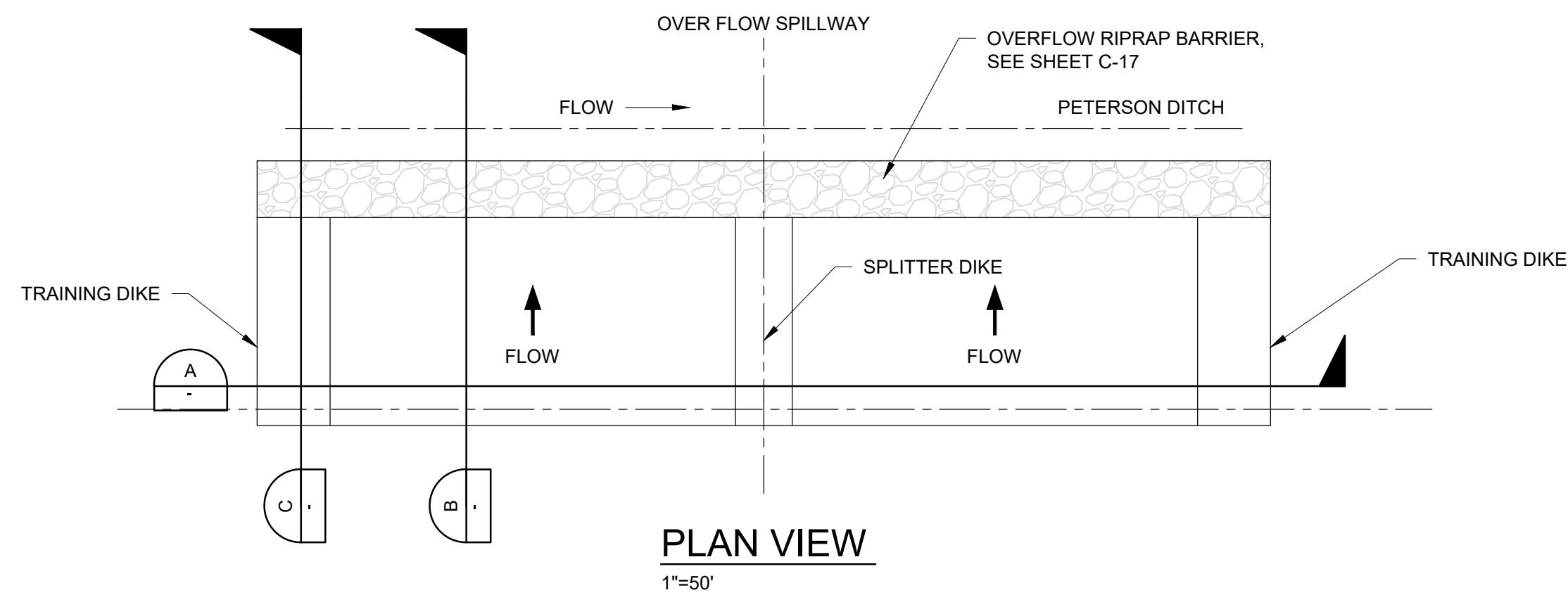
PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

OVERFLOW SPILLWAY
CELL #1



FILENAME 00C-06.dwg
SCALE 1"=50'

SHEET
C-06



5	5-04-2018	FINAL DESIGN
4	3-29-2018	FINAL PENDING PIPELINE DESIGN
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-	-	-
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	PAT ENGELBERT
PROJECT NUMBER	10057849



04 MAY 2018

**PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT**

OVERFLOW SPILLWAY CELL #2

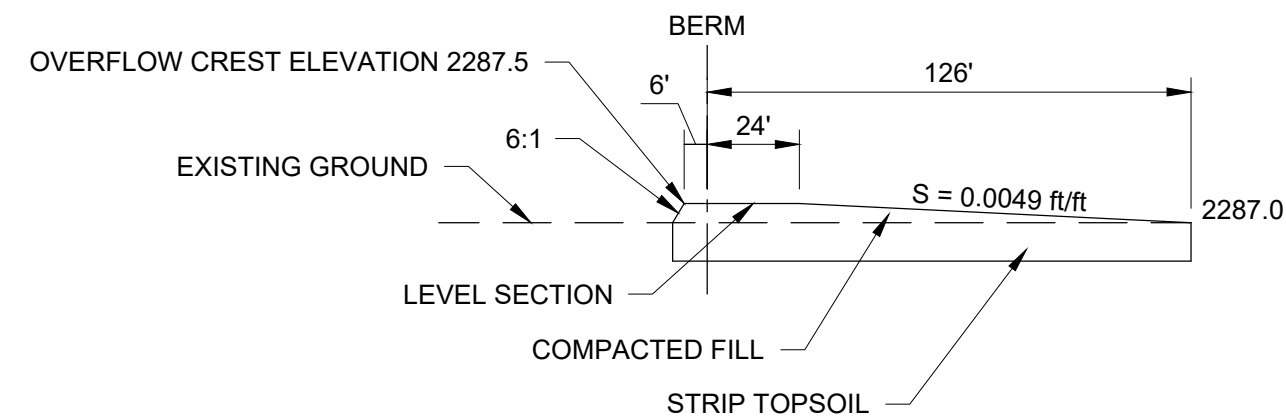
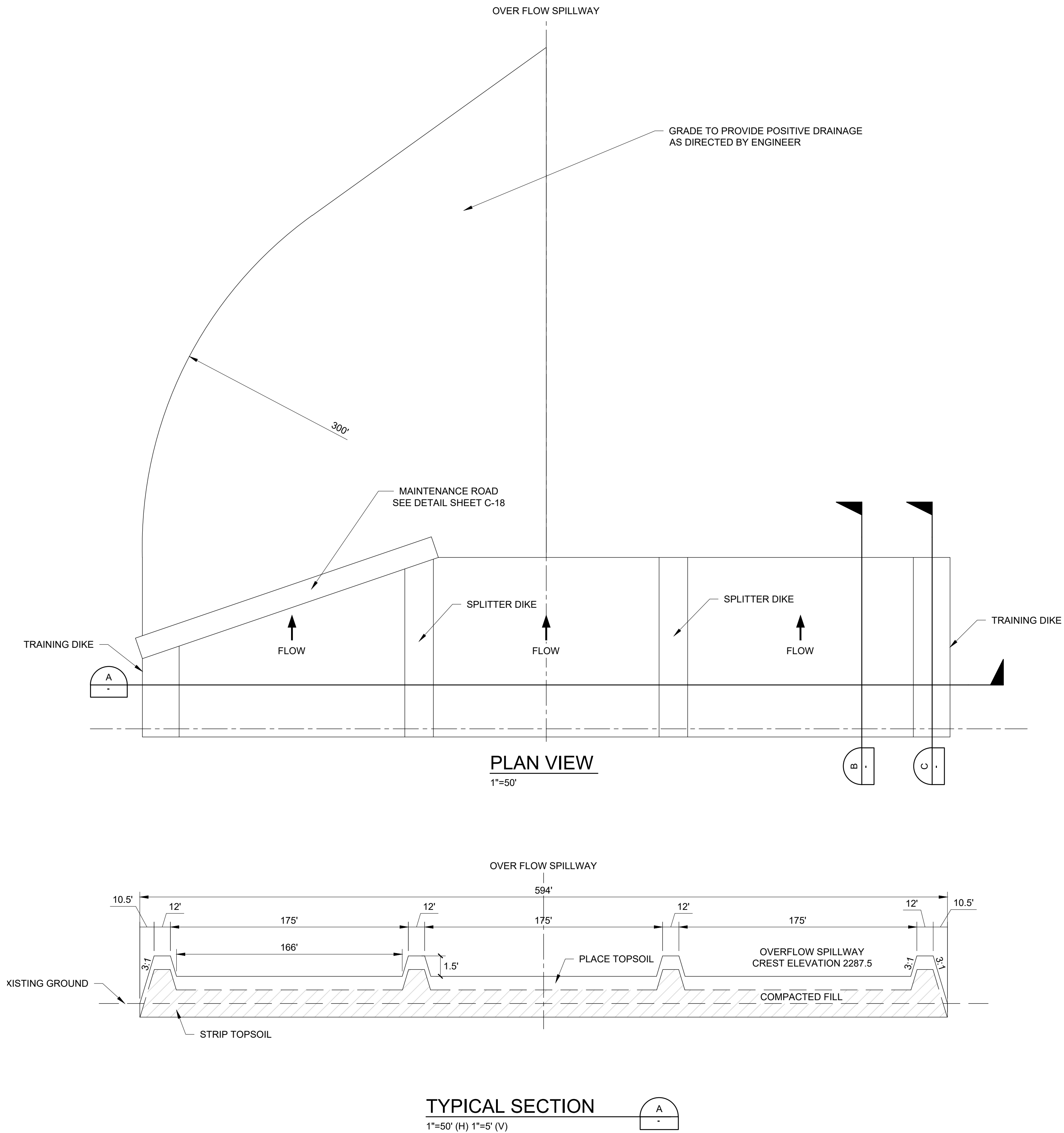


FILENAME	00C-07.dwg
SCALE	1"=50'

SHEET

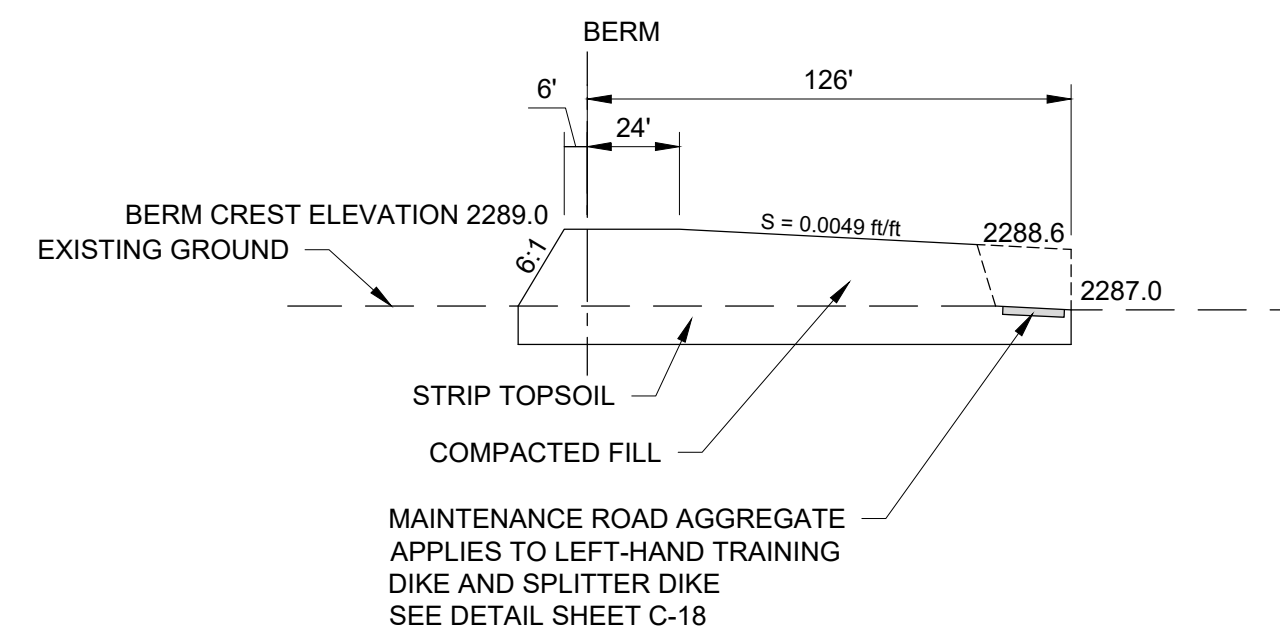
C-07

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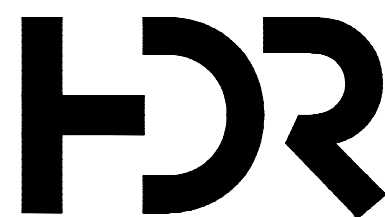
BOTTOM PROFILE
1"=50' (H) 1"=5' (V)

B



TRAINING DIKE & SPLITTER DIKE PROFILE
1"=50' (H) 1"=5' (V)

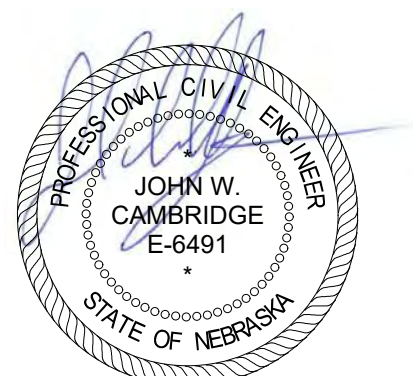
C



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-	-	-

PROJECT MANAGER PAT ENGELBERT

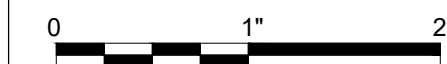
PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

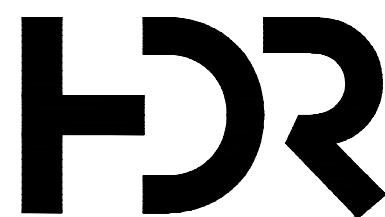
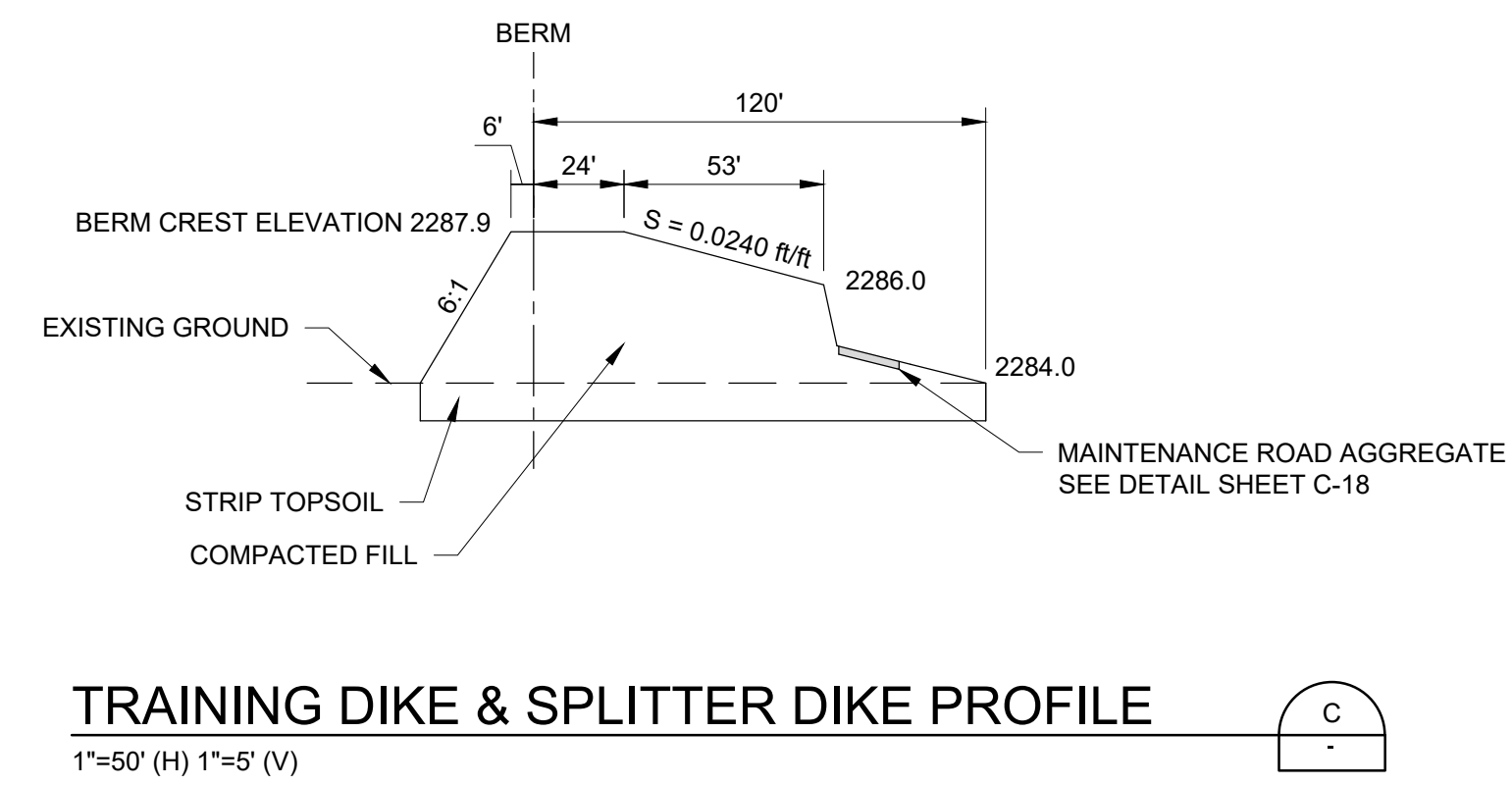
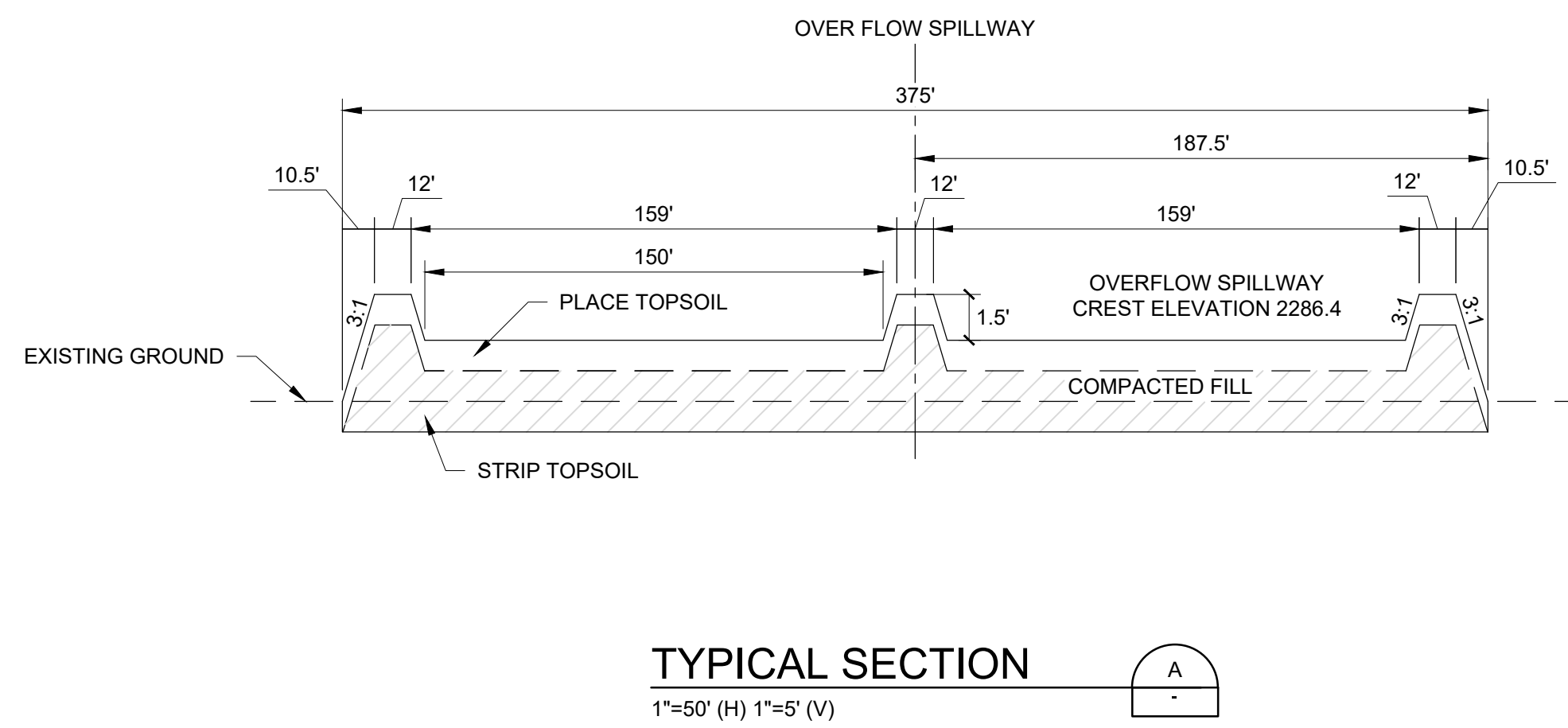
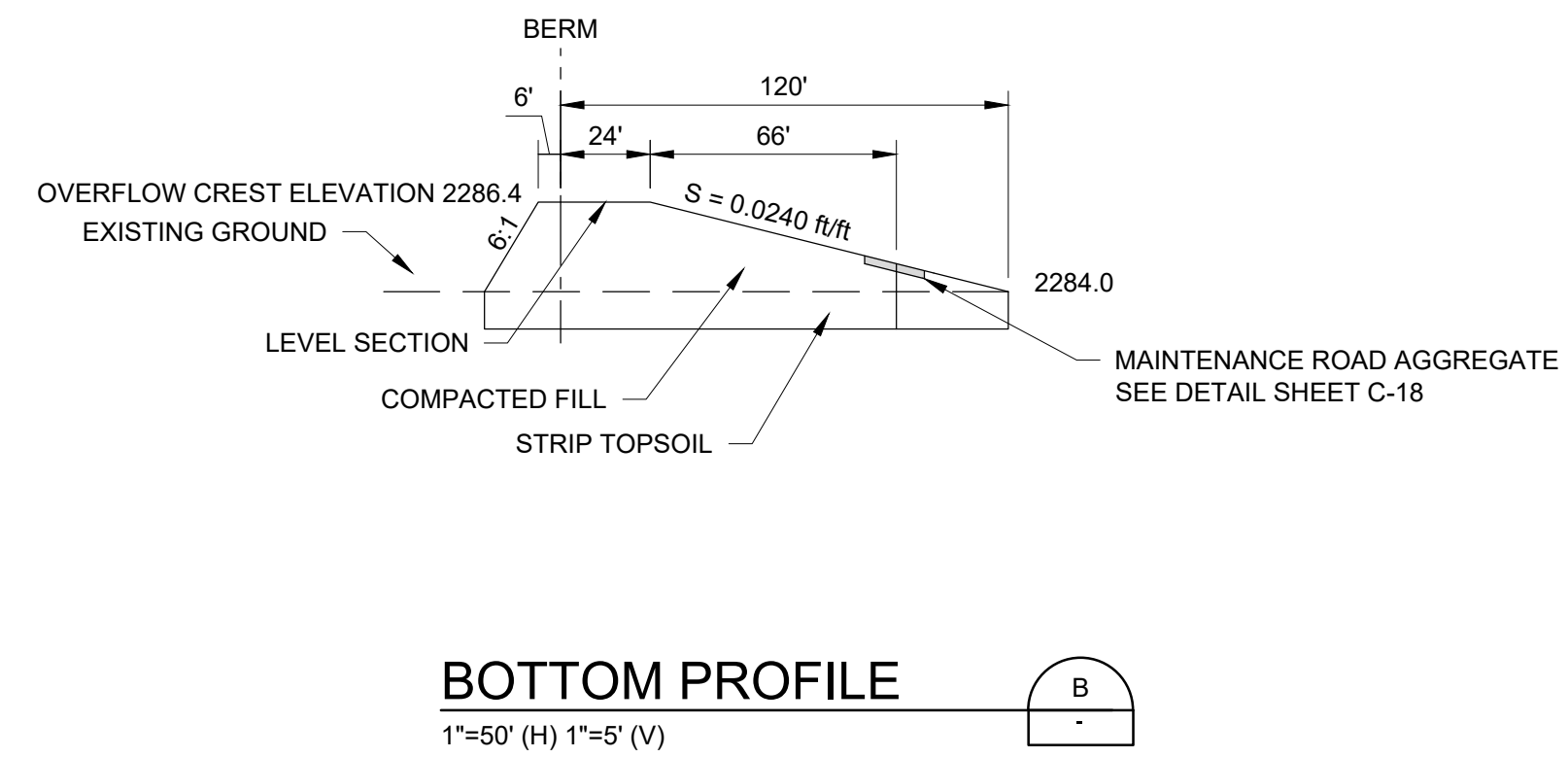
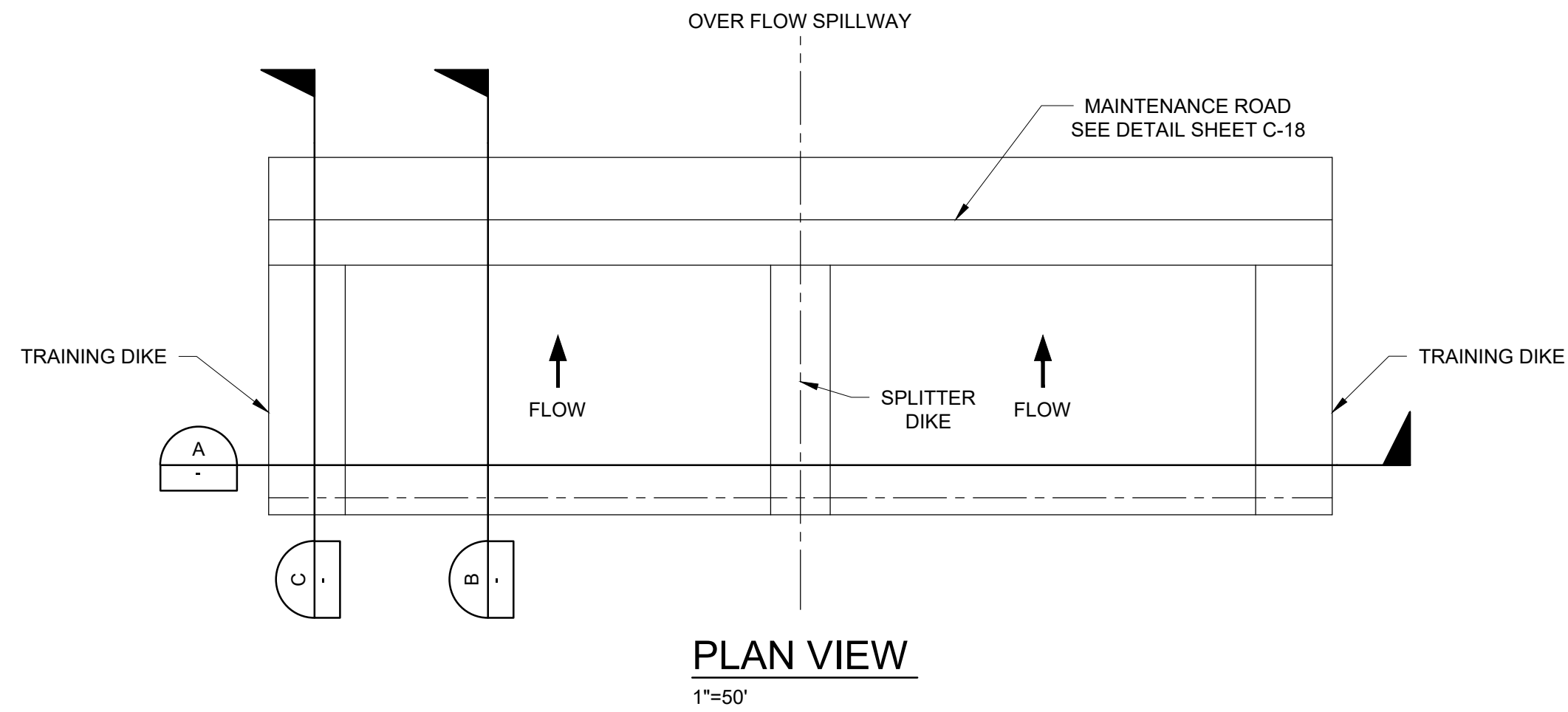
OVERFLOW SPILLWAY
CELL #3



FILENAME 00C-08.dwg
SCALE 1"=50'

SHEET
C-08

FILENAME: c:\pwworking\central\01\40573856\00C-09.dwg PLOTTED: 5/4/2018 10:09 AM Buer, Steven



ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

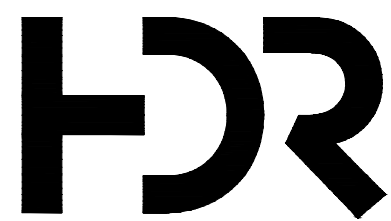
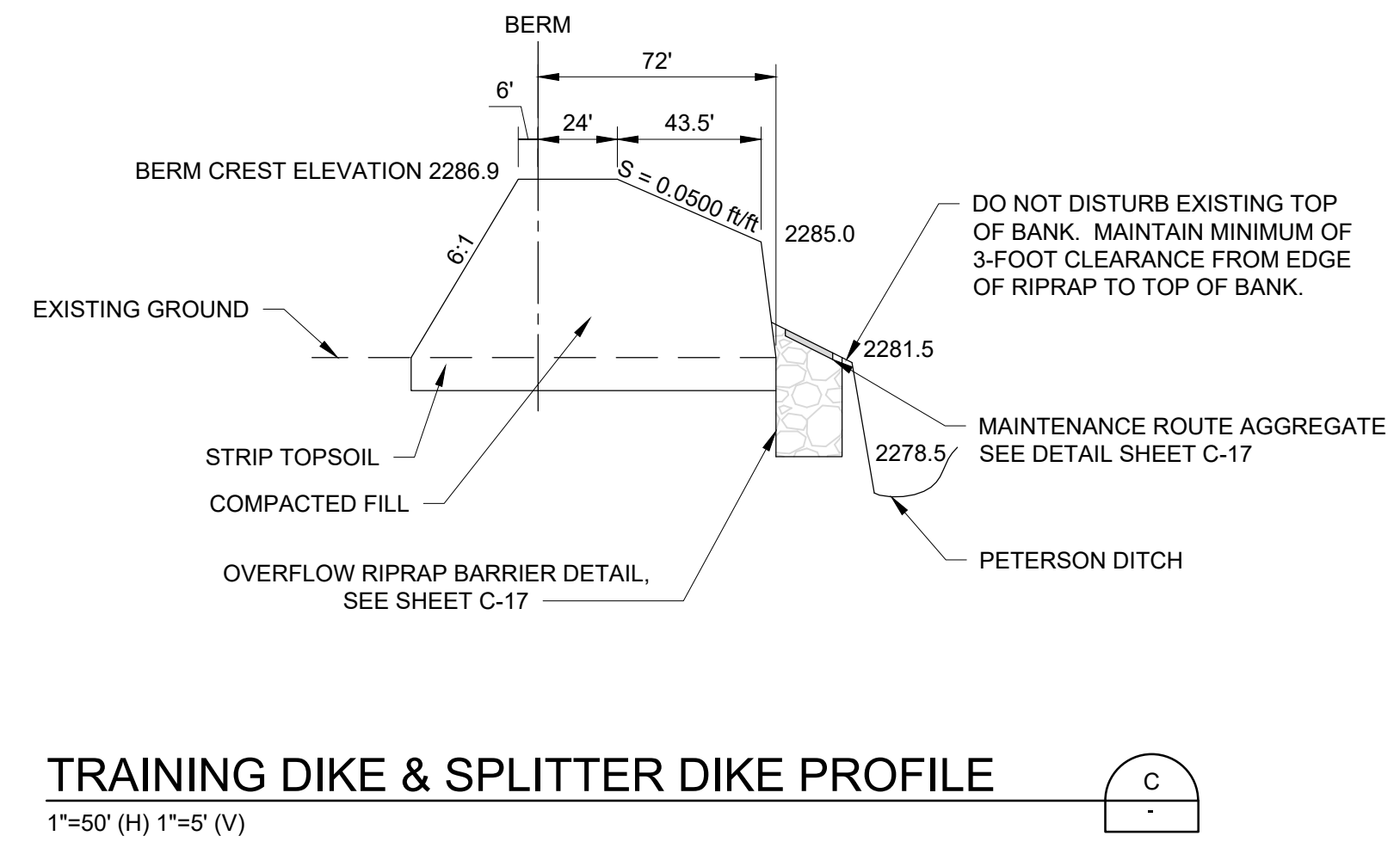
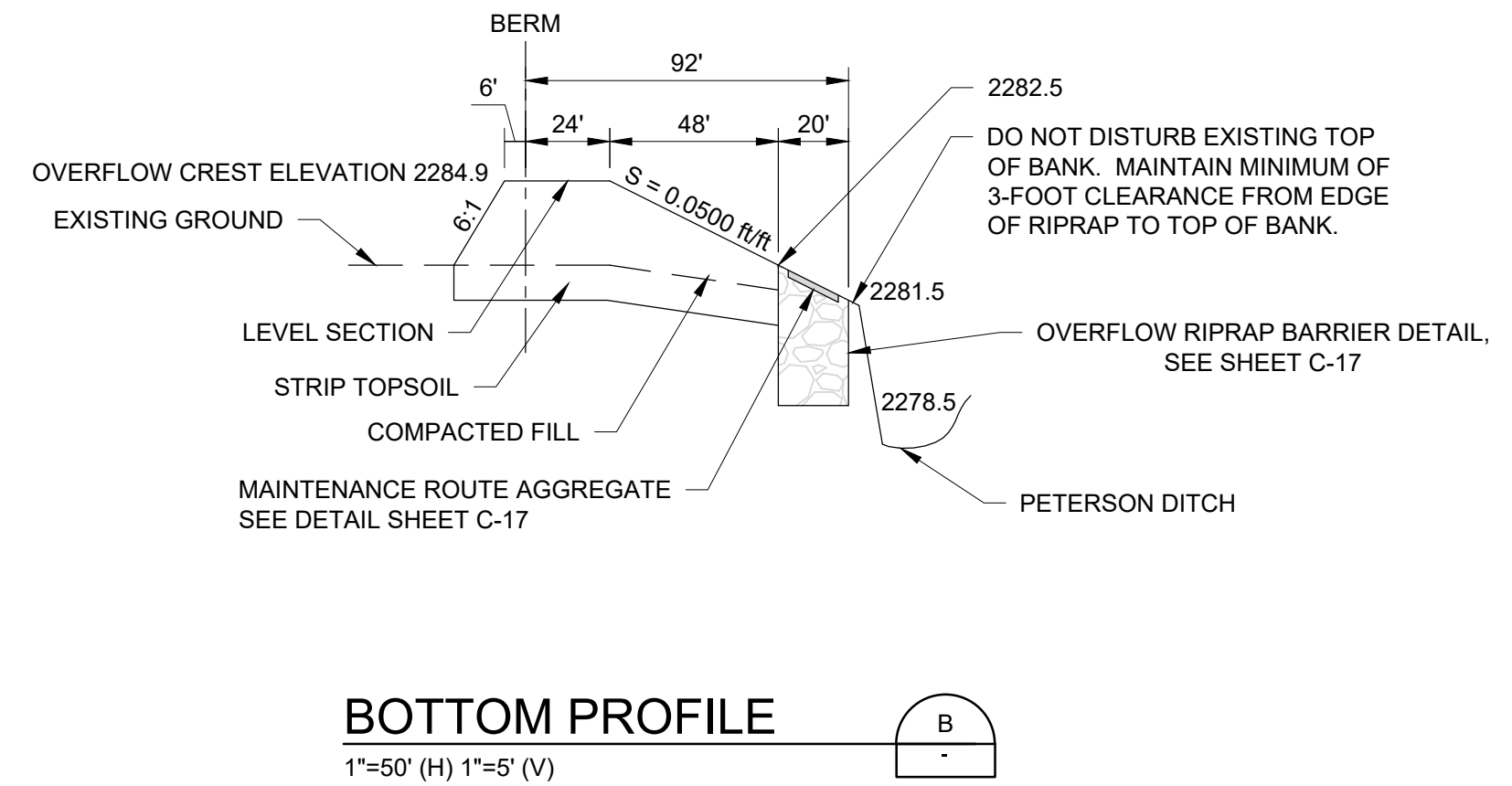
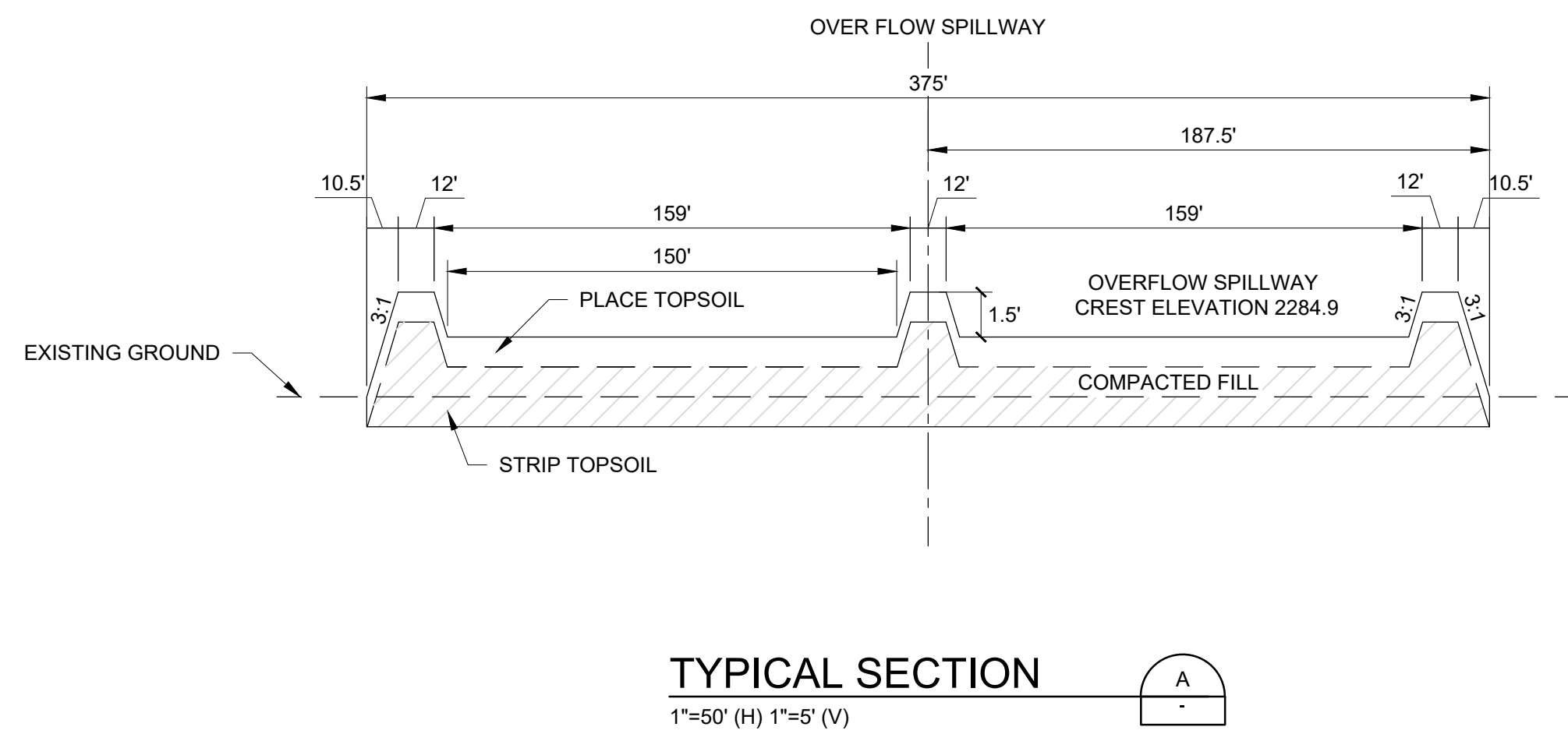
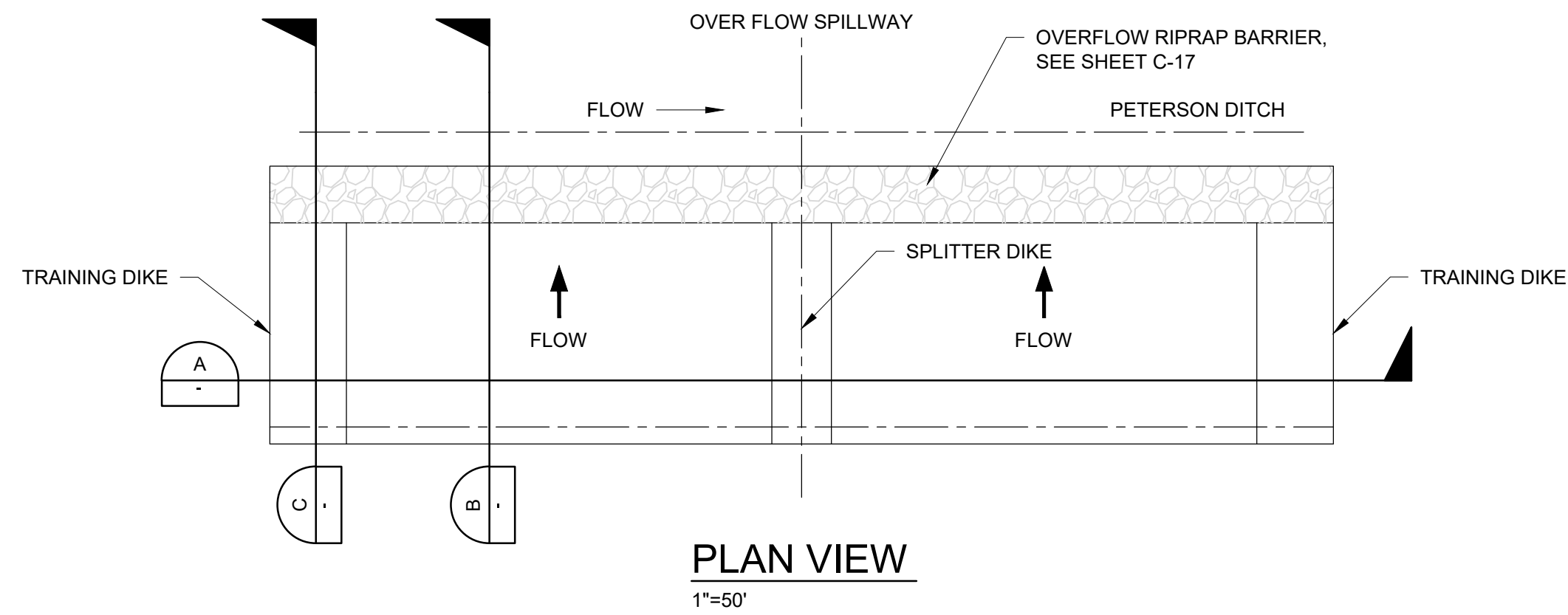
OVERFLOW SPILLWAY
CELL #4



FILENAME 00C-09.dwg
SCALE 1"=50'

SHEET
C-09

FILENAME: c:\pwworking\central\01\0573856\00C-10.dwg PLOTTED: 5/4/2018 10:09 AM Buer, Steven



ISSUE	DATE	DESCRIPTION
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-	-	-

PROJECT MANAGER	PAT ENGELBERT
PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

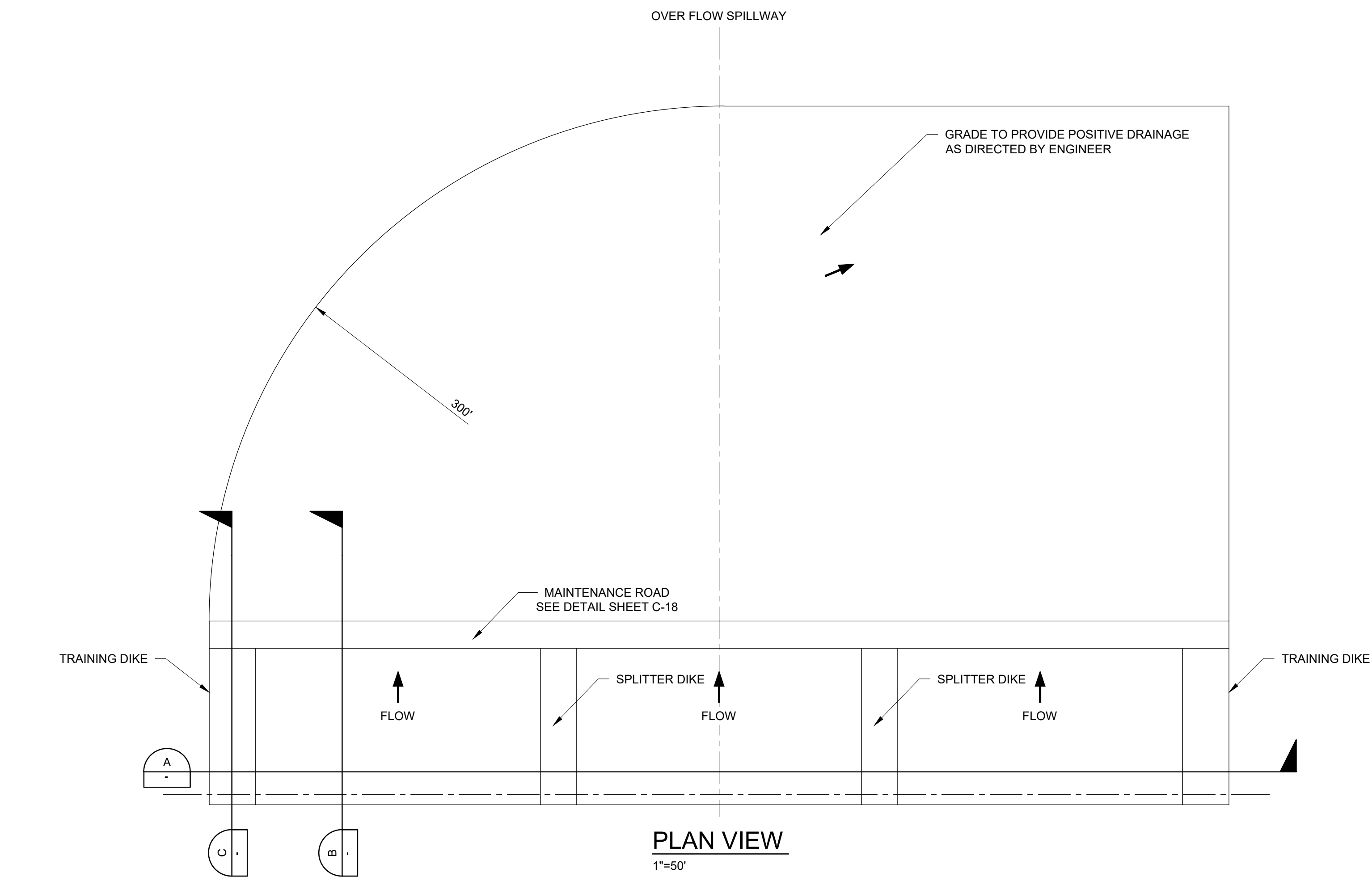
OVERFLOW SPILLWAY
CELL #5



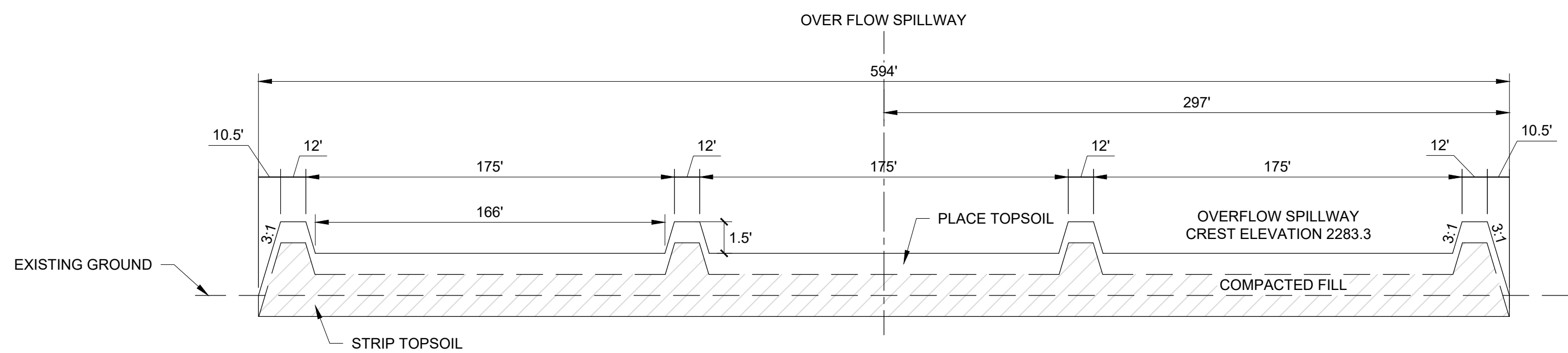
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SHEET
C-10

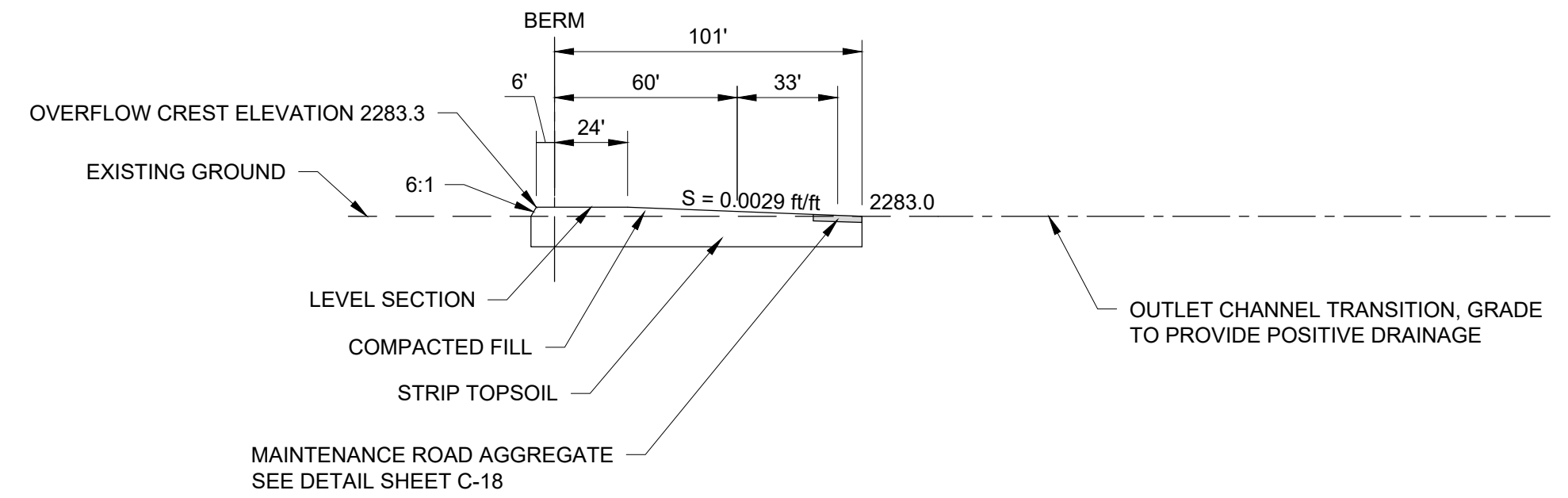
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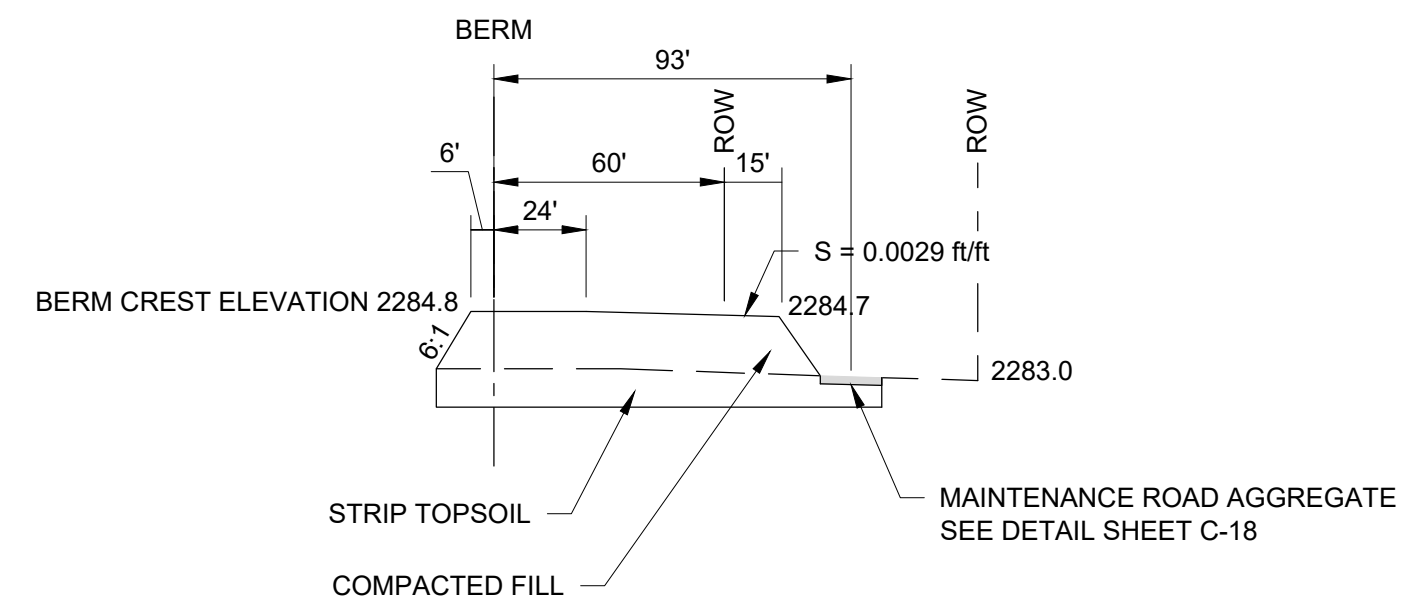
PLAN VIEW
1"=50'



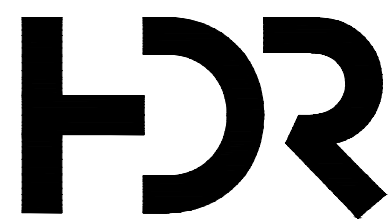
TYPICAL SECTION
1"=50' (H) 1"=5' (V)



BOTTOM PROFILE
1"=50' (H) 1"=5' (V)



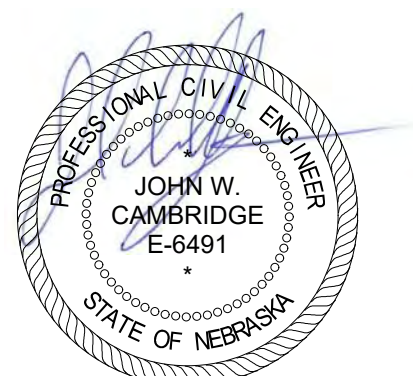
TRAINING DIKE & SPLITTER DIKE PROFILE
1"=50' (H) 1"=5' (V)



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PROJECT MANAGER PAT ENGELBERT

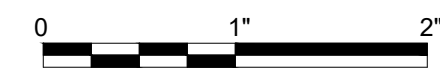
PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

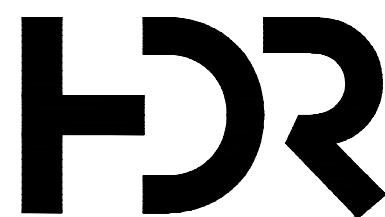
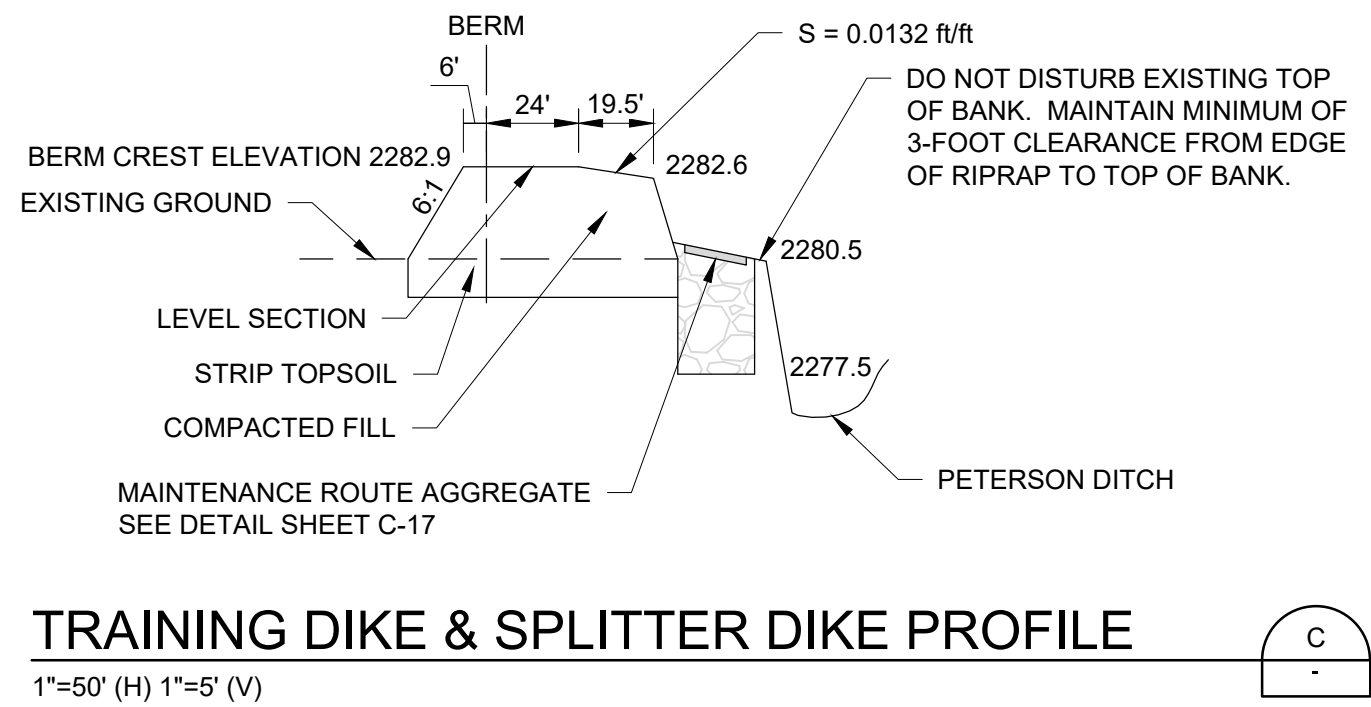
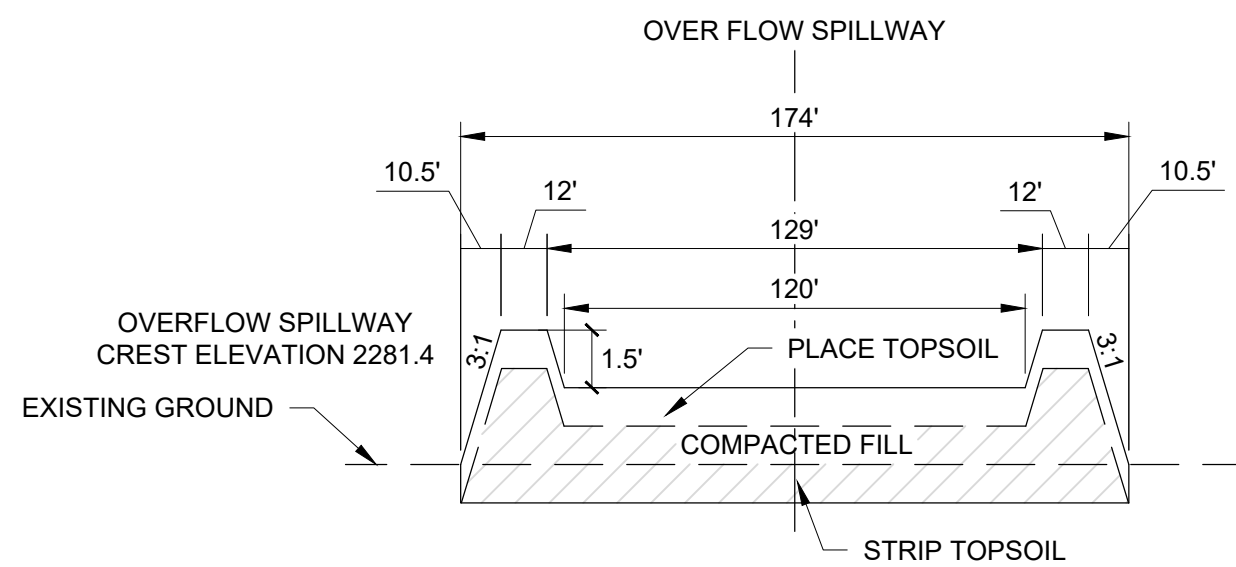
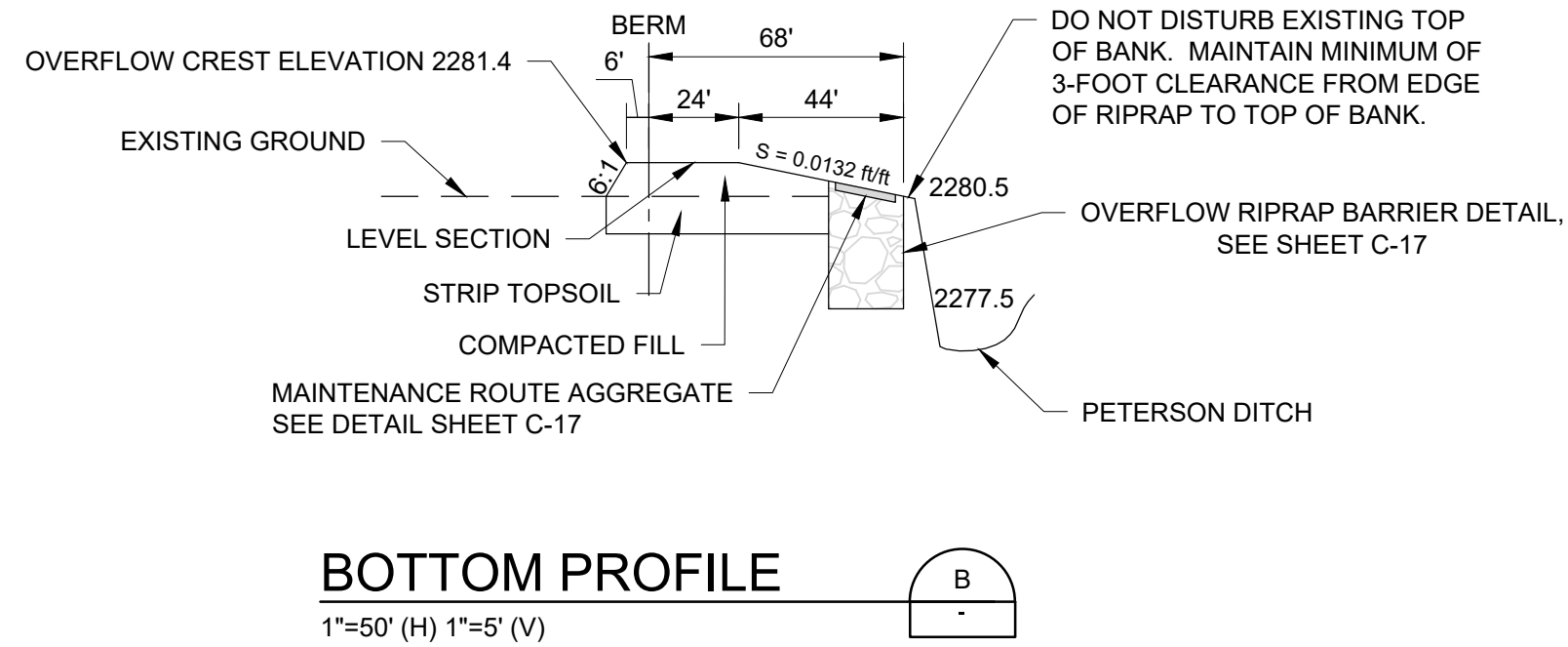
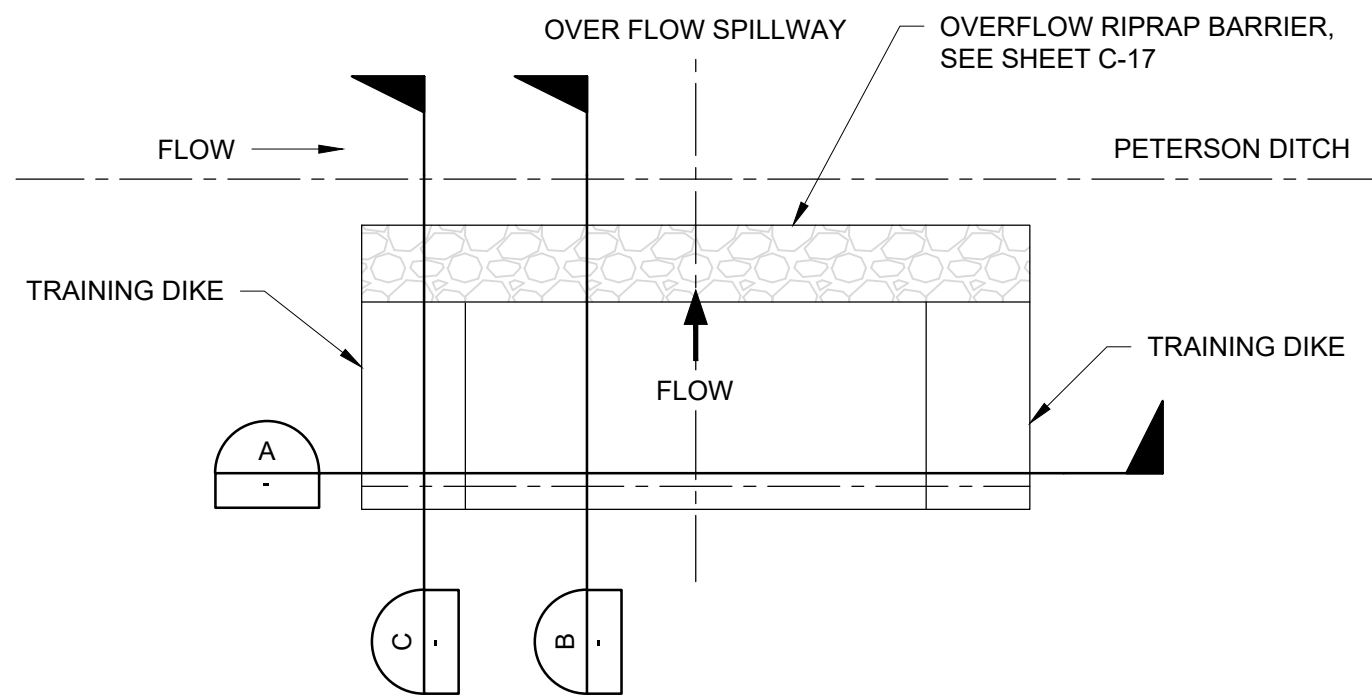
OVERFLOW SPILLWAY
CELL #6



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SCALE 1"=50'

SHEET
C-11

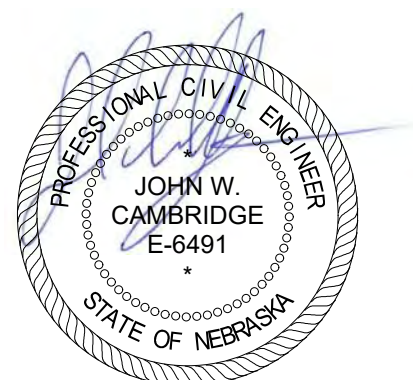
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ISSUE	DATE	DESCRIPTION
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-	-	-

PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	10057849



04 MAY 2018

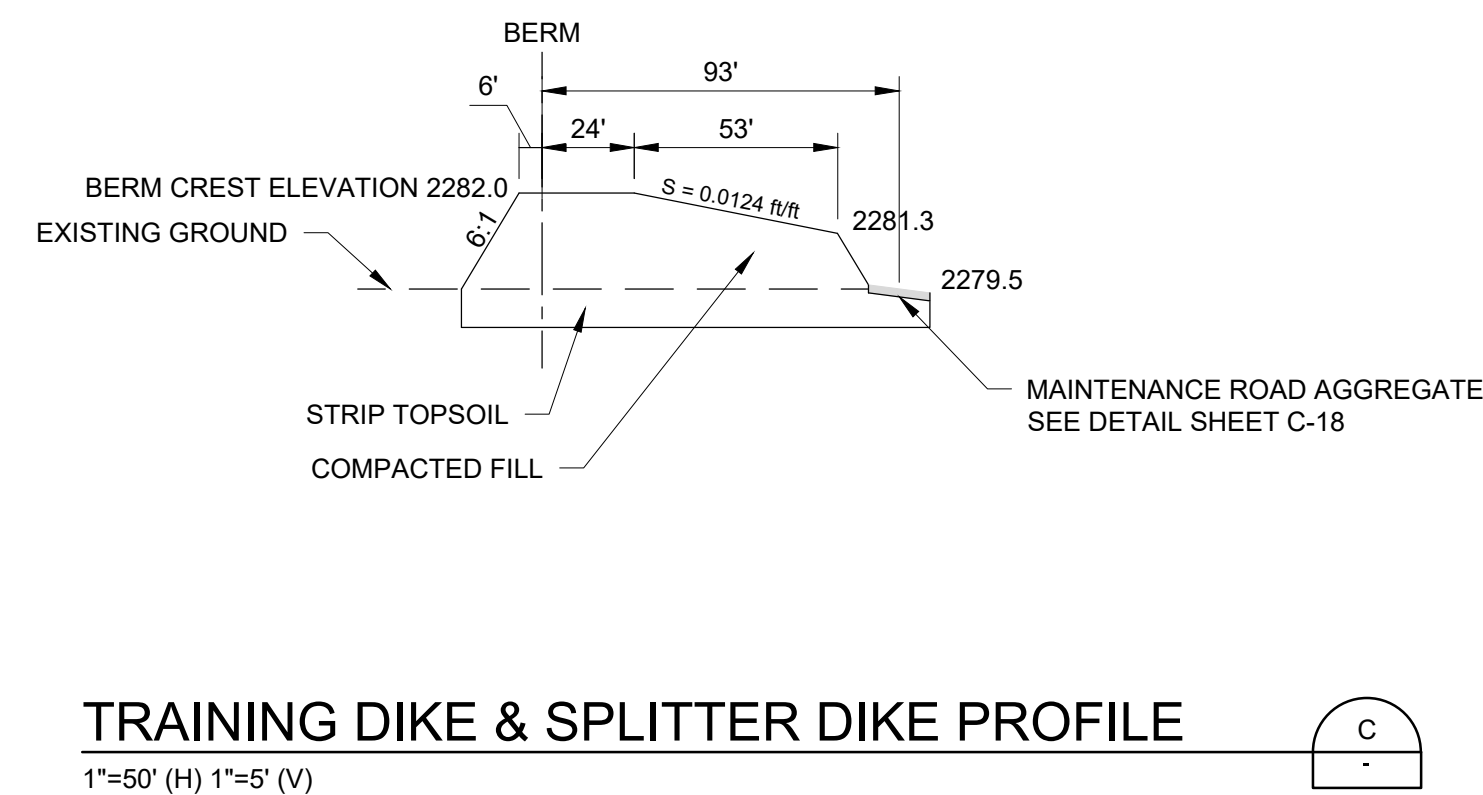
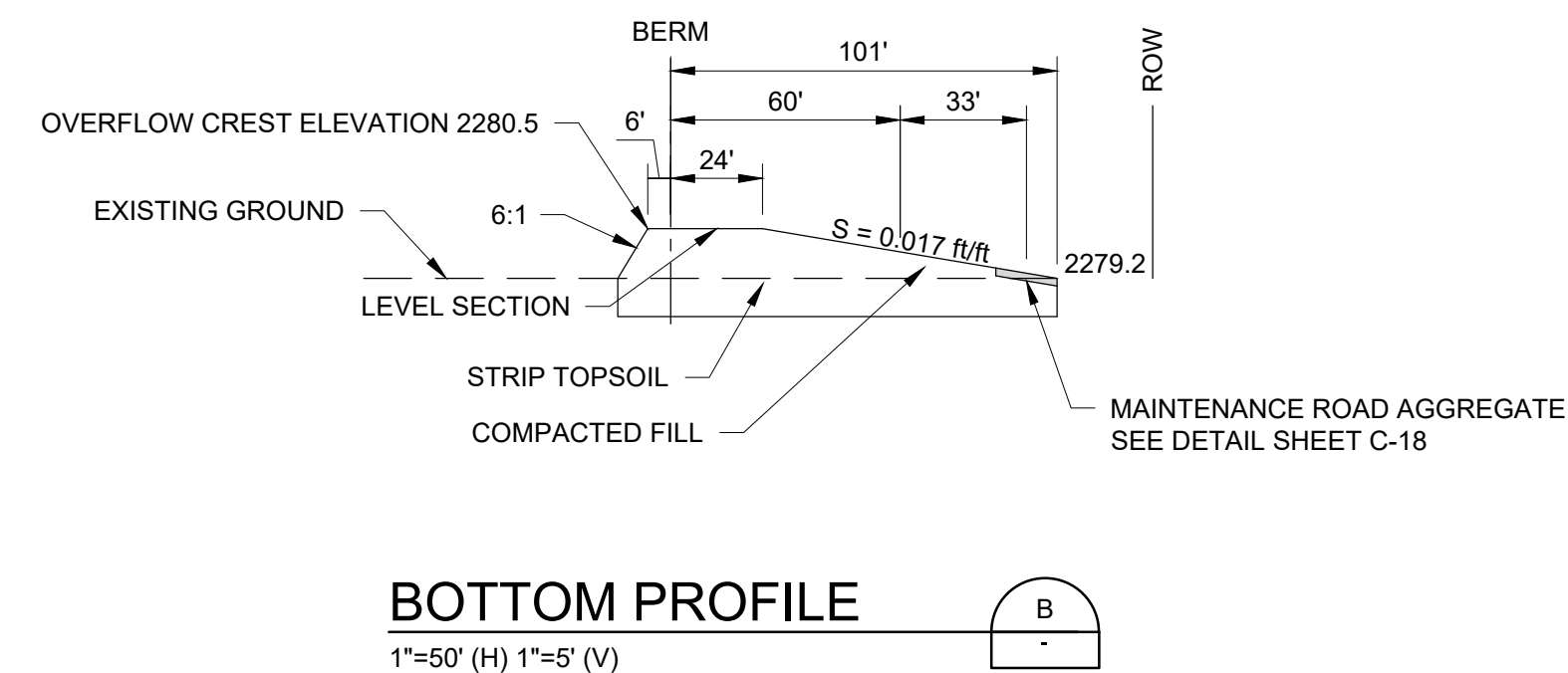
PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

OVERFLOW SPILLWAY
CELL #7

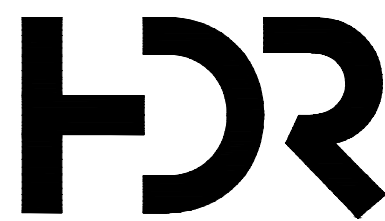
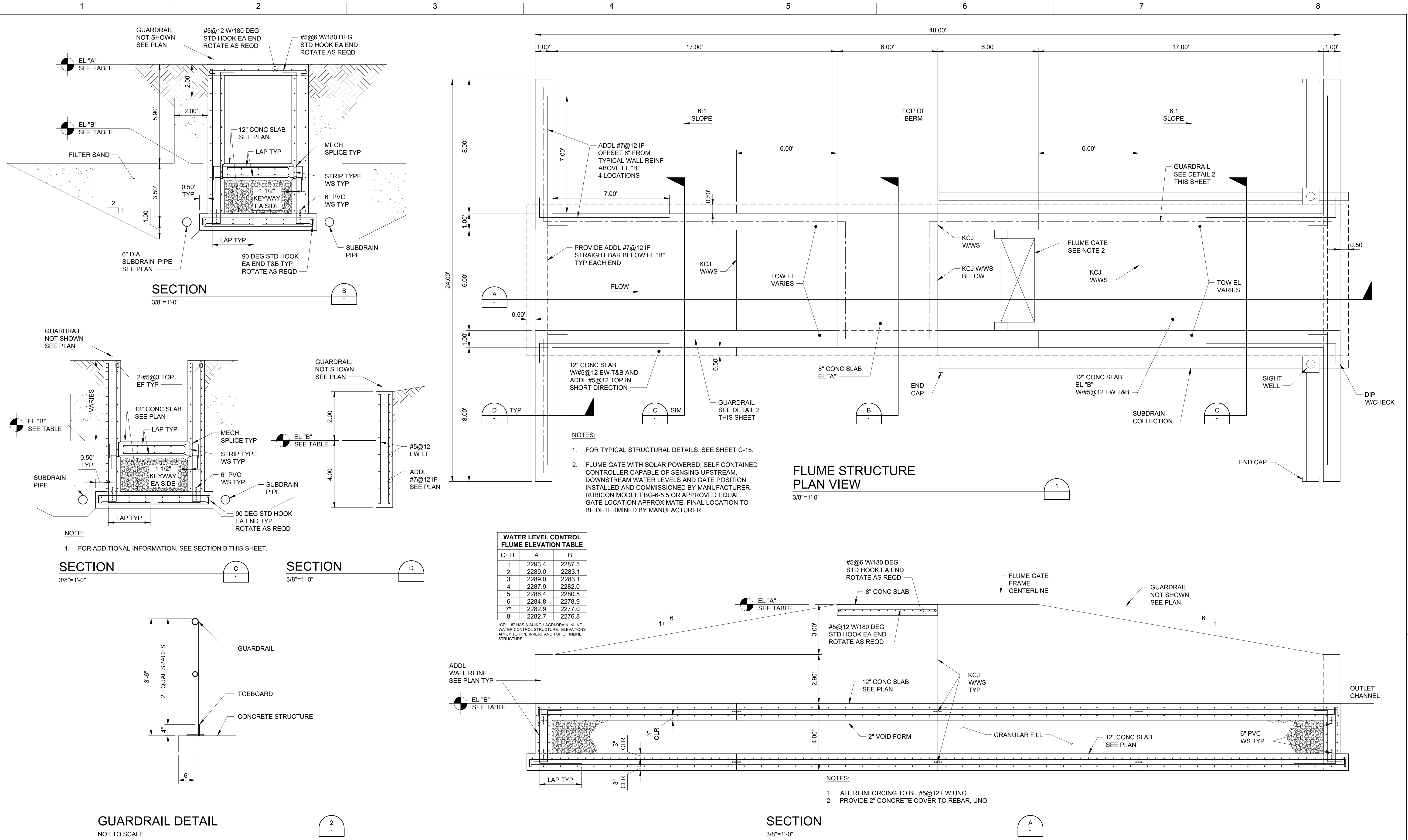


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SCALE 1"=50'

SHEET
C-12



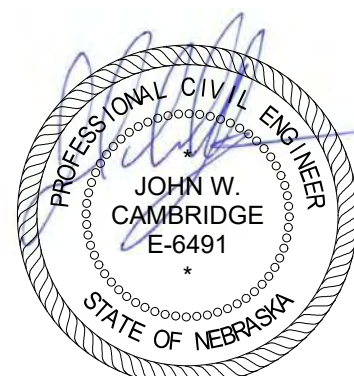
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ISSUE	DATE	DESCRIPTION
5	5-04-2018	FINAL DESIGN
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1	2-16-2018	90% PLAN REVIEW

PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	10057849
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04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

WATER LEVEL CONTROL FLUME STRUCTURE

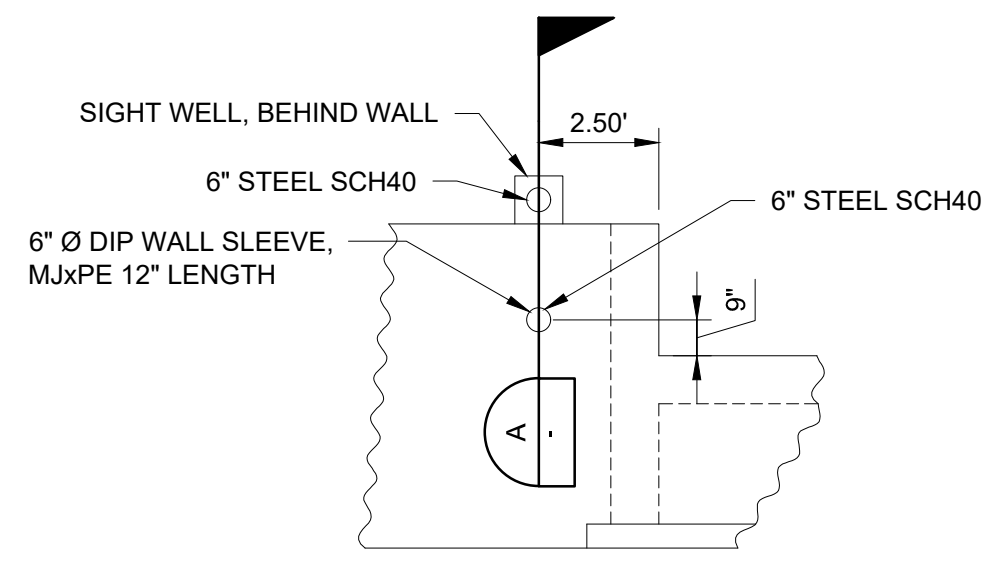


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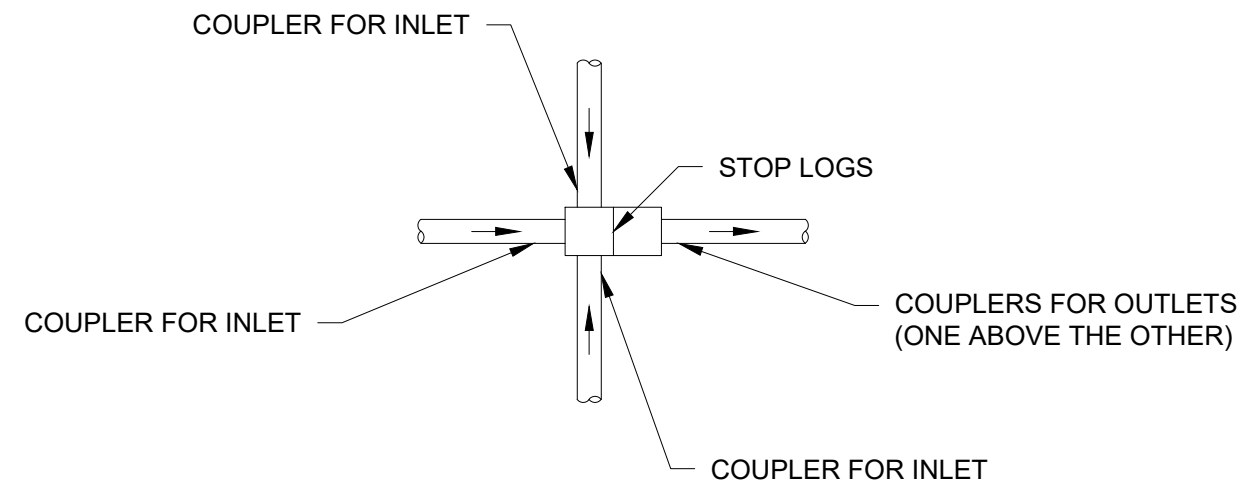
SHEET
C-14

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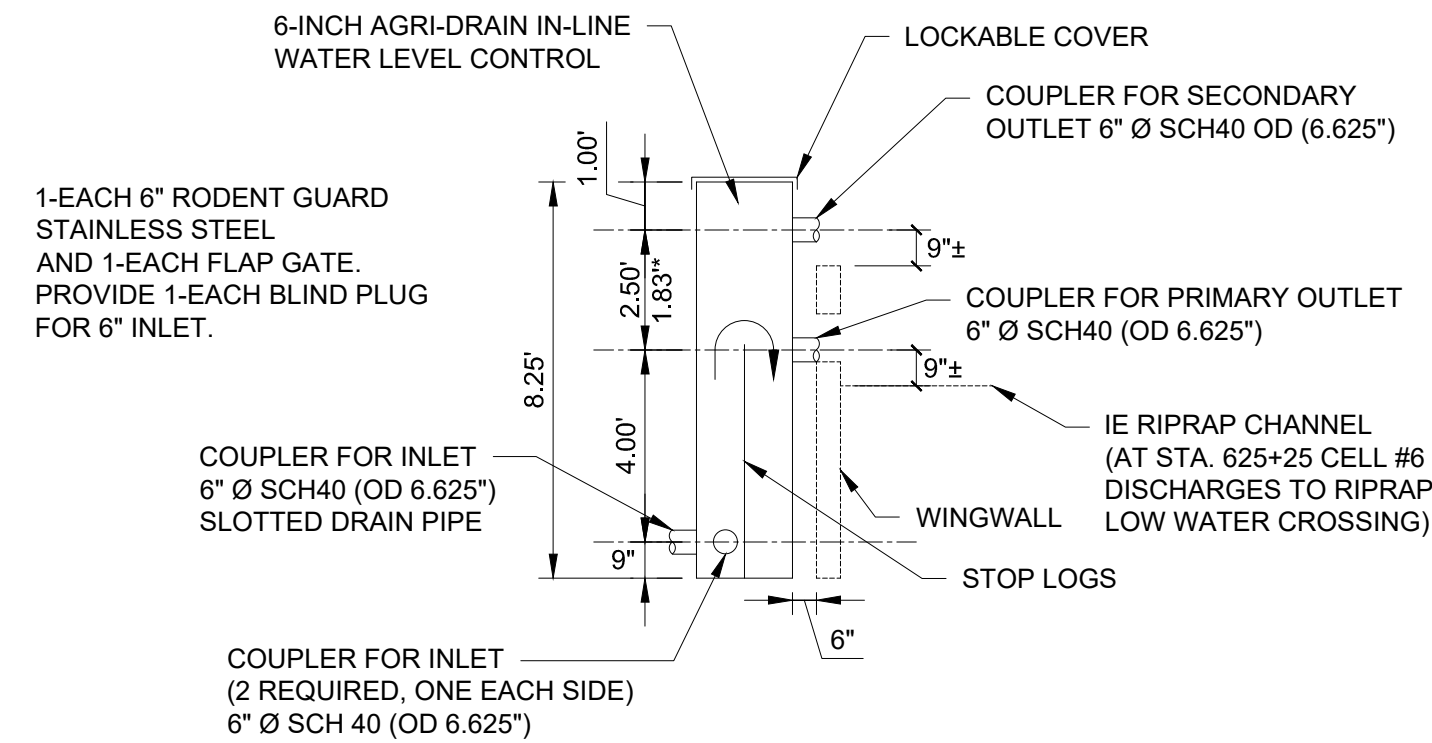
1 2 3 4 5 6 7 8



FRONT VIEW



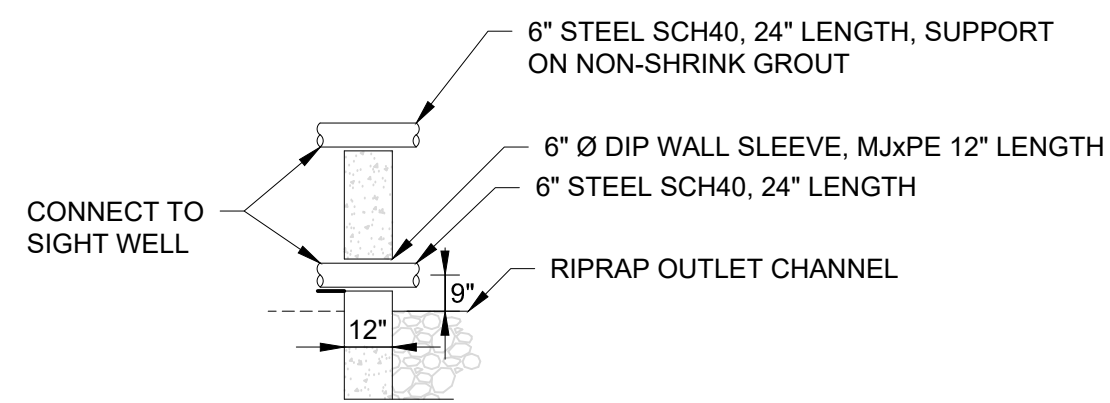
PLAN VIEW



SIDE VIEW

SIGHT WELL SUBDRAIN

1/4"=1'-0"

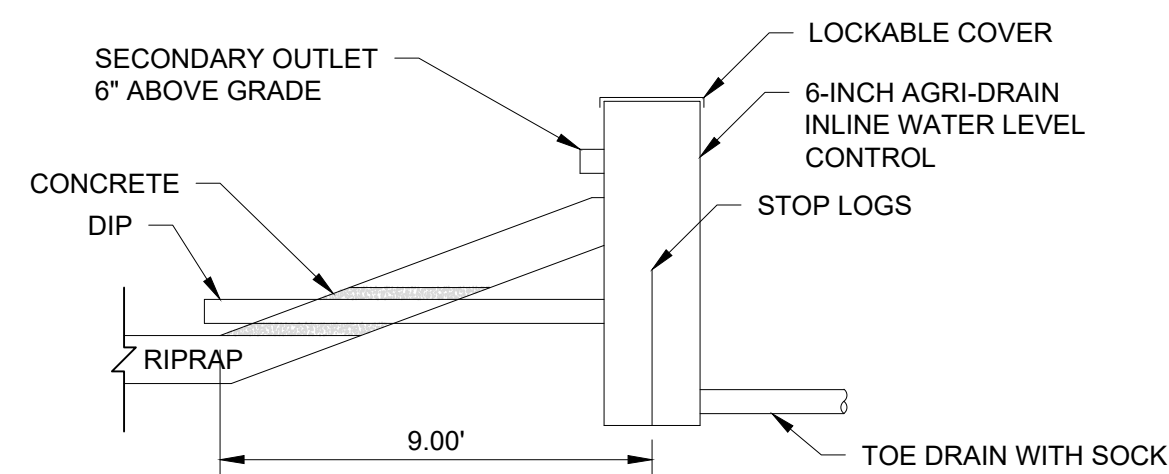


SECTION VIEW

1/4"=1'-0"

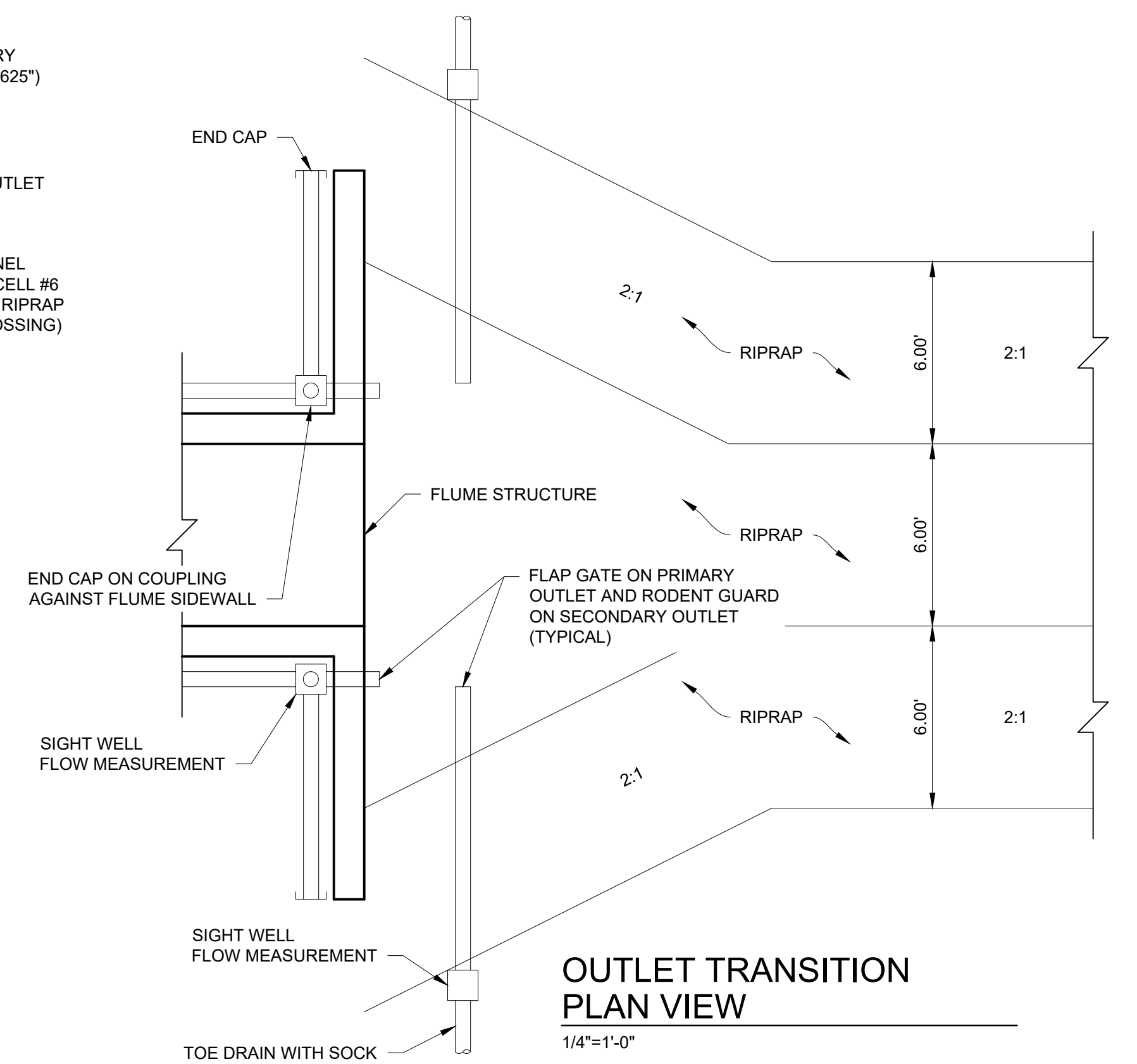
SUBDRAIN OUTLET DETAIL AT WINGWALL

1/4"=1'-0"



TOE DRAIN SECTION VIEW

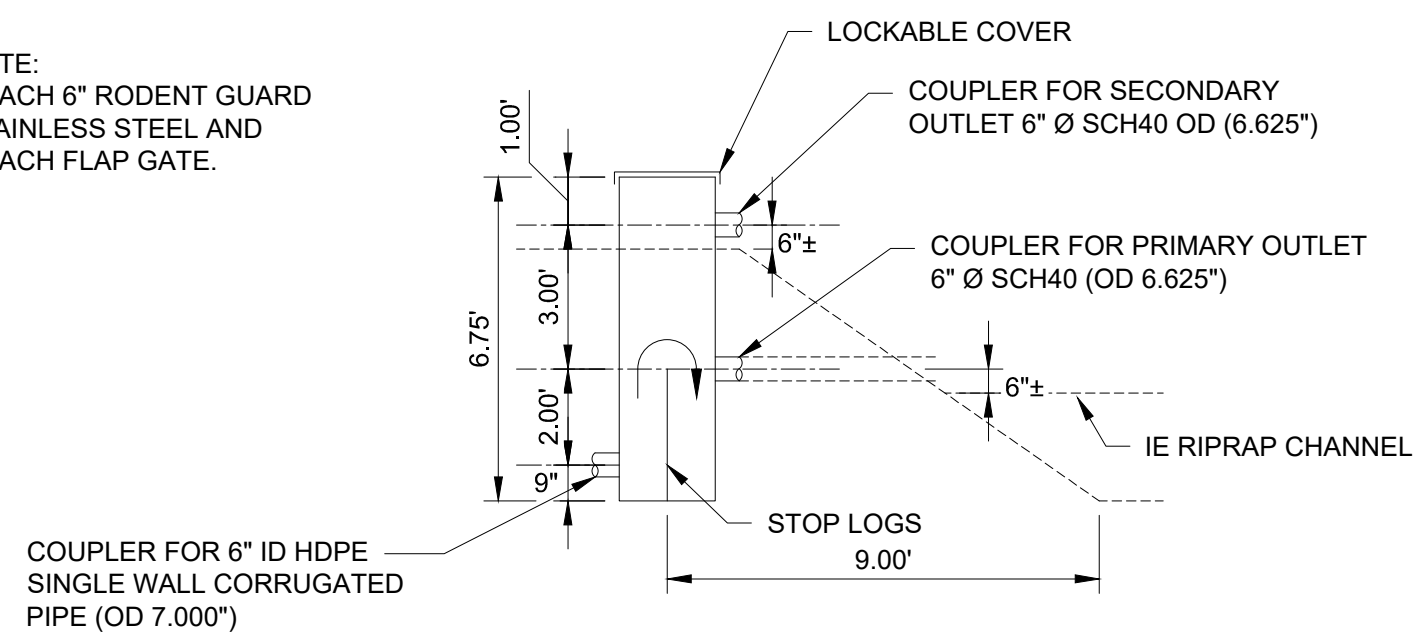
1/4"=1'-0"



OUTLET TRANSITION PLAN VIEW

1/4"=1'-0"

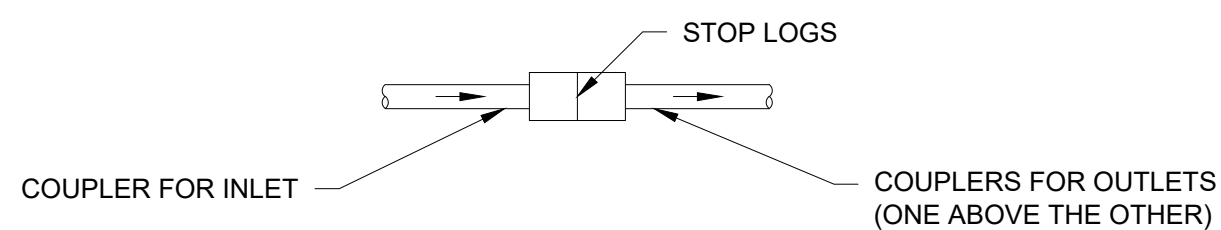
NOTE:
1-EACH 6" RODENT GUARD
STAINLESS STEEL AND
1-EACH FLAP GATE.



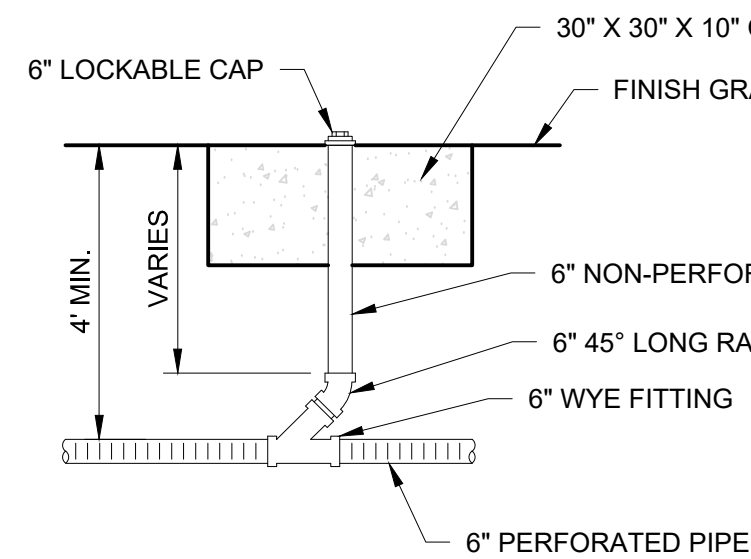
SIDE VIEW

SIGHT WELL TOE DRAIN

1/4"=1'-0"



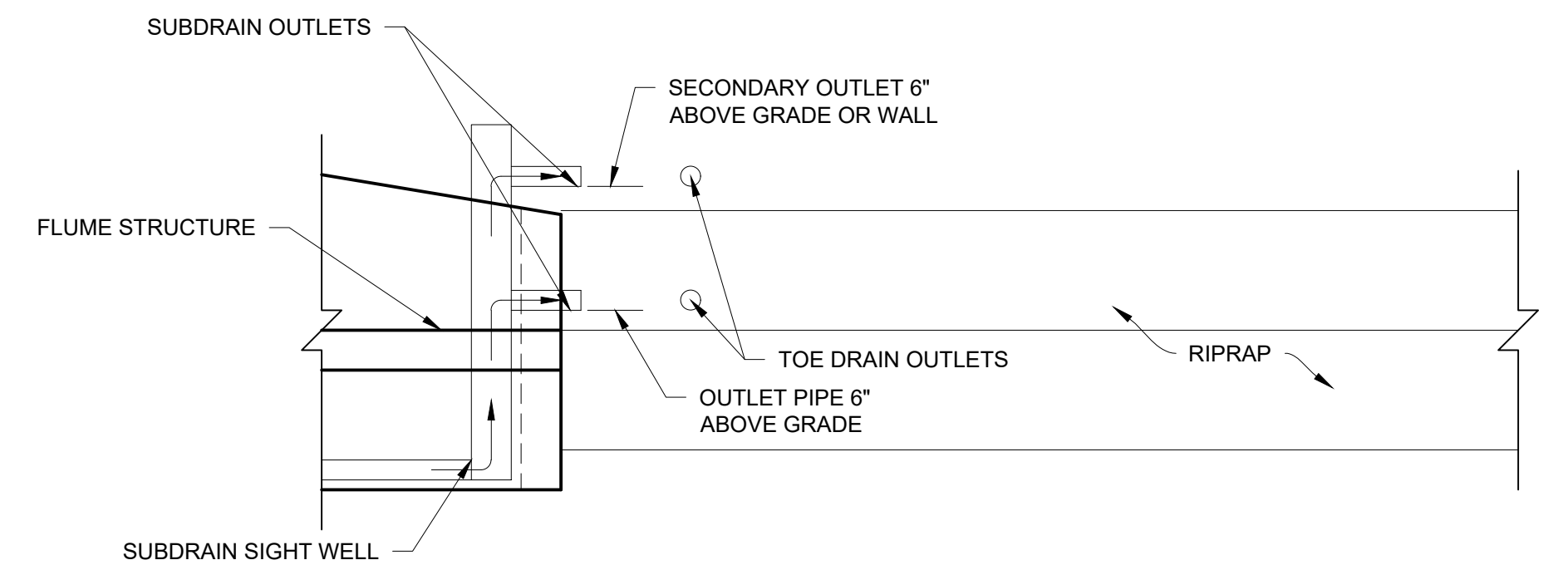
PLAN VIEW



NOTE: AT 300-FT SPACING AND
AT END OF TOE DRAIN

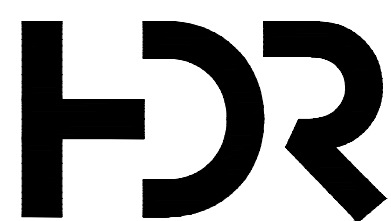
TOE DRAIN CLEAN OUT

1/4" = 1'-0"



OUTLET CHANNEL PROFILE VIEW

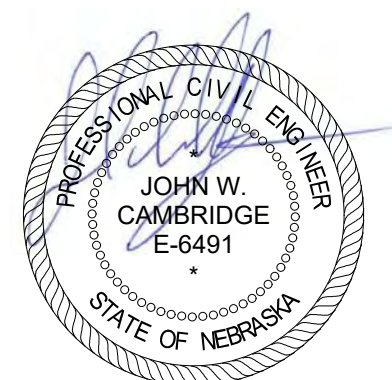
1/4"=1'-0"



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-	-	-

PROJECT MANAGER PAT ENGELBERT

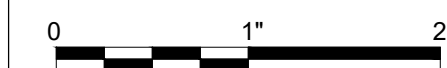
PROJECT NUMBER	10057849



04 MAY 2018

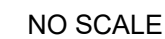
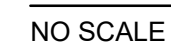
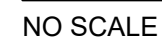
PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

SUBDRAIN AND TOE DRAIN DETAILS



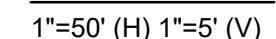
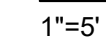
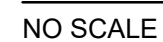
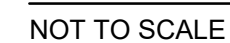
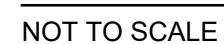
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SCALE 1/4"=1'

SHEET
C-16

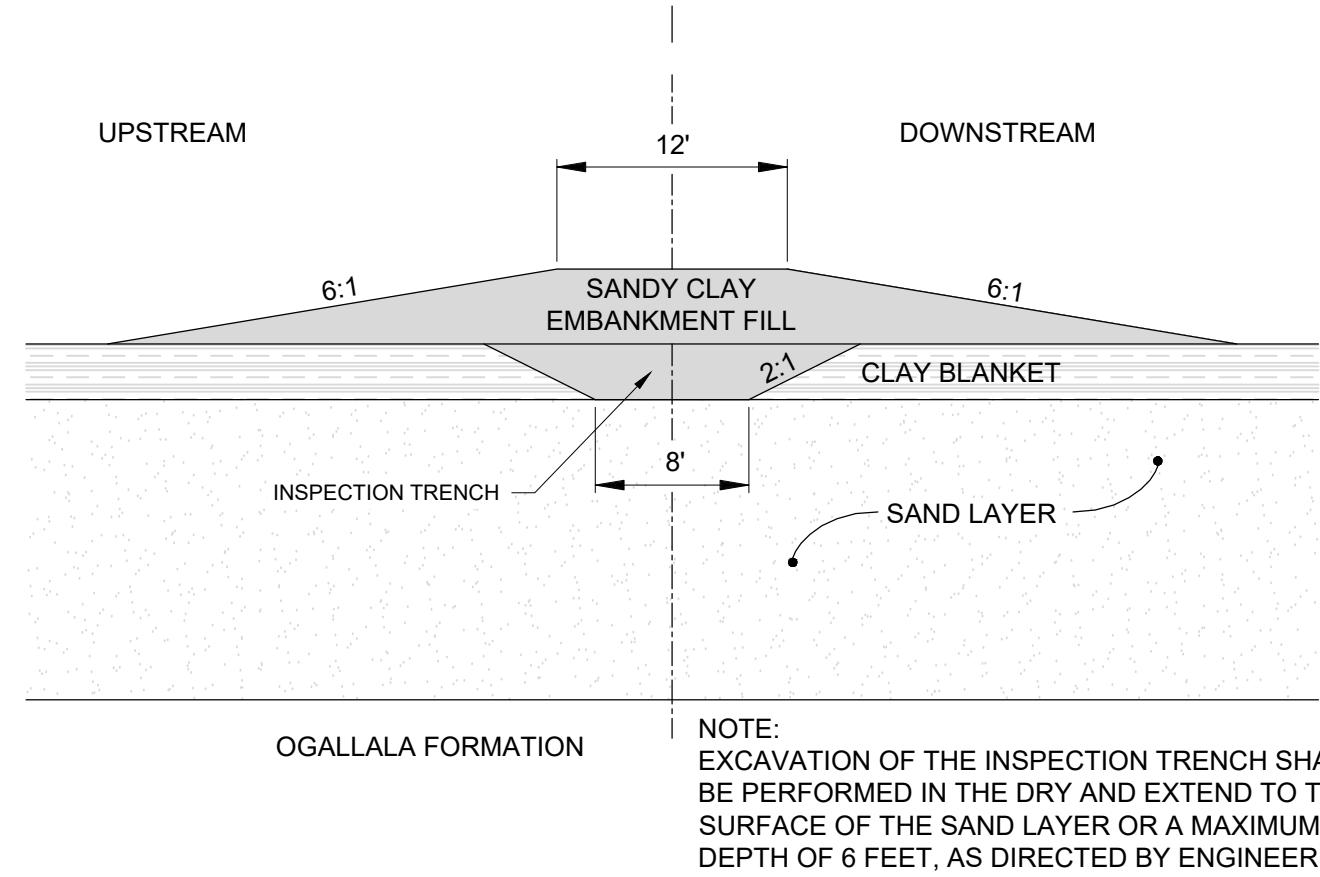


- CELL #5, CELL #6, CELL #7, AND CELL #8 MATCH
EXISTING SECTION.

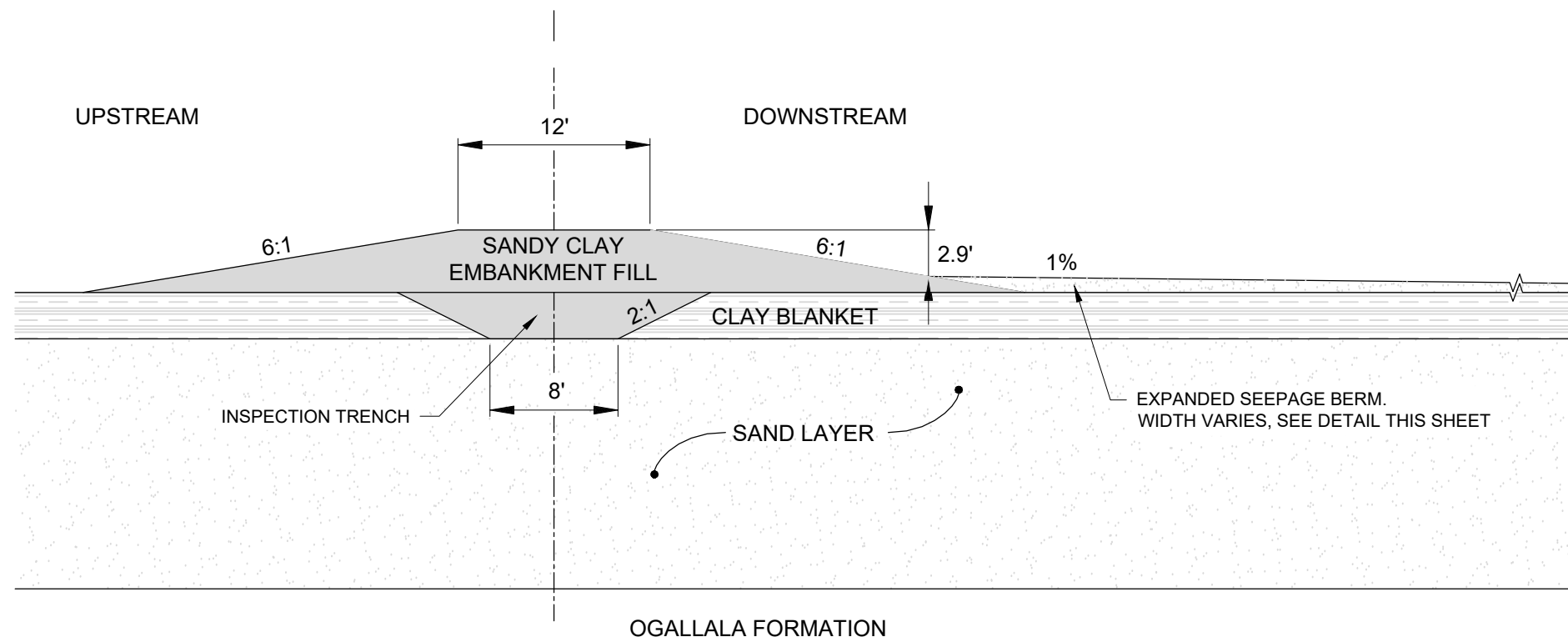
ALIGNED WITH TRAINING DIKES,
NOTE: RIPRAP TRAINING DIKES
AND SPLITTER DIKES NOT
REQUIRED _____

CELL #1, CELL #2, CELL #5 & CELL #7

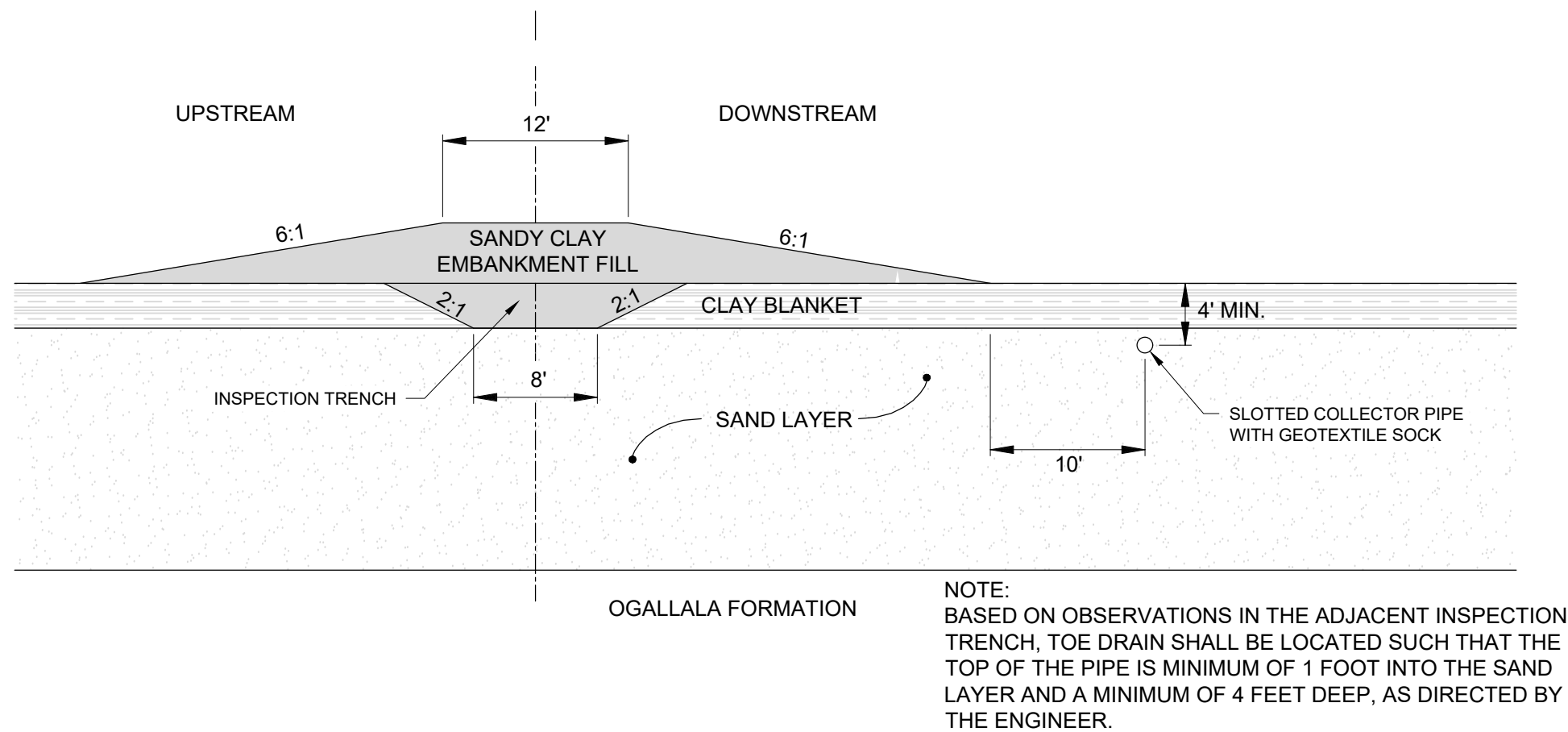
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TYPICAL SECTION - BERMS
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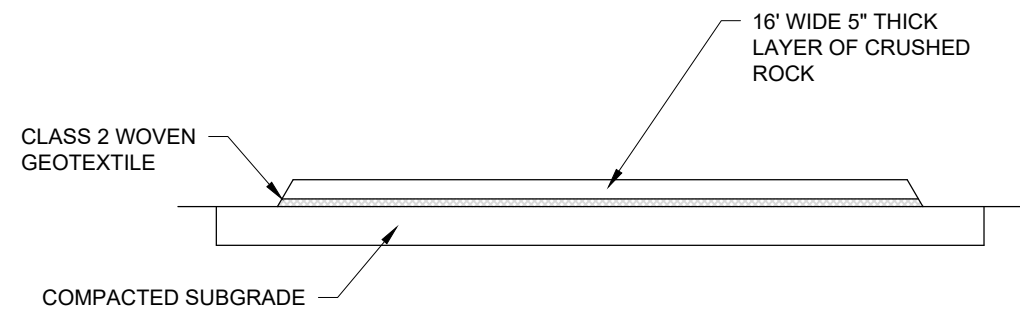


TYPICAL SECTION BERMS #1, BERMS #2, BERMS #3 AND BERMS #4 SEEPAGE BERM AT LOCATIONS SHOWN ON PLAN
NOT TO SCALE

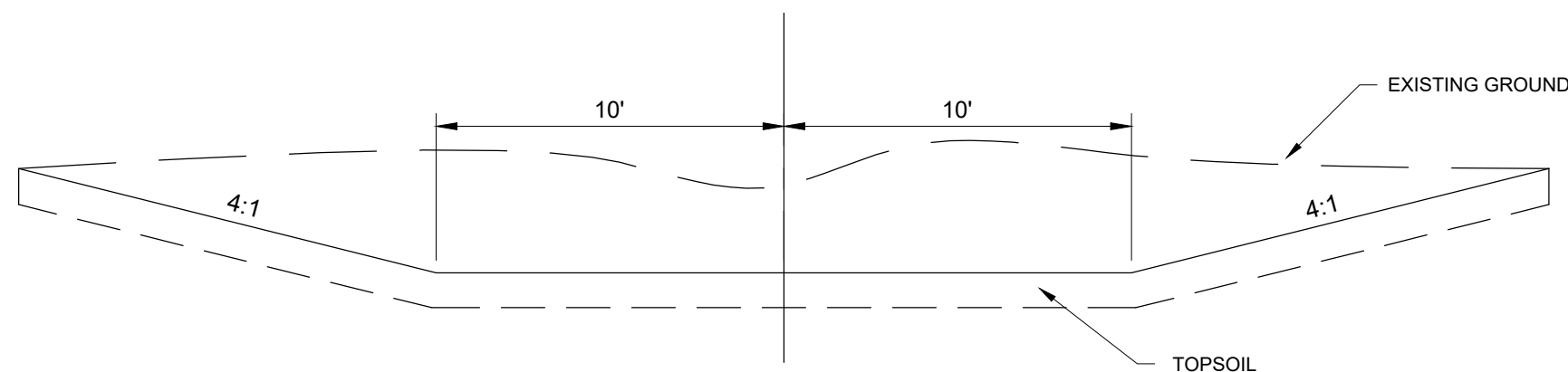


TYPICAL SECTION BERM #5, BERM #6, BERM #7 AND BERM #8 DRAIN AT LOCATIONS SHOWN ON PLAN
NOT TO SCALE

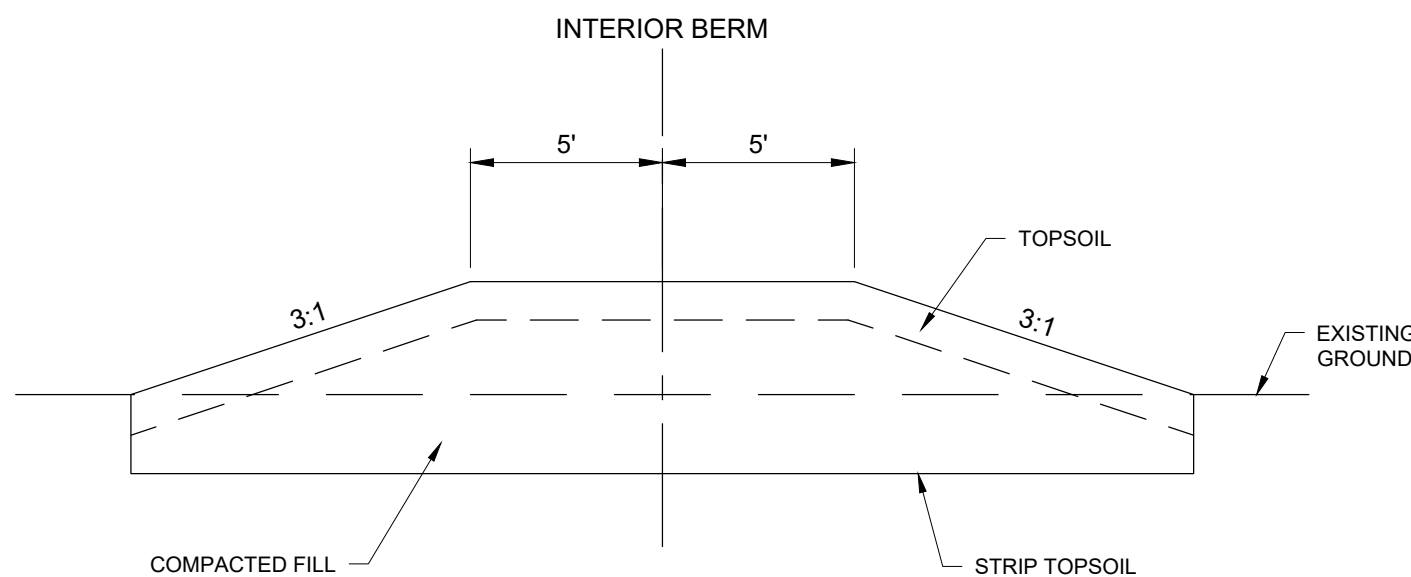
TYPICAL BERM SECTIONS



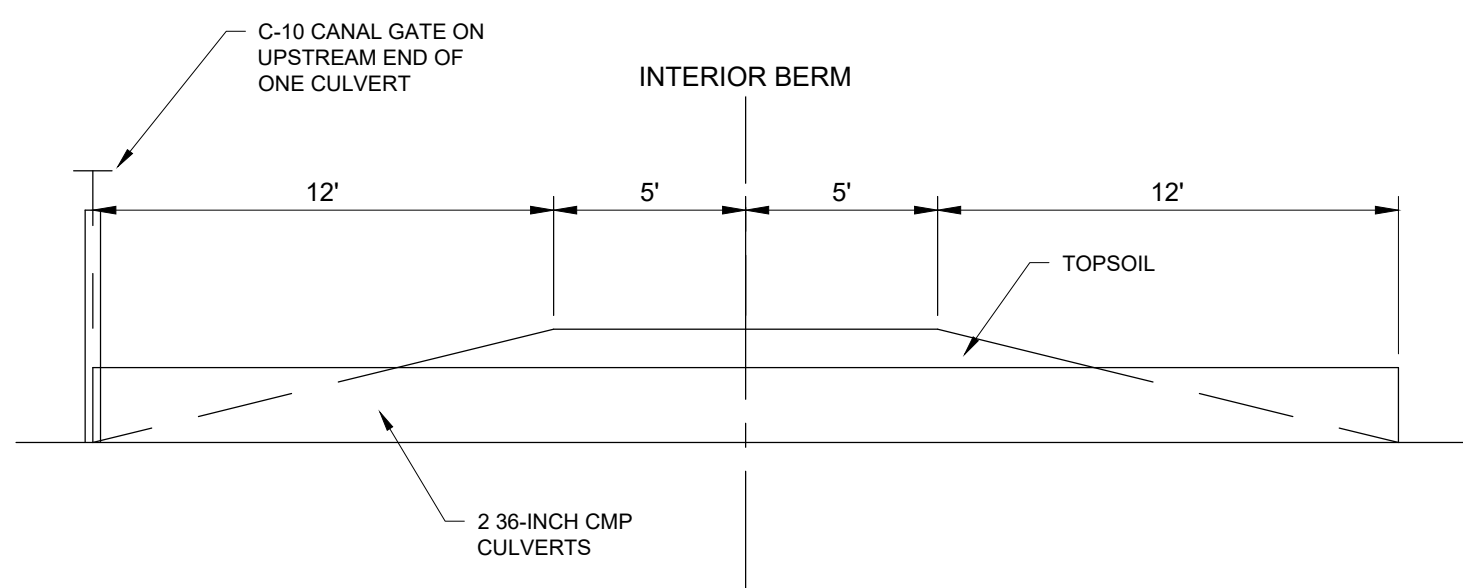
MAINTENANCE ROAD TYPICAL SECTION
NO SCALE



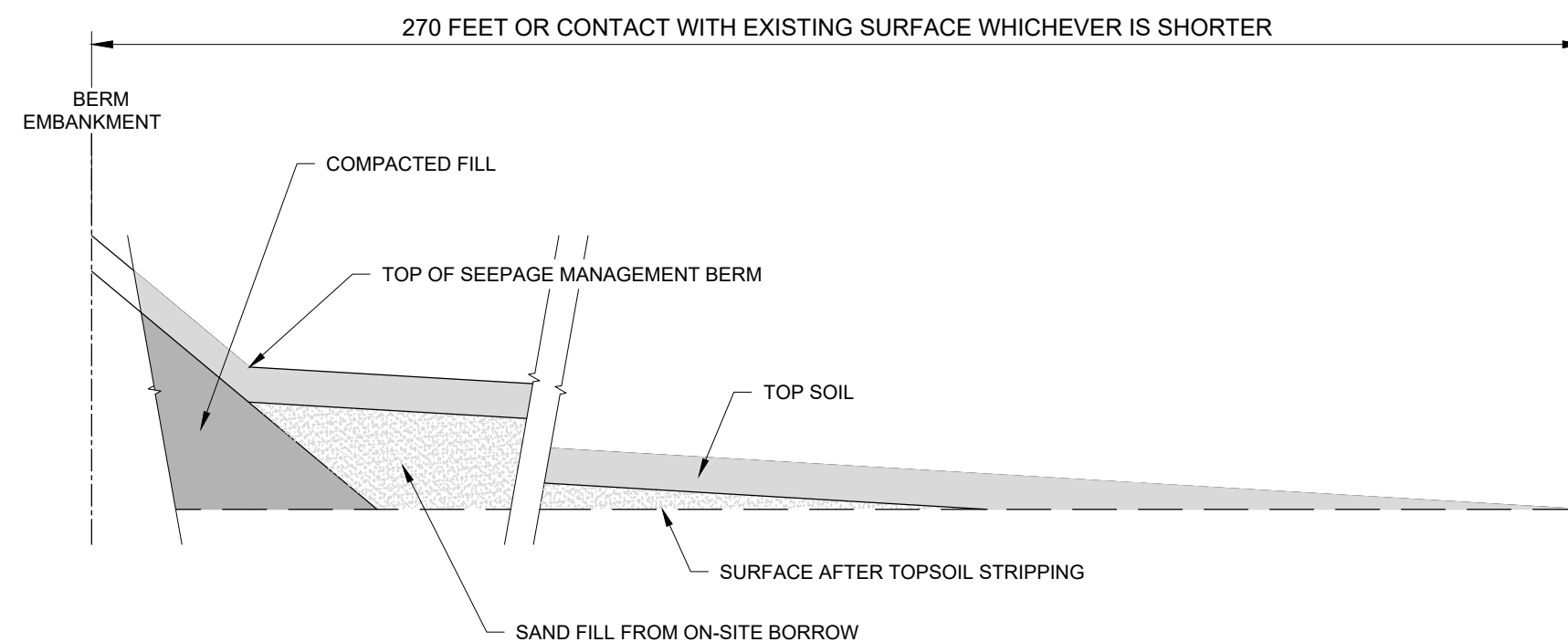
SWALE SECTION
NO SCALE



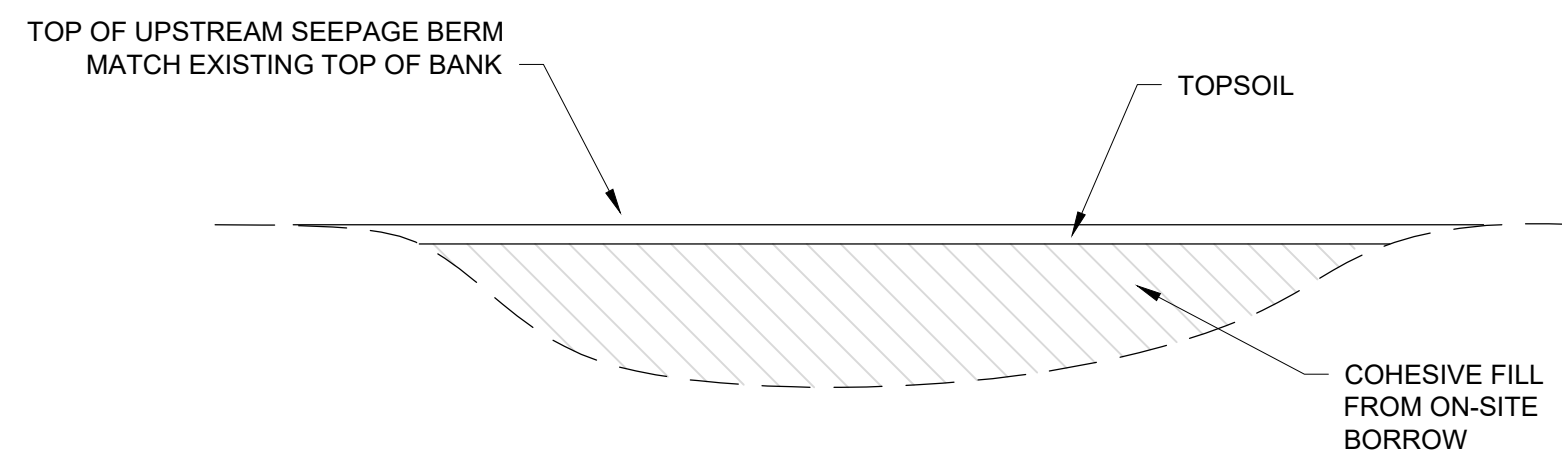
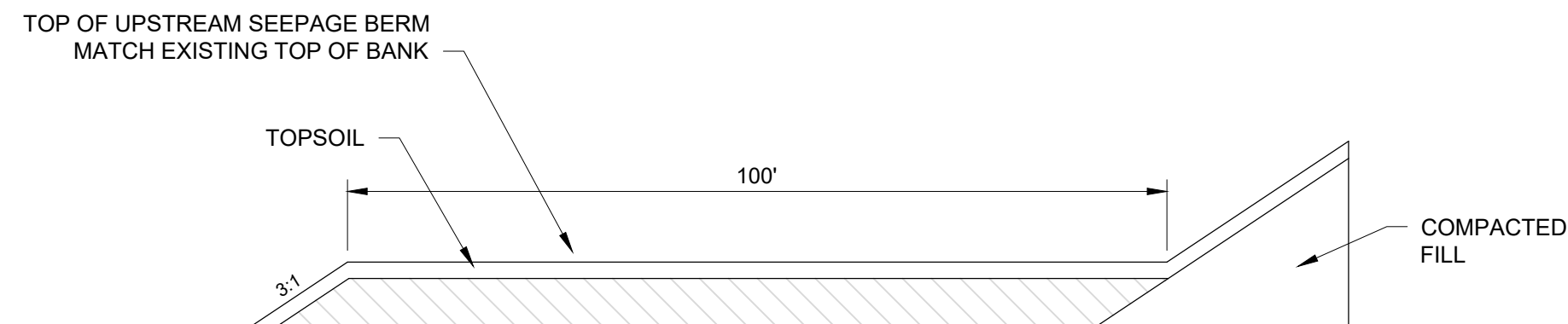
INTERIOR BERM SECTION (TYPICAL)
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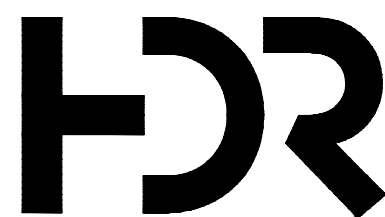
CELL #6 INTERIOR BERM CULVERT DETAIL
NO SCALE



EXPANDED TYPICAL SECTION - DOWNSTREAM SEEPAGE BERM
NOT TO SCALE



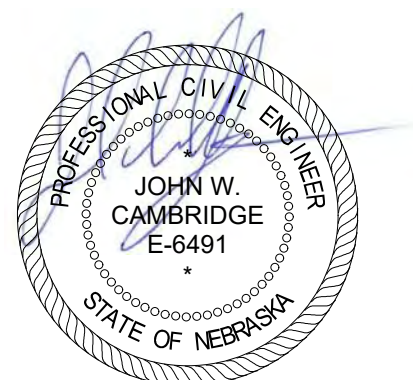
UPSTREAM SEEPAGE BERM
NO SCALE



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PROJECT MANAGER PAT ENGELBERT

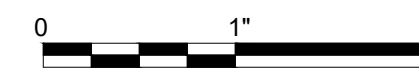
PROJECT NUMBER	10057849



04 MAY 2018

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

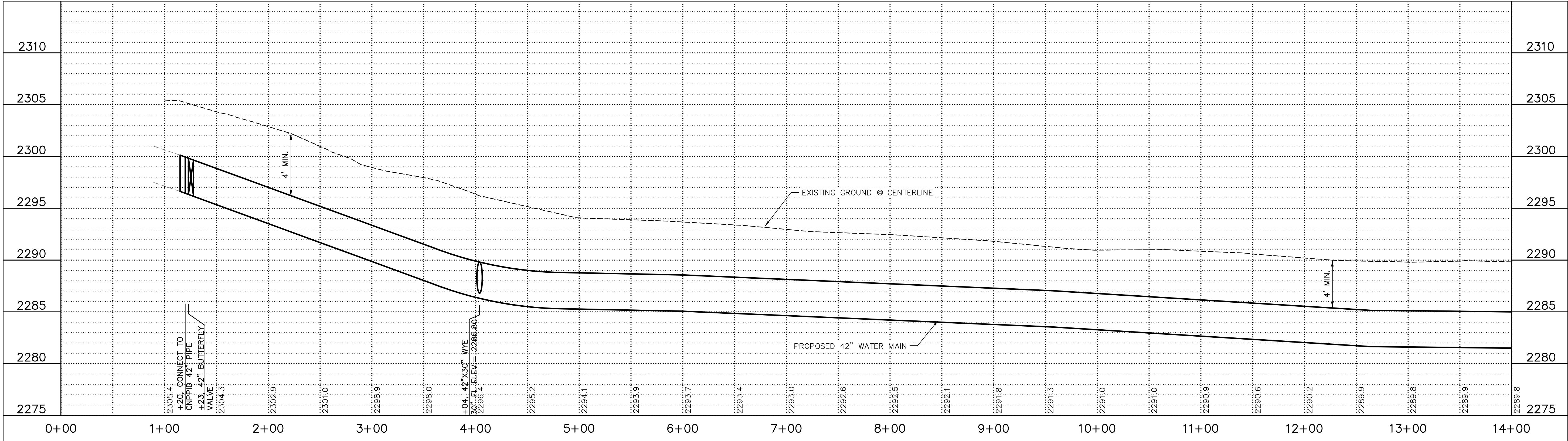
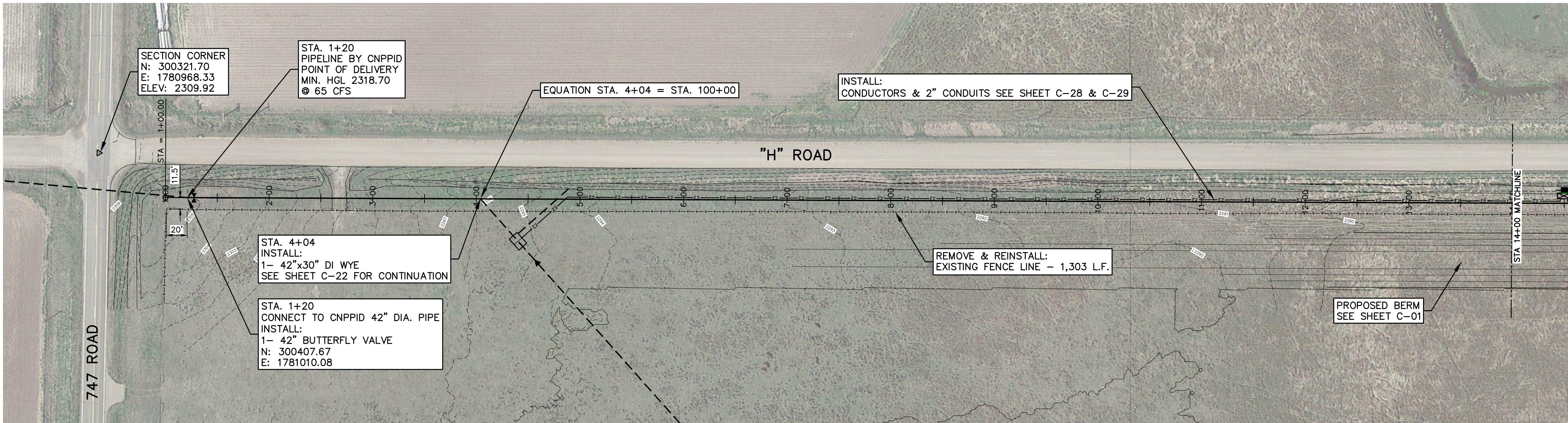
TYPICAL SECTIONS



FILENAME 00C-18.dwg
SCALE N/A

SHEET
C-18

FILENAME: G:\Projects\129\129-P1-025\Civil-Dwgs\Sheet Drawings\SH_Water.dwg PLOTTED: 5/3/2018 5:11 PM Andrew C. Olson

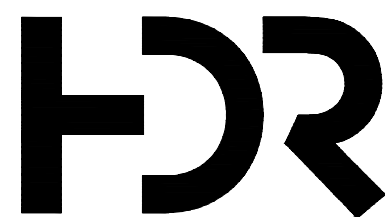
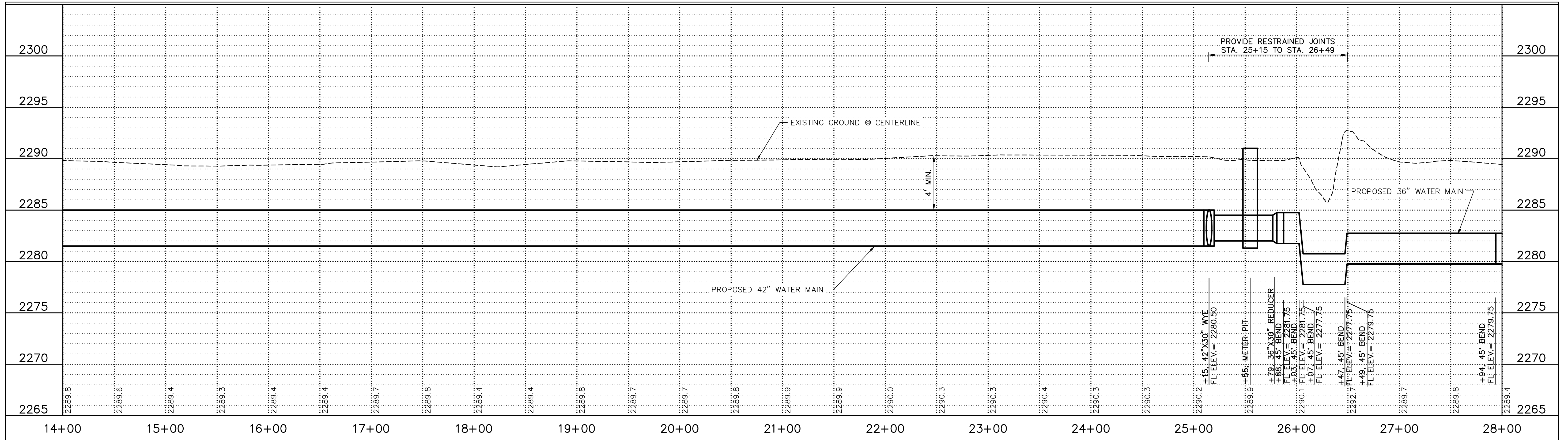
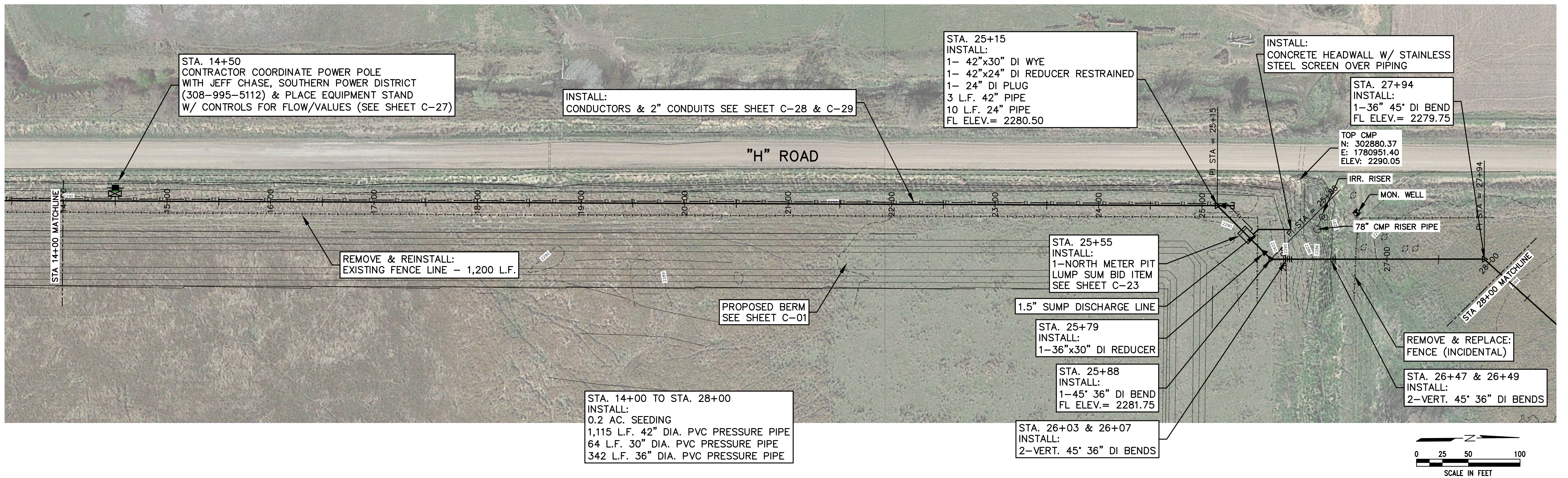


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PROJECT MANAGER PAT ENGELBERT	
PROJECT NUMBER	1005789



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PROJECT NUMBER	1005789



PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

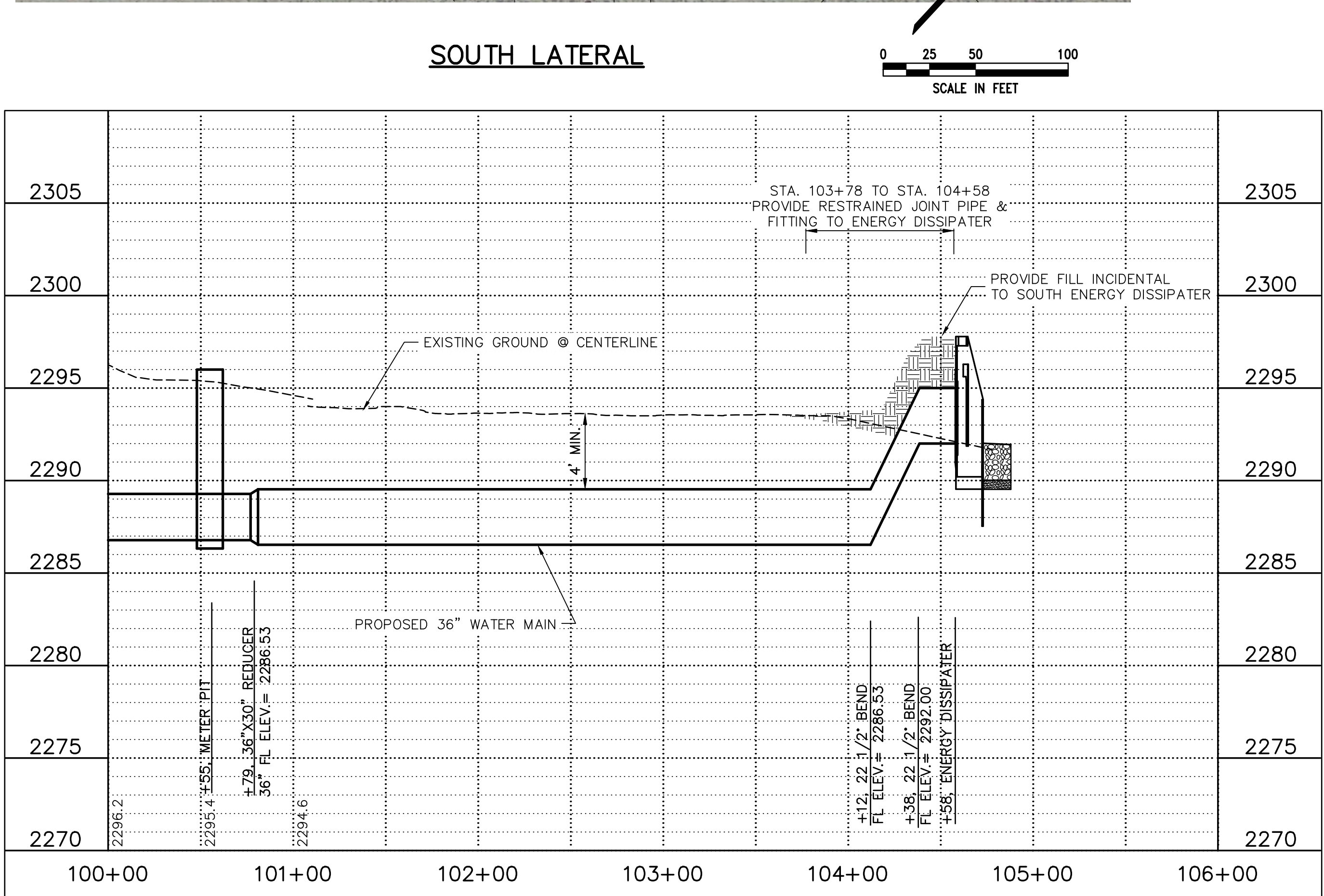
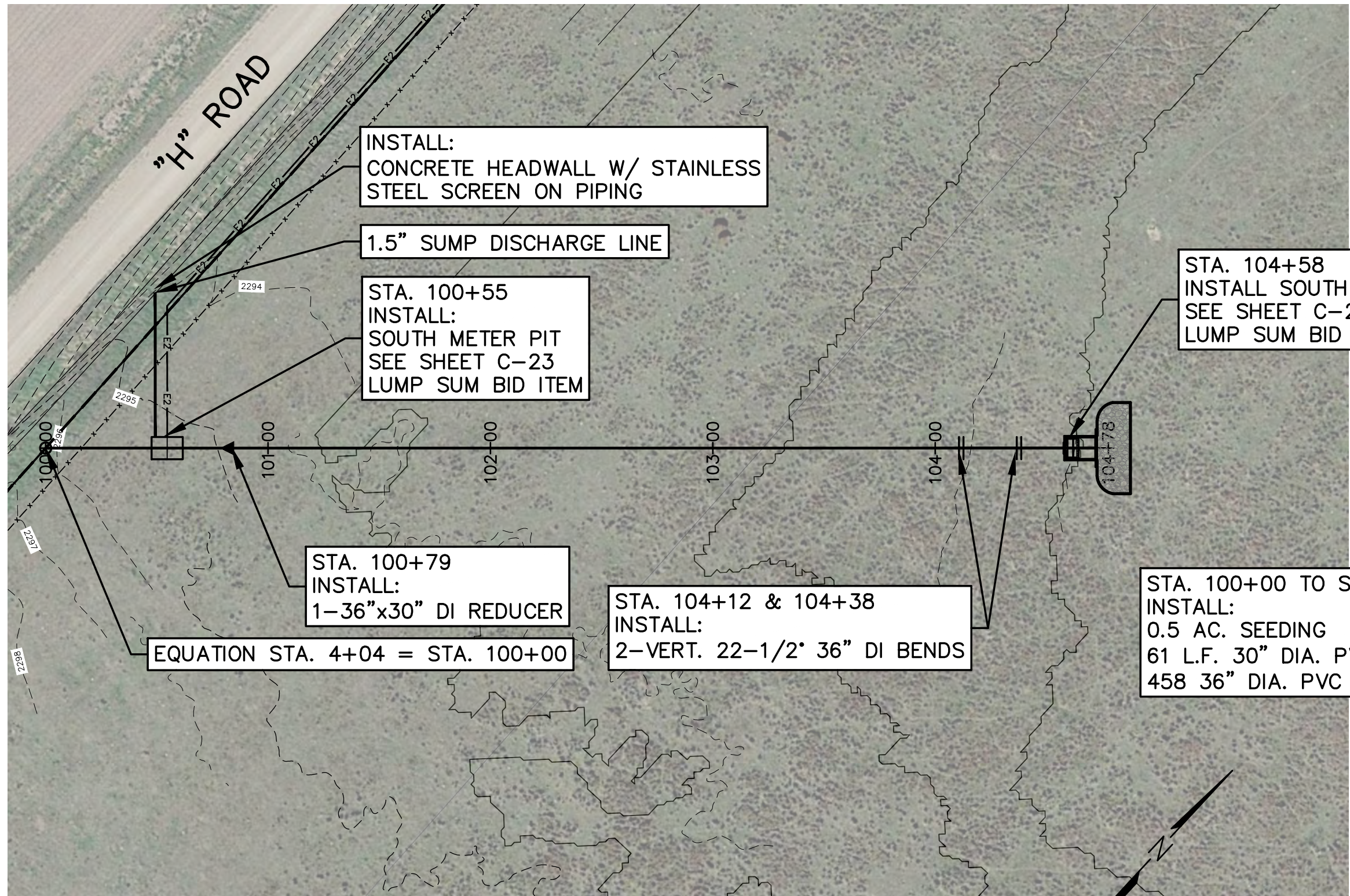
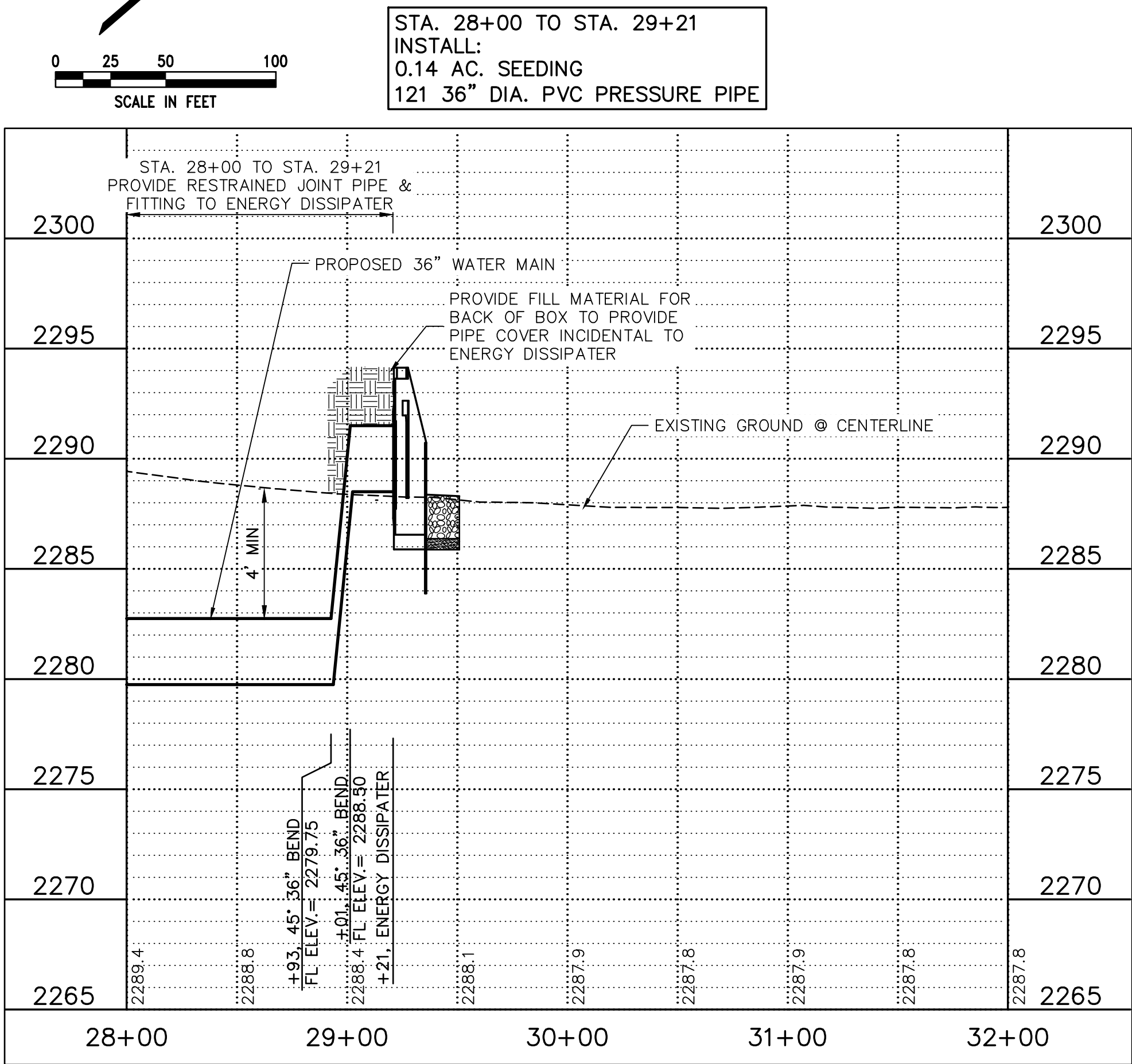
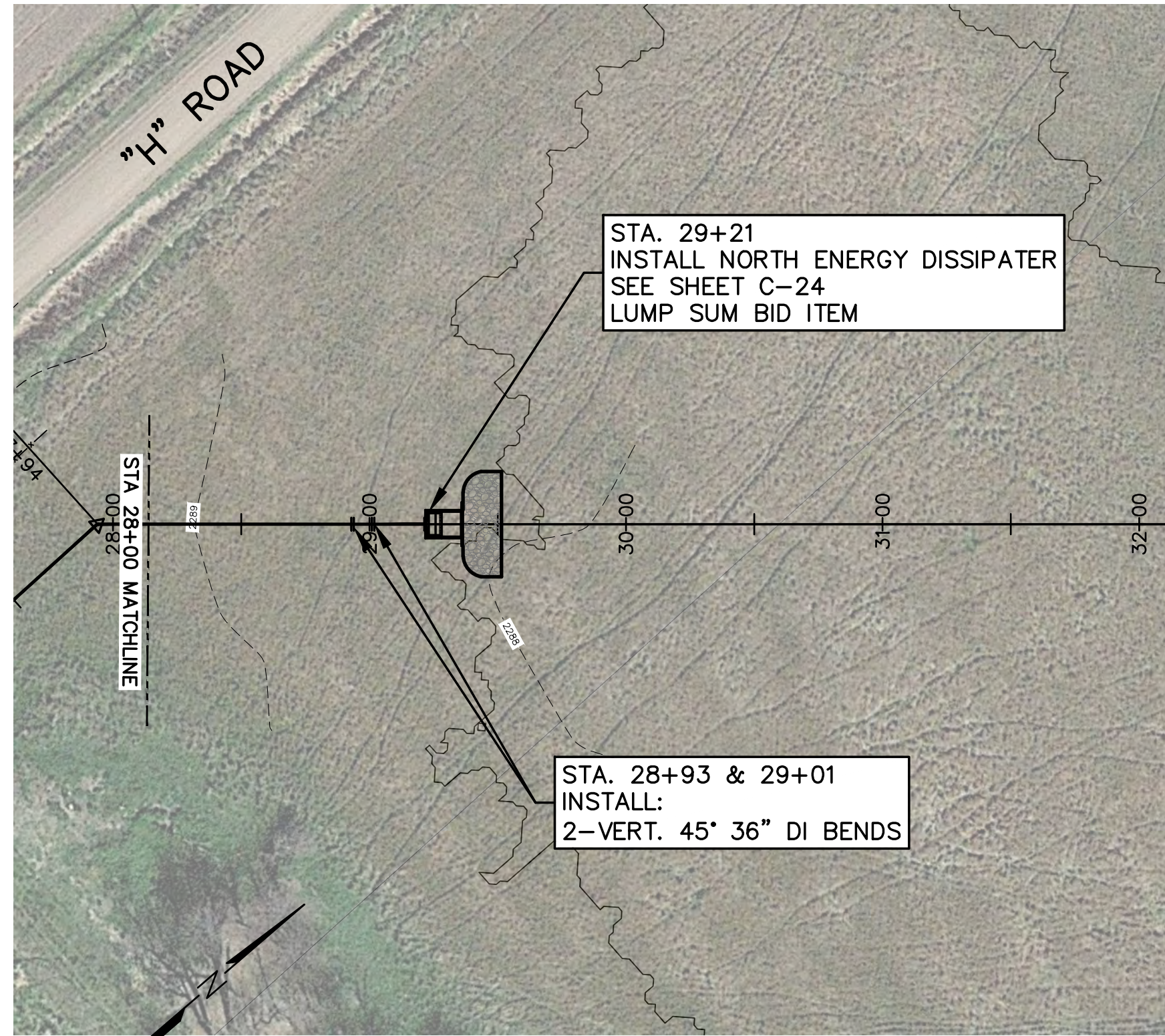
NORTH DISCHARGE PIPING
PLAN & PROFILE STA. 14+00 TO 28+00



FILENAME SH_Water
SCALE AS SHOWN

SHEET
C-21

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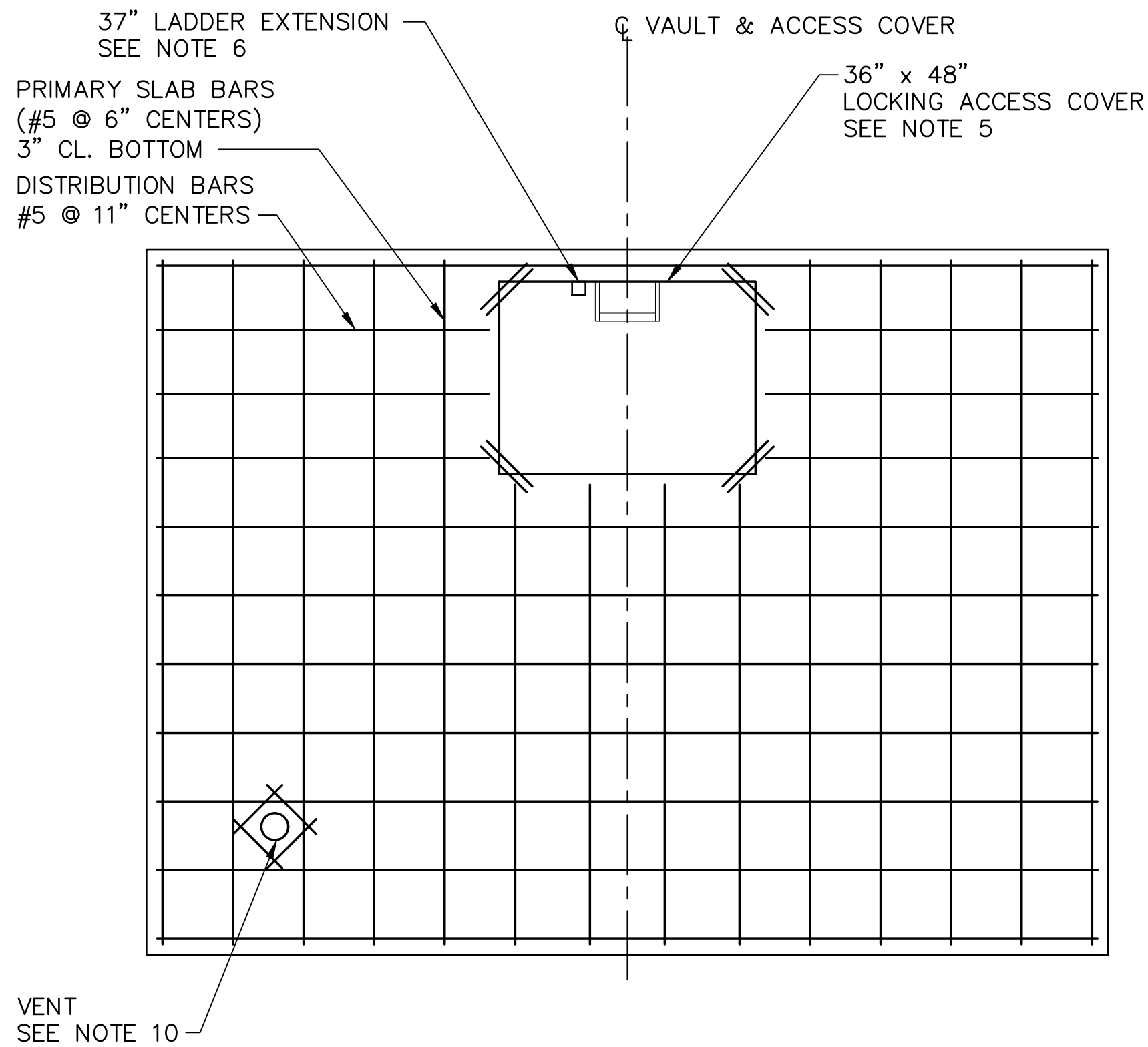
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PROJECT MANAGER PAT ENGELBERT

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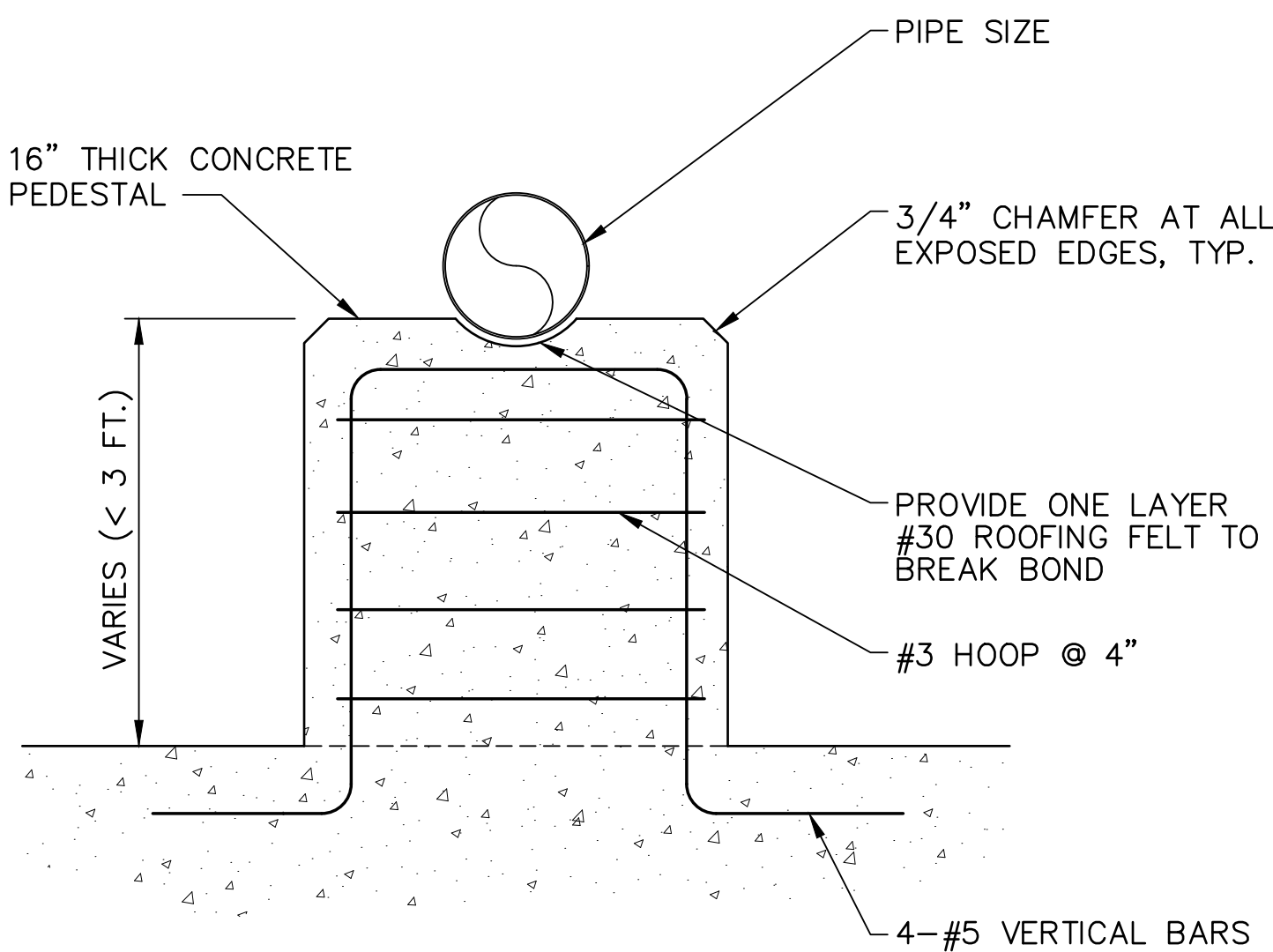


METER PIT TOP SLAB PLAN
SCALE: 1/2" = 1'-0"

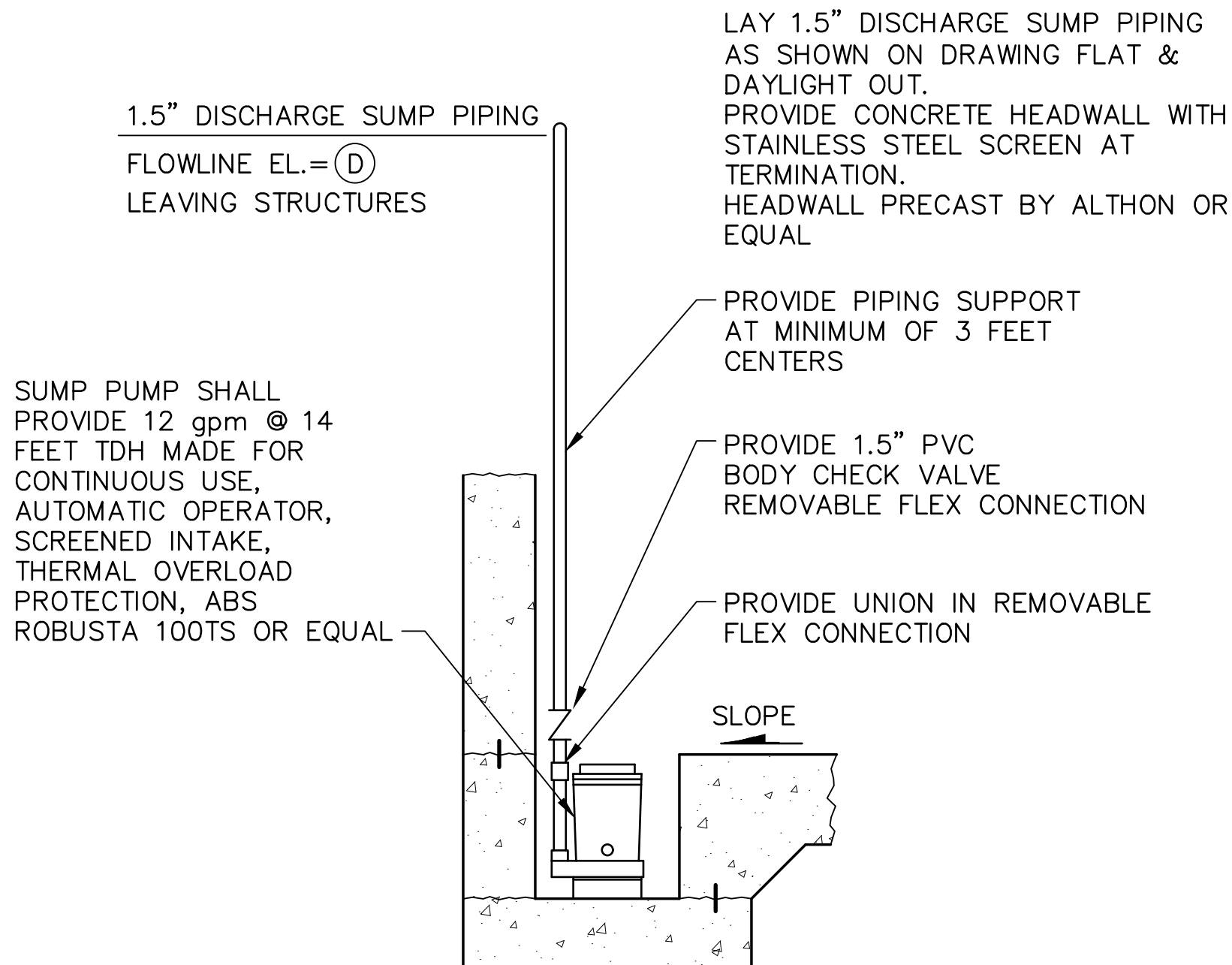
GENERAL NOTES:

1. CONFIGURATION AND DIMENSIONS SHOWN ARE SUGGESTED MINIMUM REQUIREMENTS ONLY. ALL DETAILS, INCLUDING LOCATION AND SPACING ARRANGEMENTS OF ACCESS COVER, ETC., ARE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
2. PROVIDE 8" OF CRUSHED ROCK FROM 12" ROCK BASE TO TOP OF FOOTINGS.
3. ALL VERTICAL EXTERIOR WALL SURFACES SHALL RECEIVE A FIBERED ASPHALT COMPOUND TO A FINAL WET THICKNESS OF 1/8 INCH. PROVIDE COATING MEETING ASTM D449 EQUAL TO SONNEBORN HYDROXIDE 700 B SEMI-MASTIC.
4. ALL INTERIOR METAL SURFACES SHALL RECEIVE PAINTING PER SPECIFICATIONS.
5. H-20 LOAD RATED ACCESS COVER (LOCKABLE) W/ DIAMOND PATTERN MODEL MANUFACTURED BY BILCO OR HALLIDAY.
6. MOUNT LADDER EXTENSION TO VAULT WITH STANDOFFS TO ALLOW EXTENSION ABOVE VAULT LID, HALLIDAY L1EA OR EQUAL.
7. INSTALL PVC PIPING FROM COVER DRAIN TO SUMP.
8. PROVIDE VAULT TOP SLAB WITH LIFTING HOOKS FOR FUTURE REMOVAL.
9. PLACE 4 BOLLARDS AT CORNER OF VAULT.
10. CONSTRUCT 3" VENT WITH FLANGED AND PLAIN END WALL PIPE, TWO FLANGED D.I. 90° BENDS WITH STAINLESS STEEL INSECT SCREEN.
11. STEPS SHALL BE DEETER 1607, NEENAH R-1982-W OR APPROVED EQUAL.

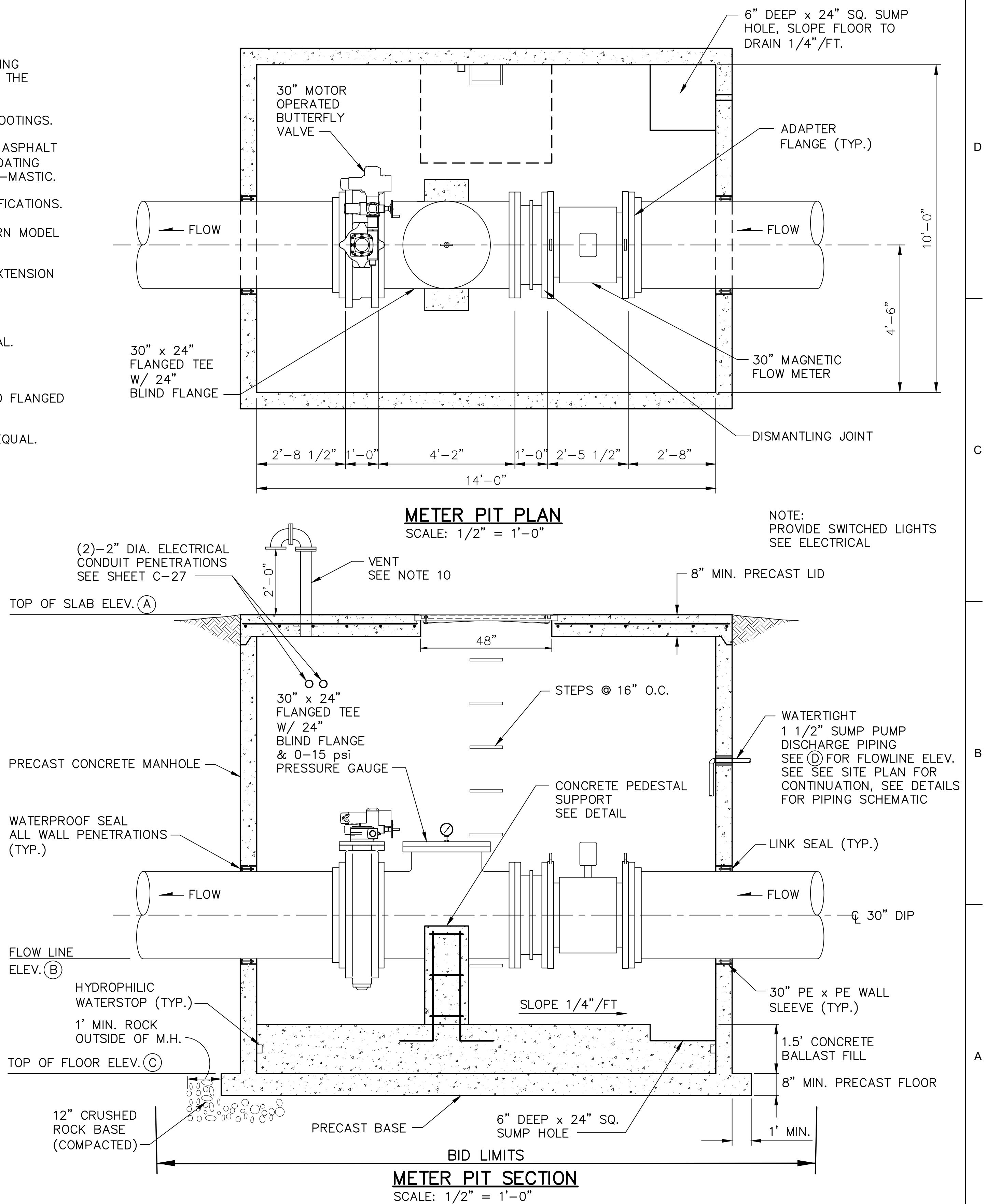
ELEVATION TABLE		
MARK	SOUTH	NORTH
A	2296.0	2291.0
B	2286.8	2280.5
C	2283.8	2277.5
D	2293.0	2289.0



CONCRETE PEDESTAL SUPPORT
NO SCALE



SUMP PUMP SECTION (TYP.)
NO SCALE



METER PIT PLAN
SCALE: 1/2" = 1'-0"

METER PIT SECTION
SCALE: 1/2" = 1'-0"

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PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	1005789



[illegible]

PROJECT MANAGER	PAT ENGELBERT
PROJECT NUMBER	1005789



C-24

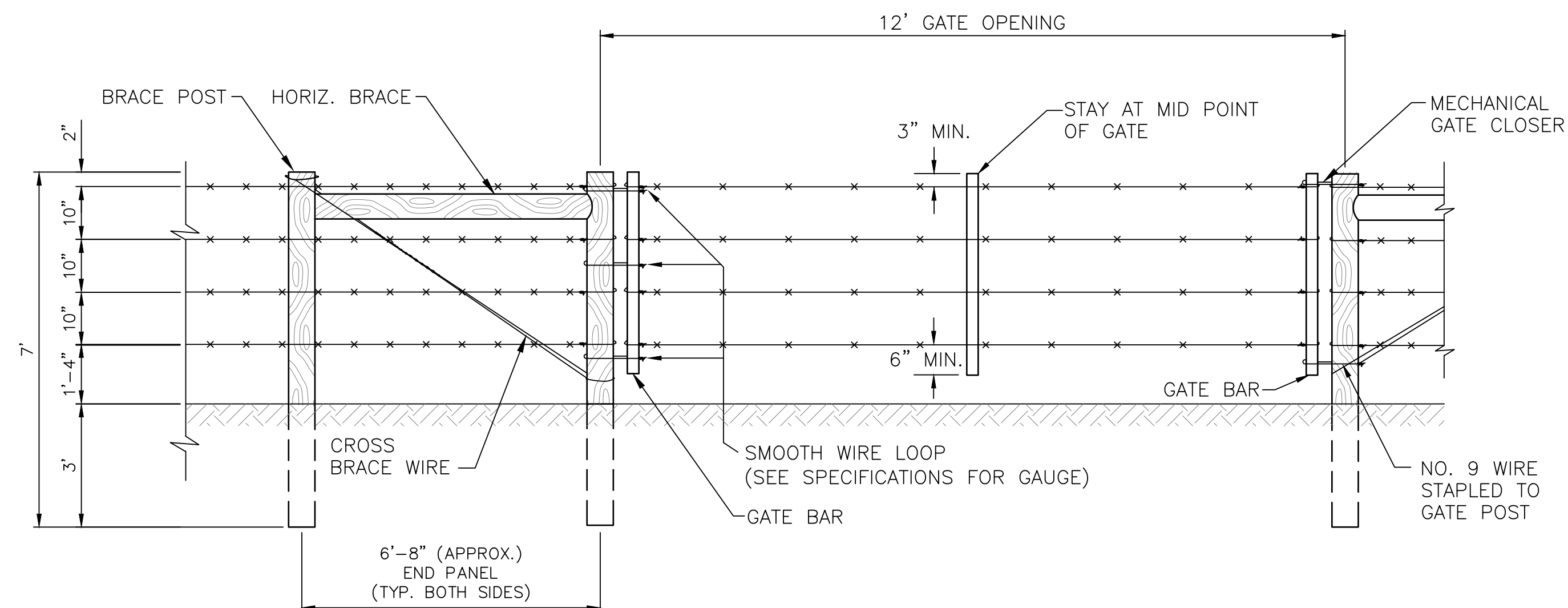
NO SCALE

NO SCALE

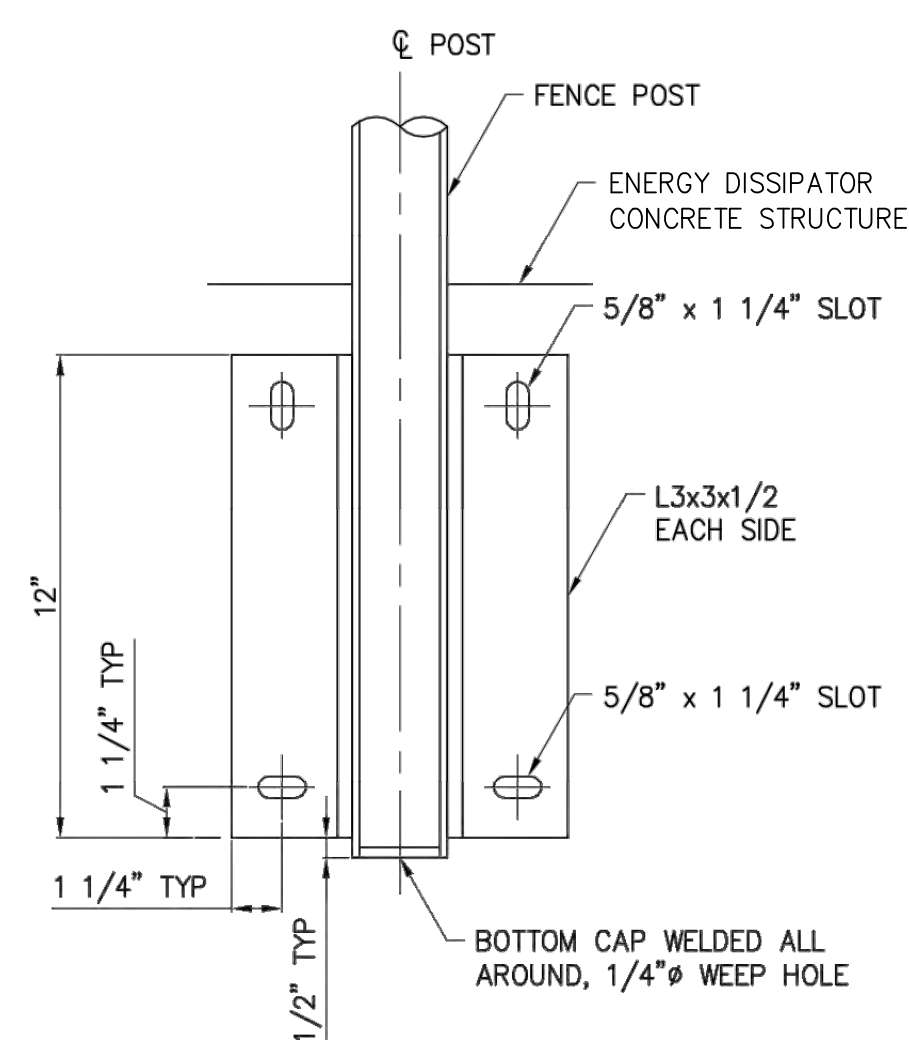
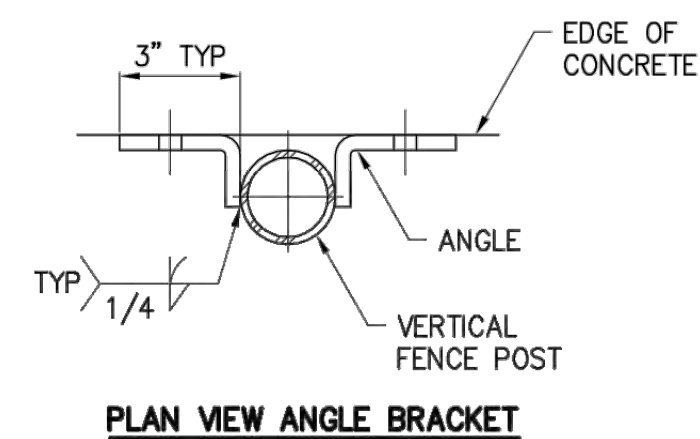
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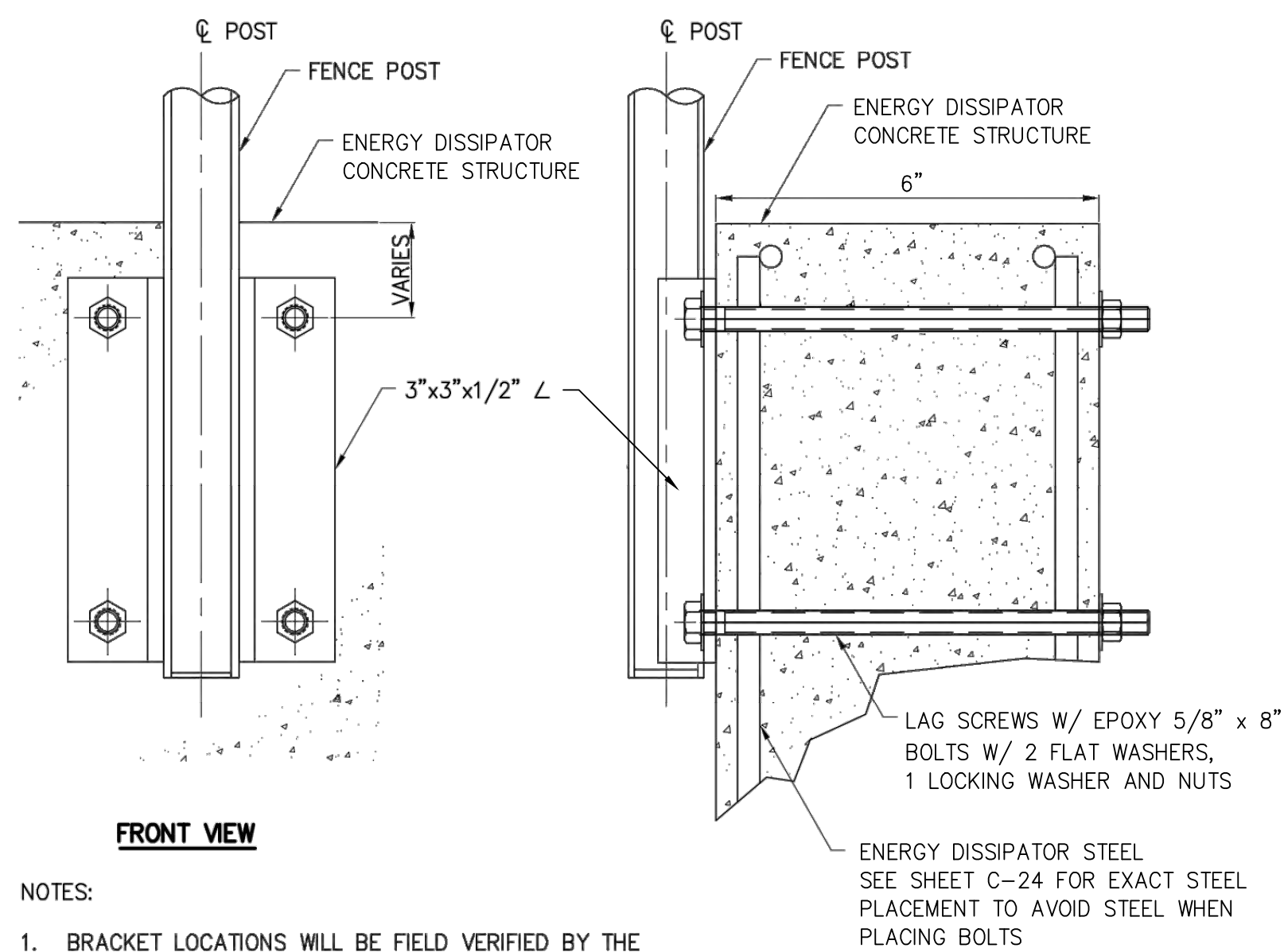
NO SCALE



GATE SECTION DETAIL
NO SCALE



FRONT VIEW – ANGLE BRACKET



SIDE VIEW

- NOTES:

1. BRACKET LOCATIONS WILL BE FIELD VERIFIED BY THE CONTRACTOR AND CONTRACTING OFFICER TO AVOID INTERFERENCE WITH STEEL REINFORCEMENT BARS.
2. BRACKETS ARE WELDED TO PIPE. SEE CALLOUT ON DETAIL.
3. WELDS SHALL BE THE FULL LENGTH OF ANGLE ON BOTH SIDES OF ALL POST ANGLE BRACKETS.
4. AFTER WELDING, PAINT WELDED AREA WITH GALVANIZED-TYPE PAINT FOR RUST PROTECTION.

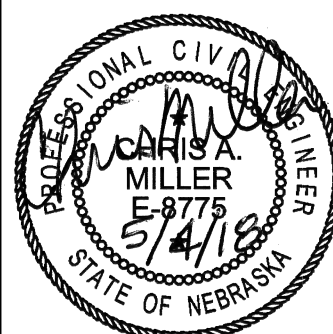
SIDE MOUNT POST BASE IN CONCRETE
NO SCALE

- GATE SECTION NOTES:

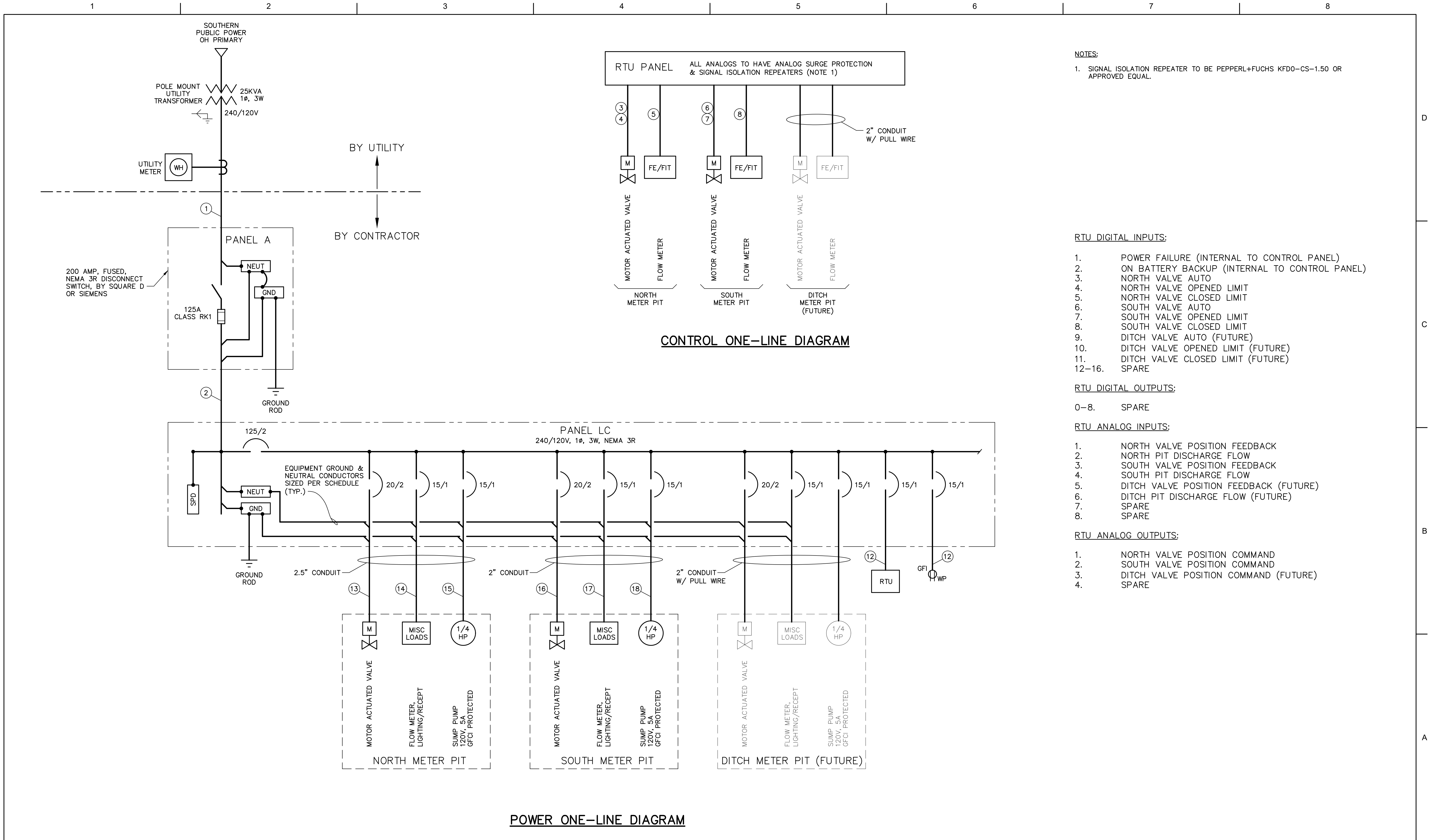
1. ALL POSTS SHALL BE SET VERTICALLY AND IN ALIGNMENT.
2. USE 4" DIA. POST OR 4"x4" PRESSURE TREATED TIMBER, APPROX. 6'-6" LONG FOR HORIZONTAL BRACES.
3. NOTCH GATE POSTS BRACE POSTS AND CORNER POST 1" FOR THE HORIZONTAL BRACE. SECURE EACH HORIZONTAL BRACE WITH WIRE SPIKES.
4. CUT, WRAP AND TIE WIRE SPIKES AT ALL GATE AND CORNER POSTS.
5. DOUBLE STAPLE NO. 9 DIAGONAL BRACE WIRES TO GATE BRACE AND CORNER POST. DOUBLE STAPLE EACH LINE WIRE AT ALL CORNER AND GATE POSTS.
6. USE 3" DIA. POSTS FOR GATE BARS. DOUBLE STAPLE EACH WIRE TO GATE BARS.
7. USE 9 GAUGE GALVANIZED STEEL STAY AT MIDPOINT OF GATE.
8. USE 1 PULL OR CENTER POST AND ONLY ONE BRACE POST FOR LOCATIONS WHERE A PULL POST ASSEMBLY IS INSTALLED ON EACH SIDE OF DRAW.
9. USE 12 1/2 GAUGE BARBED WIRE.
10. USE 4" MIN. DIA. WOOD LINE POST UNLESS OTHERWISE DIRECTED.
11. USE 5" MIN. DIA. WOOD BRACE POSTS AND CORNER POSTS.

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	PAT ENGELBERT
PROJECT NUMBER	1005789



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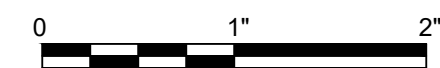
PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	1005789



PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

ELECTRICAL DETAILS



FILENAME SH-DET
SCALE AS SHOWN

SHEET
C-28

FILENAME: G:\Projects\129\129-P1-025\Civil-Dwgs\Sheet Drawings\SH-DET.dwg PLOTTED: 3/3/2018 8:32 AM Dinza Miller

CABLE/CONDUCTOR SCHEDULE							
MARK ○	PARALLEL RUNS	PHASE	NEUTRAL	GROUND	CONTROL	TRADE SIZE CONDUIT	DESCRIPTION
1	1	2-1/0 AWG	1-1/0 AWG	1-#2 AWG		2"	POWER FROM METER TO DISCONNECT
2	1	2-1/0 AWG	1-1/0 AWG	1-#2 AWG		2"	DISCONNECT TO PANEL LC
MARK	CONDUCTORS	GROUND	CONDUIT	DESCRIPTION			
3	2-2C #12 TSP		2.5"	NORTH PIT ACTUATOR CONTROL			
4	6-#12 THHN	1-#12 THHN	2"	NORTH PIT ACTUATOR CONTROL			
5	1-2C #12 TSP			NORTH PIT FLOW METER (SEE NOTE 1)			
6	2-2C #12 TSP		2"	SOUTH PIT ACTUATOR CONTROL			
7	6-#12 THHN	1-#12 THHN	2"	SOUTH PIT ACTUATOR CONTROL			
8	1-2C #12 TSP			SOUTH PIT FLOW METER (SEE NOTE 2)			
9			2"	FUTURE DITCH ACTUATOR CONTROL			
10			2"	FUTURE DITCH ACTUATOR CONTROL			
11			2"	FUTURE DITCH FLOW METER			
12	2-#12 THHN	1-#12 THHN	3/4"	POWER TO MISC. LOADS			
13	2-#2 AWG	1-#2 AWG	2.5"	NORTH PIT ACTUATOR			
14	2-#2 AWG			NORTH PIT LIGHTING AND RECEPTACLE MISC. LOADS (SEE NOTE 3)			
15	2-#2 AWG			NORTH PIT SUMP PUMP (SEE NOTE 3)			
16	2-#4 AWG	1-#4 AWG	2"	SOUTH PIT ACTUATOR			
17	2-#4 AWG			SOUTH PIT LIGHTING AND RECEPTACLE MISC. LOADS (SEE NOTE 4)			
18	2-#4 AWG			SOUTH PIT SUMP PUMP (SEE NOTE 4)			
19	PULL STRING		2"	FUTURE DITCH PIT ACTUATOR			
20	PULL STRING			FUTURE DITCH PIT LIGHTING AND RECEPTACLE MISC. LOADS (SEE NOTE 5)			
21	PULL STRING			FUTURE DITCH PIT SUMP PUMP (SEE NOTE 5)			

NOTES:

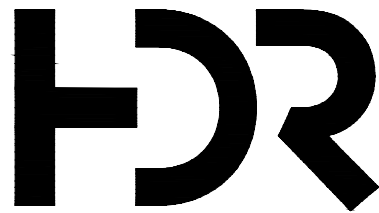
1. COMBINE MARKS 3 AND 5 IN COMMON CONDUIT.
2. COMBINE MARKS 6 AND 8 IN COMMON CONDUIT.
3. COMBINE MARKS 13, 14, 15 IN COMMON CONDUIT.
4. COMBINE MARKS 16, 17, 18 IN COMMON CONDUIT.
5. COMBINE MARKS 19, 20, 21 IN COMMON CONDUIT.

PANEL SCHEDULE								
PANEL LC								
CIRCUIT NUMBER	BREAKER TRIP	LOAD DESCRIPTION	LOAD VA	PHASE	LOAD VA	LOAD DESCRIPTION	BREAKER TRIP	CIRCUIT NUMBER
1	20/2	NORTH ACTUATOR	1000	A	720	NORTH SUMP	15/1	2
3	↓	↓	1000	B	720	SOUTH SUMP	15/1	4
5	20/2	SOUTH ACTUATOR	1000	A	600	NORTH LIGHTING / RECEPT	15/1	6
7	↓	↓	1000	B	600	SOUTH LIGHTING / RECEPT	15/1	8
9	20/2	FUTURE ACTUATOR	1000	A	720	FUTURE SUMP	15/1	10
11	↓	↓	1000	B	600	FUTURE LIGHTING / RECEPT	15/1	12
13		SPARE		A		SPARE		14
15	15/1	CONTROL PANEL	85	B	180	LOAD RECEPT	15/1	16
17	30/2	SPD		A				18
19	↓	↓		B				20

AMPS	125	LOAD	A PHASE CONNECTED VA	5040	MAIN	125/2 CIRCUIT BREAKER
VOLTAGE	240/120		B PHASE CONNECTED VA	5185	NEUTRAL	
PH/WIRE	1PH/3W		PHASE BALANCE	97.2%	ENCLO.	NEMA 3R
SH. CKT.	10 KAIC		TOTAL CONNECTED VA	10225	MOUNTING	SURFACE
TYPE	PLUG ON		DEMAND VA	11302.5	MFGR.	SQ D QO

NON-CONTINUOUS LOAD	CONNECTED VA	DEMAND FACTOR	DEMAND VA
CONTROLS	85	1	85
NORTH LIGHTING	50	1.25	62.5
NORTH RECEPT.	550	1	550
NORTH SUMP PUMP	720	1.25	900
SOUTH LIGHTING	50	1.25	62.5
SOUTH RECEPT.	550	1	550
SOUTH SUMP PUMP	720	1.25	900
FUTURE DITCH LIGHTING	50	1.25	62.5
FUTURE DITCH RECEPT.	550	1	550
FUTURE DITCH SUMP PUMP	720	1.25	900
LOAD RECEPT.	180	1	180
SUBTOTAL			4802.5
MOTOR LOAD			
LARGEST (NORTH ACTUATOR)	2000	1.25	2500
REMAINDER (SOUTH ACTUATOR)	2000	1.00	2000
REMAINDER (FUTURE DITCH ACTUATOR)	2000	1.00	2000
SUBTOTAL			6500
CONTINUOUS LOAD			
FUTURE	300	1.25	375
SUBTOTAL			375

					MIN	ACTUAL
TOTALS	VA	10225		11302.5	PANEL AMPACITY	3 125
	AMPS	42.6		47.1	OVERCURRENT DEVICE	3 125



ISSUE	DATE	DESCRIPTION
5	5-04-2018	FINAL DESIGN
4	3-29-2018	FINAL PENDING PIPELINE DESIGN
3	3-21-2018	REVISED FINAL FOR PROGRAM REVIEW
2	2-28-2018	FINAL FOR PROGRAM REVIEW
1	2-16-2018	90% PLAN REVIEW

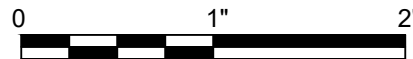
PROJECT MANAGER PAT ENGELBERT

PROJECT NUMBER	1005789



PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
COTTONWOOD RANCH - PHELPS COUNTY, NEBRASKA
BROAD-SCALE RECHARGE PROJECT

ELECTRICAL SCHEDULES



FILENAME SH-DET
SCALE AS SHOWN

SHEET
C-29



Platte River Recovery Implementation Program

Cottonwood Ranch Broad-Scale Recharge

PRRIP Project Number: P18-005

Construction Documents Project Manual




Final Design

May 4, 2018

HDR Project No. 10057849



SECTION 00007
SEALS AND SIGNATURES

 <p style="text-align: center;">04 MAY 2018</p>	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Nebraska.</p> <hr/> <p>John W. Cambridge 05/04/2018</p> <p>My license renewal date is December 31, 2018</p> <p>Pages or sheets covered by this seal: Divisions: Division 0, 1, 3 and 5 Sections: 02110, 02260, 02270, 02271, 02423, 02930 and 11515</p>
 <p style="text-align: center;">May 4, 2018</p>	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Nebraska.</p> <hr/> <p>Bryan P. Kumm 05/04/2018</p> <p>My license renewal date is December 31, 2018</p> <p>Pages or sheets covered by this seal: Sections: 02200, 02240, 02512 and 02778</p>
 <p style="text-align: center;">5/4/18</p>	<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Nebraska.</p> <hr/> <p>Chris Miller 05/04/2018</p> <p>My license renewal date is December 31, 2018</p> <p>Pages or sheets covered by this seal: Divisions: 8, 10, 13 and 16 Sections: 02221, 02284, 02444, 02660, 15060, 15062, 15064 and 15103</p>

END OF SECTION

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DIVISION 00

BIDDING REQUIREMENTS, CONTRACT FORMS, AND
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ADVERTISEMENT FOR BIDS

The Nebraska Community Foundation, Inc. (Foundation) of Lincoln, Nebraska, representing all signatories to the Platte River Recovery Implementation Program (Program) will receive sealed bids for the Cottonwood Ranch Broad-Scale Recharge Project near Overton, Nebraska. These activities are generally described as follows:

Construction of low head berms and water control structures that will be used to pond water for groundwater recharge.

Sealed bids will be received at the office of the Platte River Implementation Recovery Program located at the following address:

Platte River Recovery Implementation Program
4111 4th Avenue, Suite 6
Kearney, Nebraska 68845

All bids must be mailed, or hand delivered to the Program Office no later than **(TIME)** Central Time on **(DATE)**. The bids will then be opened and read aloud at that time. All bids shall be submitted in accordance with and on the forms included in the Project Manual.

Contract Documents, including proposal bid forms, drawings and Project Manual, have been placed on file and may be examined at the Program Office. Electronic copies of the Contract Documents can be obtained by email from the Point of Contact identified below:

Kevin Werbylo
Headwaters Corporation
4111 4th Avenue, Suite 6
Kearney, Nebraska 68845
werbylok@headwaterscorp.com)

A MANDATORY PRE-BID CONFERENCE will be held on **(DAY, DATE, TIME)** and will be held **on-site**. **(PROVIDE DIRECTIONS OR DELETE) Directions** to the pre-bid conference location will be provided along with copies of the Contract Documents.

Each bidder must include a bid security with the bid (in the amount of 10% of the total bid price), payable to the Nebraska Community Foundation, in accordance with the Instructions to Bidders. Bid bonds and cashier's checks are acceptable forms of bid security.

No bidder may withdraw its bid after the scheduled time of the bid opening. Bids are to remain open for 60 days after the bid opening.

The Program reserves the right to reject any and all bids or parts thereof, and to waive any irregularities of any bid. The Program also reserves the right to award the contract to such responsible bidders as may be determined by the Program.

END OF SECTION 00010

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00100 - INSTRUCTIONS TO BIDDERS

1.0 DEFINED TERMS.

Terms used in these Instructions to Bidders which are defined in the General Conditions of the Construction Contract, have the meanings assigned to them in the General Conditions. The term "BIDDER" means one who submits a Bid directly to the OWNER, as distinct from a sub-BIDDER, who submits a bid to a BIDDER. The term "Successful BIDDER" means the lowest, qualified, responsible and responsive BIDDER to whom the OWNER (on the basis of the OWNER's evaluation as hereinafter provided) makes an award. The term "Bidding Documents" includes the Advertisement for Bids, Instructions to Bidders, the Bid Form, Statement of Qualifications, Anticipated Subcontractors, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

In this section on "Instructions to Bidders", the term BIDDER is used to describe a prospective CONTRACTOR. When the term BIDDER is used, it refers to the company that could become the CONTRACTOR; therefore all requirements of the CONTRACTOR also pertain to the BIDDER, and vice versa.

The OWNER as defined in the General Conditions is the Nebraska Community Foundation, Inc. (FOUNDATION) of Lincoln, Nebraska representing all signatories to the Platte River Recovery Implementation Program (PROGRAM). For this construction contract, the OWNER shall be responsible for the financial aspects; the technical aspects of the construction contract will be the responsibility of the ENGINEER. The ENGINEER for the construction contract is defined as the HDR.

2.0 COPIES OF BIDDING DOCUMENTS.

- 2.1 Complete sets of the Bidding Documents may be obtained as stated in the "Advertisement for Bids".
- 2.2 Complete sets of Bidding Documents must be used in preparing Bids. Neither the OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.3 OWNER and ENGINEER, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work, and do not confer a license or grant for any other use.

3.0 QUALIFICATIONS OF BIDDERS.

To demonstrate qualifications to perform the Work, each BIDDER must submit with the Bid (or within 48 hours of the Bid, if allowed by the Project Manual) written evidence, such as financial data, previous experience, record of performance on previous projects, equipment, information on their permanent place of business, and other such data as may be called for on the Statement of Qualifications contained in the Bidding Documents. If a BIDDER has not previously completed and submitted a PROGRAM Contractor Prequalification packet, each BIDDER must do so prior to submittal of a bid. Prequalification packets are available on the PROGRAM's website (www.platteriverprogram.org).

Each BIDDER must be prepared to submit evidence of the BIDDER's qualifications to do business in Nebraska, prior to the Notice of Award.

4.0 LIST OF SUBCONTRACTORS.

Each BIDDER shall submit a list of subcontractors on the form included in the Project Manual with his Bid.

Prior to the award of Contract, the OWNER shall notify the BIDDER if the OWNER, after due investigation, has reasonable objection to any Subcontractor listed and does not accept him. Acceptance of any or all listed Subcontractors by the OWNER does not relieve the CONTRACTOR from any responsibility for its Subcontractors.

5.0 BIDDER INQUIRIES.

All questions regarding the Bid Documents shall be addressed to the ENGINEER in writing. No questions regarding the Bid Documents will be answered by phone. Inquiries shall be directed to:

Kevin Werbylo
Headwaters Corporation
4111 4th Ave, Suite 6
Kearney, Nebraska 68845
werbylok@headwaterscorp.com

All written questions shall be answered in writing and provided to all BIDDERS in possession of a bid package.

6.0 PRE-BID CONFERENCE AND SITE SHOWING.

To assist BIDDERS with the development of a bid price, the ENGINEER will conduct a Site Showing at the location of the construction project. **Attendance at the Site Showing is mandatory for the submission of a bid. Bids received from BIDDERS who did not attend the Site Showing will not be accepted. BIDDERS must be on time for the Site Showing, and must remain until such time that the Site Showing is completed.**

Interested BIDDERS shall meet for the Site Showing at **(TIME, DAY, DATE OF SITE SHOWING)**. BIDDERS shall meet the Program at the Project Site **(directions will be provided along with the construction plans and specifications)**.

7.0 EXAMINATION OF CONTRACT DOCUMENTS AND SITE.

7.1 It is the responsibility of each BIDDER, before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site to become familiar with local conditions that may affect cost, progress, performance or furnishing of the Work, (c) consider federal, state and local laws and regulations that may affect cost, progress, performance or furnishing of the Work, (d) study and carefully correlate BIDDER's

observations with the Contract Documents, and (e) notify ENGINEER of all conflicts, errors or discrepancies in the Contract Documents.

- 7.2 Information and data reflected in the Contract Documents, with respect to Underground Facilities at or contiguous to the site, is based upon information and data furnished to the ENGINEER by owners of such Underground Facilities or others, and the ENGINEER does not assume responsibility for the accuracy or completeness thereof, unless it is expressly provided otherwise in the Supplementary Conditions.
- 7.3 Provisions concerning responsibilities for the adequacy of data furnished to prospective BIDDERS on subsurface conditions, Underground Facilities and other physical conditions, and possible changes in the Contract Documents, due to differing conditions, appear in the General Conditions and Supplementary Conditions.
- 7.4 The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by the CONTRACTOR in performing the Work, are identified in the Contract Documents. All additional lands, and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the CONTRACTOR.
- 7.5 The submission of a Bid will constitute an incontrovertible representation by the BIDDER that the BIDDER has complied with every requirement of this Article 7, and that without exception, the Bid is premised upon performing and furnishing the Work required by the Contract Documents, and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

8.0 INTERPRETATIONS AND ADDENDA.

- 8.1 All questions about the meaning or intent of the Contract Documents are to be directed to the ENGINEER. Interpretations or clarifications considered necessary by the ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the ENGINEER as having received the Bidding Documents. Questions received within five days prior to the date for opening of Bids will normally not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 8.2 Addenda may also be issued to modify the Bidding Documents, as deemed advisable by the OWNER or ENGINEER.

9.0 BID SECURITY.

- 9.1 Each BIDDER must deposit bid security with the bid, payable to the OWNER, which deposit shall be one of the following:

1. Certified check, cashier's check or draft drawn on a State or National Bank in the amount of ten percent (10%) of the total bid.
 2. Bid Bond must be presented on a standard AIA form or in a manner consistent with the bonding regulations in the State of Nebraska. Bid Bond must be in the amount of ten percent (10%) of the total bid.
- 9.2 The Bid Security of the successful BIDDER will be retained until such BIDDER has executed the Agreement and furnished the required contract security, whereupon the Bid Security will be returned. If the Successful BIDDER fails to execute and deliver the Agreement and furnish the required contract security within ten (10) days after the Notice of Award, OWNER may annul the Notice of Award, and the Bid Security of that BIDDER will be forfeited. The Bid Security of the two other lowest bidders whom the OWNER believes to have a reasonable chance of receiving the award may be retained by the OWNER until the earlier of the seventh day after the effective date of the Agreement, or the sixty-first (61st) day after the Bid Opening, where upon Bid Security furnished by such Bidders will be returned. Bid Security, with Bids which are not competitive, will be returned within seven days after the Bid Opening.

10.0 CONTRACT TIME.

Due to the nature of the work, BIDDERS must be prepared to complete the work within the time frames contained in the Agreement and Special Provisions of the Bid Documents.

11.0 LIQUIDATED DAMAGES.

Provisions for liquidated damages are set forth in the Agreement.

12.0 SUBSTITUTE OR "OR-EQUAL" ITEMS.

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications. A substitute or "or-equal" item of material or equipment may be furnished or used by the CONTRACTOR, if acceptable to the ENGINEER. Application for such acceptance will not be considered by the ENGINEER until after the effective date of the Agreement. The procedure for submission of any such application by the CONTRACTOR, and consideration by the ENGINEER, is set forth in paragraph 6.05 of the General Conditions, and may be supplemented in the Supplementary Conditions.

13.0 SUBCONTRACTORS, SUPPLIERS, AND OTHERS.

- 13.1 If requested by the ENGINEER, the BIDDER shall provide information on the qualifications, experience and financial or other data of any Subcontractors proposed on this project. If ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, they may, before the Notice of Award is given, require the apparent Successful BIDDER to submit an acceptable substitute without an increase in Bid price. If apparent Successful BIDDER declines to make any such substitution, OWNER may award the contract to the next lowest BIDDER that proposes to use acceptable Subcontractors, Suppliers and other persons and organizations. The

declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any BIDDER. Any Subcontractor, Supplier, or other person or organization listed and to whom the OWNER or ENGINEER does not make written objection prior to giving of the Notice of Award will be deemed acceptable to the OWNER and ENGINEER, subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

- 13.2 No CONTRACTOR shall be required to employ any Subcontractor, Supplier, other person or organization against whom CONTRACTOR has reasonable objection.

14.0 BID FORM.

- 14.1 The Bid Form is included with the Bidding Documents; additional copies may be obtained from the ENGINEER. Bids must be submitted on the forms provided.
- 14.2 All blanks on the Bid Form must be completed in ink or by typewriter. The Bidder must include both unit prices and extended prices. In case of a difference between the unit price and the extended price, the unit price shall be used in computing the total amount of the bid. In case of a difference between the total bid price and the sum of the extended prices, the sum of the extended prices shall govern.
- 14.3 Bids by corporations must be executed in the corporate name by the president or vice president (or other corporate officer accompanied by evidence of authority to sign), and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.
- 14.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature, and the official address of the partnership must be shown below the signature.
- 14.5 All names must be typed or printed below the signature.
- 14.6 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).
- 14.7 The address, telephone and fax numbers for communications regarding the Bid must be shown.
- 14.8 Work included in each Bid Item is as covered in the discussion on Measurement and Payment in Section 01150 of Division 1-General Requirements and each applicable section of the Construction Specifications.

15.0 SUBMISSION OF BIDS.

Contractors shall submit sealed proposals to the Platte River Recovery Implementation Program Office located at the following address:

**Platte River Recovery Implementation Program
4111 4th Avenue, Suite 6
Kearney, Nebraska 68845.**

Bids will be placed in a sealed envelope marked “**Cottonwood Ranch Broad-Scale Recharge Project**” and must include the Contractors name, contact person, address and phone number clearly visible on the exterior of the envelope.

All bids must be submitted on the Bid Form provided in this document and accompanied by the Bid Security and other required documents. Bid Forms must include an original signature(s). Unsigned Bid Forms or bids not provided on the Bid Form will be automatically rejected.

All bids must be mailed, or hand delivered to the PROGRAM Office no later than **TIME, DAY, DATE OF BID OPENING**. Faxed bids will not be accepted.

16.0 MODIFICATION AND WITHDRAWAL OF BIDS.

Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed), and delivered to the place where Bids are to be submitted at any time prior to the time of opening of Bids, as called for in the Advertisement for Bids. No BIDDER may withdraw his Bid for a period as specified in the Advertisement for Bids after the date and hour set for the opening declared therein.

17.0 OPENING OF BIDS.

Bids will be opened and read aloud publicly. An abstract of the amounts of the Bids will be made available to BIDDERS within one week after the opening of Bids.

18.0 BIDS TO REMAIN SUBJECT TO ACCEPTANCE.

All bids will remain subject to acceptance for sixty days (60) after the day of the Bid Opening, but the OWNER may, in its sole discretion, release any Bid, and return the Bid Security prior to that date.

19.0 AWARD OF CONTRACT.

19.1 The PROGRAM reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time, or changes in the Work, to negotiate contract terms with the successful BIDDER, and to disregard all nonconforming, nonresponsive, unbalanced, or conditional Bids. Also, the PROGRAM reserves the right to reject the Bid of any BIDDER if the PROGRAM believes that it would not be in the best interest of the project to make an award to that BIDDER, whether because the Bid is not responsive or the BIDDER is

unqualified, or of doubtful financial ability, or fails to meet any other pertinent standard or criteria established by the PROGRAM. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures, and the correct sum thereof, will be resolved in favor of the correct sum.

- 19.2 In evaluating Bids, the PROGRAM will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form, or prior to the Notice of Award.
- 19.3 PROGRAM may conduct such investigations as the OWNER deems necessary to assist in the evaluation of any Bid, and to establish the responsibility, qualifications and financial ability of BIDDERS, proposed Subcontractors, Suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to the PROGRAM's satisfaction within the prescribed time. The PROGRAM may also use previous experience with the BIDDER in evaluating qualifications.
- 19.4 If the Contract is to be awarded, it will be awarded to the lowest responsible, responsive BIDDER, whose evaluation by the PROGRAM indicates to PROGRAM that the award will be in the best interests of the Project.

20.0 CONTRACT SECURITY.

The successful BIDDER shall be required to furnish a contract performance bond, and a labor and materials payment bond, each in the amount of one hundred percent (100%) of the contract price as originally bid or subsequently modified. The surety company shall be authorized to do business in the State of Nebraska. The cost of the bonds shall be included in the Contractor's Bid Proposal. When the successful BIDDER delivers the executed Agreement to the OWNER, it must be accompanied by the required Construction Performance Bond and Construction Payment Bond on the standard AIA forms or in a manner consistent with the bonding regulations in the State of Nebraska. No exceptions will be made.

21.0 INSURANCE CERTIFICATES.

The successful BIDDER shall be required to furnish, with the executed Agreement, Insurance Certificates called for in the Supplementary Conditions.

22.0 SIGNING OF AGREEMENT.

When the PROGRAM gives a Notice of Award to the successful BIDDER, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within ten (10) days thereafter, the CONTRACTOR shall sign and deliver the required number of counterparts of the Agreement and attached documents to the PROGRAM with the required Bonds. Within ten days thereafter, the PROGRAM shall deliver one fully signed counterpart to the CONTRACTOR. No contract shall be considered as effective until it has been fully executed by all parties.

If the BIDDER to whom the Notice of Award is given does not properly execute the Agreement within the time allowed, the PROGRAM may withdraw the Notice of Award, and the BIDDER will forfeit his Bid Security.

Following the execution of the Contract by the OWNER and the CONTRACTOR, written Notice to Proceed with the Work shall be given by the PROGRAM to the CONTRACTOR. The Contract Time will commence to run with the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the effective date of the Agreement.

23.0 SALES AND USE TAXES.

The CONTRACTOR must pay all State Sales and Use Tax on materials and equipment to be incorporated in the Work.

24.0 RETAINAGE.

Provisions concerning retainage are set forth in the Agreement.

25.0 STATE LAWS AND REGULATIONS.

All applicable laws, ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout.

END OF SECTION 00100

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00300 - BID FORM

Project Identification: Cottonwood Ranch Broad-Scale Recharge Project.

This Bid is submitted to:

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
4111 4th Avenue, Suite 6
Kearney, Nebraska 68845

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with the OWNER, in the form included in the Contract Documents, to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price, and within the Contract Time indicated in this Bid, and in accordance with the other terms and conditions of the Contract Documents.
2. The BIDDER accepts all of the terms and conditions of the Advertisement for Bids, and Instructions to Bidders, including without limitation, those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for sixty (60) days after the day of the Bid Opening. The BIDDER will sign and submit the Agreement with the Construction Performance Bond and Payment Bond, and other documents required by the Bidding Requirements, within ten days after the date of the Notice of Award.
3. In submitting this BID, BIDDER represents, as more fully set forth in the Agreement, that:

- (a) BIDDER has examined copies of all the Bidding Documents, and of the following Addenda (receipt of all which is hereby acknowledged):

NUMBER

DATE

- (b) BIDDER has familiarized itself with the nature and extent of the Contract Documents, work, work site, locality, and all local conditions, regulations and permits, local laws or ordinances that in any manner may affect cost, progress, performance, or furnishing of the Work.
 - (c) BIDDER has given the ENGINEER written notice of all conflicts, errors, or discrepancies that it has discovered in the Contract Documents, and the written resolution thereof by the ENGINEER is acceptable to the BIDDER.
 - (d) This Bid is genuine and not made in the interest of, or on behalf of, any undisclosed person, firm, or corporation, and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; the BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham Bid; the BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding;

and the BIDDER has not sought, by collusion, to obtain for itself any advantage over any other BIDDER or over the OWNER.

4. The BIDDER agrees to perform all the Work described in the Contract Documents and on the following Bid Schedule. The Method of Measurement and Payment shall be as stated in Division 1-General Requirements.
5. The BIDDER hereby agrees to accept an award of a contract for the Bid Schedule as determined under Section 00100, Paragraph 19.
6. The BIDDER agrees that the unit prices shall govern in checking the bid, and, should a discrepancy exist in the sum of extended prices and Total Amount of Bid after extensions are checked and corrections made, if any, the sum of extended prices shall be used in considering the award of this Contract.
7. The BIDDER will complete the Work for the following unit or lump sum prices(s):

ITEM NO.	ITEM	QUANTITY	UNIT COST	PROBABLE COST
1.	Mobilization and Demobilization, LS	1	\$	\$
2.	Erosion and Sediment Control, LS	1	\$	\$
3.	Clear and Grubbing, Acres	5.1	\$	\$
4.	Strip, Stockpile and Replace Topsoil, CY	72,260	\$	\$
5.	Berm Embankment, CY	174,203	\$	\$
6.	Seepage Berm Embankment, CY	12,820	\$	\$
7.	Toe Drain System, LS	1	\$	\$
8.	Water Level Flume Control Structures, EA	7	\$	\$
9.	In-line Water Level Control, EA	1	\$	\$
10.	Riprap, CY	4,523	\$	\$
11.	Crushed Rock Surfacing, CY	1,150	\$	\$
12.	Road Ditch Drainage Controls, LS	1	\$	\$
13.	Internal Drain Culverts, LS	1	\$	\$
14.	Seeding, Acres	196	\$	\$
15.	Water Supply Pipeline System, LS	1	\$	\$

8. The BIDDER understands that the OWNER reserves the right to reject any or all bids or to waive any informality or technicality in any proposal in the interest of the OWNER. If an award is made, it will be made to the lowest bidder that is determined qualified and responsible at the sole discretion of the OWNER.
9. BIDDER agrees that the Work, Cottonwood Ranch Broad-Scale Recharge Project will be substantially complete in accordance with Paragraph 3.1 of the Agreement. BIDDER accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work on time.
10. The following documents are attached to and made a condition of this bid:
- (a) Required Bid Security in the form of _____.
11. Communications concerning this Bid shall be addressed to:
- Contractor _____
- Address _____
- City/State/Zip _____
- Phone _____
- Fax _____
- E-mail _____
12. The terms used in this Bid, which are defined in the General Conditions and Supplementary Conditions of the Construction Contract included as part of the Contract Documents, have the meanings assigned to them in the General Conditions and Supplementary Conditions.
13. Affirm that the BIDDER is NOT on the federal suspended and disbarred list, and provide BIDDER'S D-U-N-S number.

BIDDER D-U-N-S # _____ Preparer's Initials _____

SUBMITTED ON _____, 2018

BY _____
Company Name (Individual, Partnership, Corporation, or Joint Venture)

(State of Residency)

BY _____
(Name of Person Authorized to Sign) (Signature and Printed) (Corporate Seal If Applicable)

(Title)

Attest _____
(If Corporation)

BIDDER Business Address: _____

Phone No.: _____ Fax No.: _____

Contactor's State License No. (If applicable): _____

ANTICIPATED SUBCONTRACTORS

1. Type of Work to be Sublet _____

Approximate Dollar Amount of Subcontract \$ _____
Probable Subcontractor _____
Address _____
2. Type of Work to be Sublet _____

Approximate Dollar Amount of Subcontract \$ _____
Probable Subcontractor _____
Address _____
3. Type of Work to be Sublet _____
Approximate Dollar Amount of Subcontract \$ _____
Probable Subcontractor _____
Address _____

Statement of Qualifications: The CONTRACTOR shall submit a statement of the subcontractor's qualifications and shall obtain written permission from the OWNER prior to the actual subletting or assignment of any portion of the contract as per Section 6.06 of the General Conditions.

PREVIOUS EXPERIENCE OF BIDDER

SIMILAR PROJECTS COMPLETED (List at least three)

1. DATE_____ VALUE _____
Name of Project, Address, Type of Improvement_____

Name/Phone of Owner_____
Name/Phone of Engineer _____

2. DATE _____ VALUE _____
Name of Project, Address, Type of Improvement _____

Name/Phone of Owner_____
Name/Phone of Engineer _____

3. DATE_____ VALUE _____
Name of Project, Address, Type of Improvement_____

Name/Phone of Owner_____
Name/Phone of Engineer _____

SIMILAR PROJECTS UNDER CONTRACT (List at least one)

DATE _____ VALUE _____

Name of Project, Address, Type of Improvement _____

Name/Phone of Owner _____

Name/Phone of Engineer _____

END OF SECTION 00300

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DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00410 - BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

_____ as Principal, and _____ as Surety, are hereby held and firmly bound unto NEBRASKA COMMUNITY FOUNDATION, INC., LINCOLN NEBRASKA, as OWNER, in the penal sum _____ for payment of which, well and truly to be made, we hereby jointly and severely bind ourselves, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to OWNER a certain BID, attached hereto, and hereby made a part hereof, to enter into a Contract in writing, for the construction of the **PROJECT NUMBER: Cottonwood Ranch Broad-Scale Recharge Project**.

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted, and the Principal shall execute and deliver a Contract in the Form of Contract attached hereto (properly completed in accordance with said BID), and shall furnish a BOND for his faithful performance of said Contract, and furnish a BOND for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID,

Then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated. The Bond shall be forfeited as liquidated damages, if the Bidder, upon the award of the Contract to him, fails to enter into the Contract within 10 (ten) days after it is presented to him for that purpose, or fails to proceed with the performance of the Contract.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers.

Signed and sealed this _____ day of _____, 20 _____.

(Principal) (SEAL)

BY: _____
(Title)

(Witness)

(Surety)

BY: _____
(Attorney-in-Fact)

END OF SECTION 00410

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00500 – AGREEMENT

THIS AGREEMENT is dated as of the [] day of [] in the year 2018, by and between the Nebraska Community Foundation, Inc. (hereinafter called OWNER) representing all signatories to the Platte River Recovery Implementation Program (PROGRAM), and [] (hereinafter called CONTRACTOR) D-U-N-S # []. The following persons are authorized to represent the parties through this Agreement: Diane Wilson representing the OWNER, Jason Farnsworth representing the PROGRAM; and [] representing the CONTRACTOR.

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1. WORK.

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Construction of low head berms and water control structures that will be used to pond water for groundwater recharge.

ARTICLE 2. ENGINEER.

HDR will serve as the ENGINEER. The ENGINEER may in writing designate a representative(s) who shall carry out the ENGINEER's functions as set forth in the Contract Documents. In all cases as provided for in this Agreement, the powers, authorities, rights and responsibilities of the ENGINEER shall also extend to the ENGINEER's representative(s).

ARTICLE 3. CONTRACT TIME.

- 3.1 Substantial Completion. Substantial Completion of all Work is to be completed as soon as possible following issuance of the Notice to Proceed, and shall be completed no later than **MONTH DAY, 2018**. Work will be initiated within 30 days after execution of this Agreement unless otherwise approved by the PROGRAM.
- 3.2 Final Completion. Final Completion is to be reached within 30 days of Substantial Completion.
- 3.3 In determining whether an extension of time will be granted, consideration will be given to unusual weather conditions that may delay the completion of the Work, providing the CONTRACTOR has notified the OWNER, in writing, that an extension of time is needed.
- 3.4 Liquidated Damages. The OWNER and CONTRACTOR recognize that time is of the essence of this Agreement, and that the OWNER will suffer financial loss if the Work is not completed within the times specified in Paragraph 3.1 above, plus any extensions thereof allowed, in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by the OWNER if the Work is not completed on time.

Accordingly, instead of requiring any such proof, the OWNER and CONTRACTOR agree that, as liquidated damages for delay, (but not as a penalty), the CONTRACTOR shall pay the OWNER \$500.00 for each calendar day that expires after the time specified in paragraph 3.1 for Substantial Completion, until the Work is substantially complete. After Substantial Completion, if the CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by the OWNER, the CONTRACTOR shall pay the OWNER \$500.00 for each calendar day that expires after the time specified in Paragraph 3.1 for final completion and readiness for final payment of all work.

The provisions in Section 3.3 regarding declaration of weather shutdown and suspension of counting days shall apply to this Section.

ARTICLE 4. CONTRACT PRICE.

The OWNER shall pay the CONTRACTOR for completion of the Work, in accordance with the Contract Documents according to the Bid, which is attached as an Exhibit. The total awarded sum is \$_____. The total price can vary due to the actual quantities of the unit price items installed, or due to Change Orders. Measurement and payment for bid items shall be per information provided in the Division 1-General Requirements.

ARTICLE 5. PAYMENT PROCEDURES.

The CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by the ENGINEER, as provided in the General Conditions.

- 5.1 A semi-final payment will be made only upon substantial completion of all work. Substantial completion shall have been achieved when, based upon the recommendation of the ENGINEER, all work required in the Contract Documents has been completed with the exception of minor corrections or adjustments.

The amount of the semi-final payment to be provided will be the balance of the amount remaining under the Contract minus two times the value of any items remaining to be corrected or adjusted as well as any amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not been suitably discharged.

Upon satisfactory completion of the corrections and/or adjustments, the PROGRAM shall, upon receipt of a requisition approved by the OWNER, promptly pay these items. The PROGRAM shall retain any funds as may be required to satisfy claims, liens and judgments against the CONTRACTOR arising in connection with of the project and which have not been suitably discharged.

Reduction of the balance of the amount due under the Contract, does not relieve the CONTRACTOR of the responsibility for corrective work or adjustments required during the guarantee period.

Prior to issuance of the semi-final payment, the CONTRACTOR shall furnish to the OWNER (on forms supplied in the Bidding Documents), a sworn statement that all materials, labor, equipment etc. that have been furnished performed or otherwise included under the Contract, have been paid for. In the event all CONTRACTOR costs have not been paid, the CONTRACTOR must provide a statement of the balance due to each and every supplier of labor, materials, equipment, etc.

If required by the OWNER, the CONTRACTOR shall provide similar statements from Subcontractors or suppliers, etc. to the same effect that they have paid for all labor, materials etc. furnished by them and used in connection with the Contract or a statement of any unpaid balances.

- 5.2 Final Payment will be made upon certification issued by the OWNER, in consultation with the ENGINEER, that all work has been completed in accordance with the Contract and upon proof that any claims, liens or judgments have been suitably discharged.

The PROGRAM shall make the final payment promptly upon receipt of a Certification of Final Completion from the ENGINEER, and signed by the CONTRACTOR and OWNER.

ARTICLE 6. CONTRACTOR'S REPRESENTATIVES

In order to induce the OWNER to enter into this Agreement, the CONTRACTOR makes the following representations:

- 6.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance, or furnishing of the Work.
- 6.2 CONTRACTOR has studied carefully all reports of investigations and tests of latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which were relied upon by ENGINEER in the preparation of the Drawings and Specifications and which have been identified in the Contract Documents.
- 6.3 CONTRACTOR has made or caused to be made examinations, investigations and tests and studies of such reports and related data in addition to those referred to above as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time, and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports or similar data are or will be required by CONTRACTOR for such purposes.
- 6.4 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.
- 6.5 CONTRACTOR has carefully reviewed and checked all information and data shown or indicated on the Contract Documents, with respect to existing Underground Facilities at or contiguous to the site, and assumes responsibility for the accurate location of said Underground Facilities.

- 6.6 CONTRACTOR has given ENGINEER written notice of all conflicts, errors, or discrepancies that he has discovered in the Contract Documents, and the written resolution thereof by the ENGINEER is acceptable to the CONTRACTOR.

ARTICLE 7. CONTRACT DOCUMENTS

The Contract Documents, which comprise the entire agreement between the OWNER and the CONTRACTOR concerning the Work, consists of the following:

7.1 This Agreement

7.2 Performance Bond and Labor and Material Payment Bond.

7.3 Notice of Award and Notice to Proceed.

7.4 General Conditions and Supplementary Conditions to the General Conditions.

7.5 General Requirements, Construction Specifications, Material Specifications, and Special Provisions

7.6 Drawings and Details.

Cover Sheet

G-01 General Information

G-02 Wetland Site Plan

C-00 Overall Site Plan

C-01 Cell #1 & Cell #2 Site Plan & Geometrics

C-02 Cell #3 Site Plan & Geometrics

C-03 Cell #4 & Cell #5 Site Plan & Geometrics

C-04 Cell #6 Site Plan & Geometrics

C-05 Cell #7 & Cell #8 Site Plan & Geometrics

C-06 Cell #1 Overflow Spillway

C-07 Cell #2 Overflow Spillway

C-08 Cell #3 Overflow Spillway

C-09 Cell #4 Overflow Spillway

C-10 Cell #5 Overflow Spillway

C-11 Cell #6 Overflow Spillway

C-12 Cell #7 Overflow Spillway

C-13 Cell #8 Overflow Spillway

C-14 Water Level Control Flume Structure

C-15 Structural Details, Road Ditch Drainage

C-16 Subdrain and Toe Drain Details

C-17 Low Water Crossing, Overflow Barrier, Maintenance Route Crossing

C-18 Typical Sections

C-19 SWPPP

C-20 North Discharge Piping Plan & Profile Sta. 1+20 TO 14+00

C-21 North Discharge Piping Plan & Profile Sta. 14+00 TO 28+00

C-22 North Discharge Piping Plan & Profile Sta. 28+00 TO 29+25

C-23 Meter Pit Details

C-24 Energy Dissipator

C-25 Miscellaneous Details
C-26 Fencing Details
C-27 Electrical Details
C-28 Electrical Details
C-29 Electrical Schedules

7.7 Addenda listed on the Bid forms.

None

7.8 Supplemental Sheets and Attachments

None

7.9 CONTRACTOR'S executed Bid forms.

7.10 Any Modification, including Change Orders, duly delivered after execution of Agreement.

There are no Contract Documents, other than those listed above, in this Article 7. The Contract Documents may only be amended, modified, or supplemented, as provided in Article 3 of the General Conditions.

The Contract Documents listed above are intended to be complementary and to describe and provide for a complete work. The CONTRACTOR will not take advantage of an apparent error or omission in the plans and specifications. If the CONTRACTOR discovers such an error or omission, he will immediately notify the ENGINEER. The ENGINEER will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract Documents.

ARTICLE 8. MISCELLANEOUS

8.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

8.2 No assignment by a party hereto of any rights under, or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically, but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

8.3 The OWNER and the CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

ARTICLE 9. OTHER PROVISIONS.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR, and ENGINEER. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR or by ENGINEER on their behalf.

This Agreement will be effective on MONTH DAY, 2018.
(Note: Effective Date must precede dates for performance and payment bonds)

OWNER:

By: _____

Title: _____

CONTRACTOR:

By: _____

Title: _____

(CORPORATE SEAL IF APPLICABLE)

Attest: _____

Attest: _____

Address for giving notices:

Address for giving notices:

License No. _____

Agent for service of process:

(If the CONTRACTOR is a corporation, attach evidence of authority to sign).

END OF SECTION 00500

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00610 – PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal and
(Corporation, Partnership, or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

NEBRASKA COMMUNITY FOUNDATION, INC.
P.O. BOX 83107
LINCOLN, NE 68501-3107

hereinafter called OWNER, in the penal sum of _____
Dollars, (\$ _____)

In lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered is into a certain contract with the OWNER, dated the [] day of [], 2018, a copy of which is hereto attached and made a part hereof for the construction of: Cottonwood Ranch Broad-Scale Recharge Project.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or the Work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on the BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge that right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this the _____ day of _____ 2018.

ATTEST:

Contractor as Principal

Witness as to Principal

By: _____
(Signed)

(SEAL)

(Address)

(Address)

ATTEST:

Surety

Witness as to Surety

Attorney-in-Fact

(SEAL)

(Address)

(Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners shall execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

END OF SECTION 00610

DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS
SECTION 00620 – LABOR AND MATERIALS PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal and
(Corporation, Partnership, or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

NEBRASKA COMMUNITY FOUNDATION, INC.
P.O. BOX 83107
LINCOLN, NE 68501-3107

hereinafter called OWNER, in the penal sum of _____
Dollars, (\$ _____)

In lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the [] day of [] 2018, a copy of which is hereto attached and made a part hereof for the construction of: Cottonwood Ranch Broad-Scale Recharge Project.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or the Work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on the BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge that right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in five (5) counterparts, each one of which shall be deemed an original, this the _____ day of _____ 2018.

ATTEST:

_____	_____ Contractor as Principal
Witness as to Principal	By: _____ (Signed)

(SEAL)

_____	_____
(Address)	(Address)
_____	_____

ATTEST:

_____	_____ Surety
Witness as to Surety	_____ Attorney-in-Fact

(SEAL)

_____	_____
(Address)	(Address)
_____	_____

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners shall execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

END OF SECTION 00620

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. abnormal weather conditions;
 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 - 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; or
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

- c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
- 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 - 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 - 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 2. claims for damages insured by reasonably available personal injury liability coverage.
 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
 - 1. include at least the specific coverages provided in this Article.
 - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 - 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 - 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and

- 2) available engineering, sales, maintenance, repair, and replacement services.
- d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
 - C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
 - D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
 - E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
 - F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
 - G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*

- a. Contractor shall submit the number of Samples required in the Specifications.
- b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.

- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

- a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
- a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
- a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

- e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner:*

- 1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
- 2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

- A. *Application for Payment:*
 - 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

- C. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 00810
SUPPLEMENTARY CONDITIONS
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I. SUPPLEMENTARY CONDITIONS

A. *Caption and Introductory Statements*

Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY – NOT USED

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 *Copies of Documents*

SC-2.02.A. Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor up to five (5) copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

SC-3.01 *Intent*

SC-3.01 Add the following new paragraphs immediately after Paragraph 3.01.E:

- F. The Specifications may vary in form, format and style. Some specification sections are written in varying degrees of streamlined or declarative style and some sections may be relatively narrative by comparison. Omissions of such words and phrases as "the Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or articles within a part depending on the format of the section. The Contractor shall not take advantage of any variation of form, format or style in making claims for extra Work.**
- G. The cross referencing of specification sections under the subparagraph heading "Related Sections include but are not necessarily limited to:" and elsewhere within each specification section is provided as an aid and convenience to the Contractor. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire Work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each section or whether or not the cross referencing is complete.**

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.B:

- C.** The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:
 - 1.** Report dated December, 2017, prepared by HDR Engineering, Inc., entitled: “Final Report of Geotechnical Investigation and Design”, consisting of 335 pages.
- D.** Contractor may examine copies of reports and drawings identified in SC 5.03.C and SC 5.03.D that were not included with the Bidding Documents at Platte River Recovery Implementation Program Office in Kearney, NE during regular business hours, or may request copies from Engineer.
- E.** The Technical Data contained in such reports upon whose accuracy Contractor may rely are those indicated in the definition of Technical Data in the General Conditions.

SC-5.06 *Hazardous Environmental Conditions*

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

- A.** No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B.** Not Used.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

- 1.** Contractor may obtain worker’s compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker’s compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker’s compensation insurance for similar projects by the state within the last 12 months.

SC-6.03 *Contractor’s Liability Insurance*

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

- K.** The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	<u>Statutory</u>
Federal, if applicable (e.g., Longshoreman's):	<u>Statutory</u>
Jones Act coverage, if applicable:	
Bodily injury by accident, each accident	\$ <u>NA</u>
Bodily injury by disease, aggregate	\$ <u>NA</u>
Employer's Liability:	
Bodily injury, each accident	\$ <u>1,000,000</u>
Bodily injury by disease, each employee	\$ <u>1,000,000</u>
Bodily injury/disease aggregate	\$ <u>1,000,000</u>
For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	\$ <u>NA</u>
Foreign voluntary worker compensation	<u>Statutory</u>

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	\$ <u>2,000,000</u>
Products - Completed Operations Aggregate	\$ <u>1,000,000</u>
Personal and Advertising Injury	\$ <u>1,000,000</u>
Each Occurrence (Bodily Injury and Property Damage)	\$ <u>1,000,000</u>

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Bodily Injury:	
Each person	\$ <u>1,000,000</u>
Each accident	\$ <u>1,000,000</u>
Property Damage:	
Each accident	\$ <u>1,000,000</u>

4. Excess or Umbrella Liability:

Per Occurrence	\$ 1,000,000
General Aggregate	\$ 1,000,000

5. Contractor's Pollution Liability:

Each Occurrence	\$ NA
General Aggregate	\$ NA



If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

7. Contractor's Professional Liability:

Each Claim	\$
Annual Aggregate	\$

[CJ1]

SC-6.05 Property Insurance[CJ2]

SC-6.05.A. Add the following to the list of items in Paragraph 6.05.A, as numbered items:

14. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorney's fees and engineering or other consultants' fees, if not otherwise covered;
17. include by express endorsement coverage of damage to Contractor's equipment.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.01 Supervision and Superintendence

SC-7.01.B. Amend Paragraph 7.01.B to add the following sentences: "The Contractor shall identify their representative at the Site that shall have authority to act on behalf of Contractor. All communications given to or received from this representative shall be binding on Contractor."

SC-7.01.C. Add the following new paragraph immediately after Paragraph 7.01.B:

Any superintendent or other personnel, who repeatedly fails to follow the Engineer's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project. Upon the written request of the Engineer, the Contractor shall immediately remove such superintendent or other personnel and name a replacement in writing. Noncompliance with the Engineer's request to remove and replace personnel at any level shall be grounds for terminating the Contract.

SC-7.12 Insert the following after the second sentence of Paragraph 7.12.C:

The following Owner safety programs are applicable to the Work:

It is expressly understood by the parties to this Agreement that the CONTRACTOR is solely responsible for initiating, maintaining, and supervising safety precautions and programs in connection with the Work. The right of the OWNER and ENGINEER to observe or otherwise review the Work and operations shall not relieve the CONTRACTOR from any of his covenants and obligations hereunder. CONTRACTOR shall incorporate all safety requirements into his construction progress and work schedules including preconstruction and scheduled safety meetings, posted safety rules, tailgate meetings, and site inspections by safety and other inspectors employed by the CONTRACTOR.

The CONTRACTOR shall be responsible for and shall take necessary precautions and provide all material and equipment to protect, shore, brace, support and maintain all underground pipes, conduits, drains, sewers, water mains, gas mains, cables, etc., and other underground construction uncovered in the proximity, or otherwise affected by the construction work performed by him. All pavement, surfacing, driveways, curbs, walks, buildings, grass areas, trees, utility poles or guy wires damaged by the CONTRACTOR's operations in the performance of this work shall be repaired and/or replaced to the satisfaction of the OWNER, ENGINEER, and effected property owner at the CONTRACTOR's expense. The CONTRACTOR shall also be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property or facility, regardless of location or character, which may be caused by moving, hauling, or otherwise transporting equipment, materials, or men to and from the work or any part of site thereof; whether by him or his subcontractors. The CONTRACTOR shall make satisfactory and acceptable arrangements with owner of, or the agency or authority having jurisdiction over, the damaged property or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

The CONTRACTOR shall conduct his work so as to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, the CONTRACTOR shall obtain approval from the governing party and shall, at his own expense, provide and maintain suitable and safe bridges, detours, and other temporary expedients for the accommodation of public and private drives before interfering with them. The provisions for temporary expedients will not be required when the CONTRACTOR has obtained permission from the owner and tenant of the private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

SC-Safety provisions must be entirely adequate and meet with County or State and Federal regulations to protect the public on these streets and roads.

SC-.7.18 Indemnification

SC 7.18.A Amend the second sentence of Paragraph 7.18.A by striking out "negligent".

ARTICLE 9 – OWNER’S RESPONSIBILITIES

SC-9.13 Owner’s Site Representative

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

SC-9.13 Owner will furnish an “Owner’s Site Representative” to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner’s Site Representative is not Engineer’s consultant, agent, or employee. Owner’s Site Representative will be a staff member of the Executive Director’s Office of the Platte River Recovery Implementation Program.

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

- B.** The Resident Project Representative (RPR) will be Engineer’s representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR’s actions.
- 1.** General: RPR’s dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR’s dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.
 - 2.** Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
 - 3.** Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
 - 4.** Liaison:
 - a.** Serve as Engineer’s liaison with Contractor. Working principally through Contractor’s authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b.** Assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s on-Site operations.

- c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
- 5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
- 6. Shop Drawings and Samples:
 - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
 - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
 - c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.
- 7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
- 8. Review of Work and Rejection of Defective Work:
 - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
- 9. Inspections, Tests, and System Start-ups:
 - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
 - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
- 10. Records:
 - a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field

Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

11. Reports:

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

- a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
- b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
- c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

9.07A. Modify Paragraph GC-9.07A. by adding the following sentence at the end of the first sentence: "Contractor shall, at his own expense, provide help and other assistance as may be required for making measurements of Unit Price Work."

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.01 Cost of the Work

SC 13.01.B.5.c Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:

c. Construction Equipment and Machinery:

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
- 2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the *Nebraska Department of Transportations' blue book equipment rental rates source*. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such

equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools.

SC-13.03 Unit Price Work

SC-13.03.B. Amend Paragraph 13.03.B to add the following sentences: "Progress estimates serve only as basis for partial payments. The Engineer may revise progress estimates and/or quantities any time before final acceptance. If the Engineer deems it proper to do so, changes may be made in progress estimates and in the final estimate."

SC-13.03.C. Amend Paragraph 13.03.C to add the following sentences: "Work described in the Contract Documents, or reasonably inferred as required for a functionally complete installation, but not identified in the listing of unit price items, shall be considered incidental to unit price work listed and the cost of incidental work included as a part of the unit price."

SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:

- E.** The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
 - 1.** If Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.03 Substantial Completion

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

- 1.** If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-15.07 Waiver of Claims

SC-15.07.B. Amend Paragraph 15.07.B to state "The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner and/or Engineer other than those pending matters that have been duly submitted or appealed under the provisions of Article 17."

SPECIAL PROVISIONS

These Special Provisions amend or supplement the Technical Specifications of the Construction Contract, and other provisions of the Contract Documents as may be indicated below. All Technical Specifications so referenced that are not so amended or supplemented remain in full force and effect.

1. DEFINITIONS AND PRINCIPLES

FOUNDATION

For the purpose of this Contract, FOUNDATION refers to the Nebraska Community Foundation, Inc. of Lincoln, Nebraska.

PROGRAM

For the purpose of this Contract, PROGRAM refers to the Platte River Recovery Implementation Program.

Project Engineer

For the purpose of this Contract, HDR will serve as the Project Engineer, or designate an ENGINEER to represent the PROGRAM. The Project Engineer or ENGINEER may in writing designate a Resident Project Representative (RPR) who shall carry out the Project Engineer's or ENGINEER's functions as set forth in the Supplementary Conditions (00810).

Contracting Officer

For the purpose of this Contract, the Executive Director of the PROGRAM will serve as the Contracting Officer. The Contracting Officer may designate, in writing, a representative(s) who shall carry out the Contracting Officer's functions as set forth below. In all cases as provided for in this document, the powers, authorities, rights and responsibilities of the Contracting Officer shall also extend to the Contracting Officer's designated representative(s). Reference to the Contracting Officer herein shall apply to the Contracting Officers designated representative if any.

The Contracting Officer will appoint a representative that will function as the coordinator between the CONTRACTOR and the PROGRAM.

The Contracting Officer shall assist the Project Engineer with the execution of the technical aspects of the project, to include inspection, and shall, supervise the administrative and other non-technical aspects of the Contract Documents.

The Contracting Officer shall have the authority to stop the work, or to require and direct the CONTRACTOR to properly comply with the Contract Documents. In the event of a dispute as to the intent of non-technical portions of the Contract Documents, the Contracting Officer shall have the right to correct any errors or

omissions at any time such corrections are necessary. In the case of any dispute or disagreement in regard to the drawings, specifications or other technical documents, the Contracting Officer, upon consultation with the Project Engineer, shall provide for amendments to the Contract Documents as required.

2. PROGRAM RIGHT TO DO WORK

The PROGRAM and/or its employees, agents or assigns shall be responsible for the following items related to the work:

None

3. UNEMPLOYMENT AND WORKMEN'S COMPENSATION INSURANCE

Before issuing a Notice to Proceed, the CONTRACTOR and all subcontractors shall furnish proof of registration with the Employment Security Commission and the Workmen's Compensation Division as required by Nebraska Statutes.

A current letter obtained directly from the Employment Security Commission and the Workers Compensation Division shall be submitted as evidence of compliance with this requirement. Proof that the CONTRACTOR and all Subcontractors are still registered at the time of completion of construction shall be submitted prior to Final Acceptance of the Project.

4. PROJECT ACCESS

CONTRACTOR access the site is presented on the Construction Drawings. The CONTRACTOR shall be responsible to keep access roads graded and suitable for use by the CONTRACTOR and/or their Subcontractors as well as by the PROGRAM and/or its representatives.

In the event that the PROGRAM and/or their representatives discover equipment, appliances or tools that are leaking excessive petrochemical products (i.e., fuel, oil or other lubricants), the CONTRACTOR and/or their sub-contractors shall be instructed to remove the vehicle, equipment, appliance or tool with the leak until such time that the leak is repaired.

If access through the adjoining private properties becomes necessary, it must be done with extreme caution. The PROGRAM, on the information provided by the landowners, will mark known underground items such as septic systems, residential drainage and wells. The CONTRACTOR shall take every precaution to prevent damage to said properties and shall be held responsible for repairs to septic systems, drainage pipes or wells.

The CONTRACTOR shall be responsible for reviewing the site and informing themselves fully regarding site peculiarities and limitations of space available.

5. STAGING AND STORAGE AREA

The primary staging area will be identified in the field by the Project Engineer.

The CONTRACTOR shall at all times keep their staging area clean and free of an accumulation of debris and rubbish. All areas used for storage or staging will be cleaned and restored within ten (10) days of completion of the project.

Between the dates of April 1 and May 10, or October 1 and November 15, heavy equipment will be moved from the river to an upland site behind a tree line at the end of each work day if such features are available. If not available, the equipment will be moved to the farthest extent feasible or to a position of cover at least 0.25 miles away from the channel.

6. REMOVAL OF MATERIALS

Unless a specific item or material is noted to remain the property of the PROGRAM's and/or the effected private property owners, or said item is specified as being owed by the CONTRACTOR, all items will be inspected by the Contracting Officer to determine the need to retain the item. If the material is designated as scrap, the CONTRACTOR will remove the item from site.

7. CONTROL OF PERSONS AND TRAFFIC ON SITE

The CONTRACTOR shall control the actions of its employees, agents or assigns, as well as its subcontractors and their employee, agents or assigns working on the site and shall enforce all regulations.

The CONTRACTOR shall be responsible for traffic control on the public roadways as may be necessary to access the work site with trucks, equipment and/or materials.

The PROGRAM retains the right to visit the site with other agencies and interested parties when needed. The PROGRAM will coordinate access with the CONTRACTOR and will access the site such that the work of the CONTRACTOR is not hindered or delayed.

8. PROTECTION OF PERSONS AND PROPERTY

The CONTRACTOR shall take special precautions to insure that adequate safety is provided to personnel at all times during construction operations.

Temporary items such as, but not limited to, staging, lifting and hoisting devices, excavation barricades, and safety and construction procedures necessary to complete the project shall be the responsibility of the CONTRACTOR and its subcontractors, and shall comply with all applicable codes and regulations. Nebraska Occupational Health and Safety Rules and Regulations shall be complied with in their entirety. It shall not be the responsibility of the PROGRAM to determine if the CONTRACTOR, subcontractors or their representatives are in compliance with the aforementioned regulations.

9. CONSTRUCTION LIMITS

Construction limits for the Work are defined on the construction drawings. CONTRACTOR shall coordinate with PROGRAM to confirm construction limits associated with the work at each project site.

No other disturbance shall be allowed on private property unless specifically authorized. Care shall be taken to protect existing structures and fences. CONTRACTOR shall be liable for all damages to private property.

10. HOURS OF WORK

From December 15 to February 15 and within a 0.25 mile area around a known eagle roost, site activity should occur beginning one (1) hour after sunrise and finishing one hour (1) before sunset to minimize disturbance of the roost.

For Work occurring in or within 0.25 miles of the Platte River channel between the dates March 6 and April 29, or October 9 and November 15, the CONTRACTOR will not begin work until one of the following requirements has been met each day: 1) The CONTRACTOR observes the airplane conducting whooping crane surveys during their daily basis fly-over the construction zone without circling back to verify a whooping crane sighting; or 2) it is at least one (1) hour after sunrise and the CONTRACTOR has confirmed there are no whooping cranes or large white birds in the construction zone; or 3) the PROGRAM has confirmed the lack of whooping cranes in the construction zone. If the CONTRACTOR has any suspicion or question as to whether or not a whooping crane is present, he will not start work until a positive identification can be made by the PROGRAM or the bird(s) leave by their own accord. The CONTRACTOR will contact the Project Engineer anytime he thinks there may be a whooping crane in the construction zone. The Project Engineer will notify the PROGRAM. Between these same dates, the CONTRACTOR must conclude work two (2) hours before sunset and equipment must be staged according to the specifications of Provision 5 above.

The PROGRAM conducts daily whooping crane surveys by flying an airplane up the river at an elevation of 750 FT starting one-half (1/2) hour before sunrise. When the plane observes a white object they circle around to determine what it is. If it is a whooping crane on PROGRAM property they will notify the PROGRAM in order for the PROGRAM to confirm the sighting from the ground. If the plane continues to fly up the river, then there are likely not any whooping cranes in the area. The PROGRAM will provide the CONTRACTOR with the phone number of the whooping crane survey contractor.

If one contractor requires the service of another Contractor beyond the standard working hours, the CONTRACTOR requiring the extra service shall be responsible for any costs associated with the other Contractor working extra hours.

11. EXISTING UNDERGROUND UTILITIES

There are two buried irrigation pipelines as shown on the plans. The alignments are based on best available information. There are no other utilities known to the PROGRAM buried in the work area.

The CONTRACTOR shall be responsible for contacting Diggers Hotline of Nebraska five (5) days prior to the start of construction at (800) 331-5666, for the purpose of locating any underground utilities. Identification and location of utilities is the sole responsibility of the CONTRACTOR.

12. PRE-CONSTRUCTION MEETING

Within five (5) days of award of this Contract, the Contracting Officer shall arrange a meeting at the job site. This meeting shall include the CONTRACTOR in addition to the Project Engineer, Contracting Officer and all substantial subcontractors.

At the Pre-construction Meeting, each CONTRACTOR shall explain their anticipated procedures on site in detail and shall provide a progress schedule for review.

13. TIME OF COMPLETION AND SEQUENCE OF OPERATIONS

All Work shall be completed as soon as possible and shall be completed no later than **MONTH DAY, YEAR.**

All time frames as contained in this section are the product of the Project Engineer's estimate. Reasonable adjustments in the time frames allowed for each component may be approved by the PROGRAM upon review of the CONTRACTOR's schedule for progression of work which is to be reviewed at the pre-construction meeting.

Work shall start no later than **four (4) weeks** after execution of this Contract unless approved by the PROGRAM.

The final sequencing of construction items will be according to a schedule mutually agreed upon by all parties.

14. TESTING

CONTRACTOR shall hire a qualified Testing Agency to perform quality control testing and provide test results to the RPR, as directed in the Contract Documents.

Required testing, testing procedures, reports, certificates, and costs associated with all phases of securing required satisfactory test information which may be required by individual Specification Sections or Drawings are the full responsibility of the CONTRACTOR.

Additional testing and inspection required because of changes in materials or proportions requested by CONTRACTOR are the full responsibility of the CONTRACTOR.

Additional testing and inspection required because of changes or rejection of materials are the full responsibility of the CONTRACTOR.

Quality Control:

Sampling and testing shall be witnessed by RPR.

CONTRACTOR shall coordinate scheduling of testing with RPR.

CONTRACTOR shall provide minimum 24 HRS notice to RPR prior to performing quality control testing.

CONTRACTOR shall provide necessary testing services for prequalification of proposed materials.

Use of CONTRACTOR'S Testing Agency and results of tests on proposed materials shall in no way relieve CONTRACTOR of responsibility to furnish materials and construction in full compliance with Contract Documents.

Duties and Authorities of Testing Agency:

Any Testing Agency or agencies and their representatives retained by CONTRACTOR or PROGRAM for any reason are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.

CONTRACTOR'S Testing Agency shall inform the CONTRACTOR and Resident Project Representative regarding acceptability of or deficiencies in the work including materials furnished and work performed by CONTRACTOR that fails to fulfill requirements of the Contract Documents.

CONTRACTOR'S Testing Agency is to inspect, sample and test materials as required by these Contract Documents.

CONTRACTOR'S Testing Agency is to submit test reports and inspection reports to ENGINEER, CONTRACTOR, and RPR immediately after they are performed.

When it appears that any material furnished or work performed by CONTRACTOR fails to fulfill requirements of the Contract Documents, CONTRACTOR'S Testing Agency is to test suspect materials and to report findings to ENGINEER, CONTRACTOR, and RPR.

All test reports to include exact location and depth from which the material was taken and/or location of samples selected from in-place materials.

CONTRACTOR'S Testing Agency is to maintain a daily log of deficiencies in the work. This log shall be reported to the CONTRACTOR and RPR on a weekly basis until all deficiencies have been addressed.

PROGRAM retains the responsibility for ultimate rejection or approval of any portion of the Work.

Duties of CONTRACTOR:

To facilitate testing and inspection, perform the following:

Furnish any necessary labor to assist the CONTRACTOR'S or PROGRAM'S Testing Agency in obtaining and handling samples at site.

Notify CONTRACTOR'S Testing Agency and RPR sufficiently in advance of operations (minimum of 24 HRS) to allow completion of quality control and quality assurance tests for assignment of personnel and for scheduled completion of quality control and quality assurance tests.

Quality Assurance:

The PROGRAM may perform quality assurance tests.

The RPR will determine random locations of quality assurance tests and perform quality assurance tests on the samples and at the locations tested by the CONTRACTOR'S Testing Agency.

If the RPR observes quality control tests not being performed according to the applicable test procedures, the RPR may stop production until corrective action is taken. The RPR will notify the CONTRACTOR of observed deficiencies, promptly, both verbally and in writing.

Qualifications:

Testing Agency:

Meeting requirements of ASTM E329.

Provide evidence of recent inspection by Cement and Concrete Reference Laboratory of National Bureau of Standards, and correction of deficiencies noted.

Definitions:

CONTRACTOR'S Testing Agency: An independent professional testing/inspection firm or service hired by CONTRACTOR to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

Name and qualifications of the CONTRACTOR'S Testing Agency are to be presented in the CONTRACTOR'S list of subcontractors.

PROGRAM'S Testing Agency: An independent professional testing/inspection firm or service hired by PROGRAM to perform quality assurance testing, inspection or analysis services.

15. CONSTRUCTION SURVEYING

CONTRACTOR construction surveying to include:

Establish or re-establish project centerlines.

Referencing or re-referencing control points.

Running a circuit of bench levels to check or re-establish plan benchmarks.

Setting benchmarks as needed.

Staking right-of-way and performing all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage, and all other appurtenances required for the completion and acceptance of the Work.

CONTRACTOR shall be responsible for all construction surveying and hire and pay a registered land surveyor to perform construction staking and surveying to complete the Work.

Owner will hire and pay for an independent surveyor to perform the following survey:

Provide existing control points.

ENGINEER's Design Files:

ENGINEER can provide AutoCAD file for grading and layout of the berms, interior berms, interior swales, overflow spillways, culverts, water level flume control structures, inline water level control structure, road ditch drainage controls, toe drains, borrow area, riprap, and other project features shown on the contractor documents. CONTRACTOR shall verify accuracy of the information and coordinate with ENGINEER to resolve any discrepancies prior to beginning construction.

Duties of CONTRACTOR:

All stakes, references, lines, grades, and batter boards which may be required for the construction operations shall be furnished, set, and properly referenced by the CONTRACTOR in a manner consistent with standard engineering practices and in accordance with the NDOT's Construction Manual or alternate procedures approved by the ENGINEER. The CONTRACTOR shall be solely and completely responsible for the accuracy of the line and grade of all features of the work.

Any errors or apparent discrepancies found in the survey shall be immediately called to the attention of the ENGINEER by the CONTRACTOR for correction or interpretation before proceeding with the work.

Seeding boundary shall be staked by the CONTRACTOR.

The CONTRACTOR shall submit to the ENGINEER upon completion of the work all surveying field notes, field books, and computer files regarding stationing, grades and elevations.

Data shall be clear, orderly, and neat and consistent with standard engineering practices.

As-Built Drawings to be submitted in electronic format showing the line, grades, and elevations of the Work.

The field notebooks shall be subject to inspection by ENGINEER at any time.

Data will be used for development of As-Built Drawings.

The ENGINEER will not recommend approval of final payment until these items have been received and reviewed by the ENGINEER.

The CONTRACTOR shall be responsible for the placement and preservation of adequate ties and references to all control points, whether established by him/her or found on the project, necessary for the accurate reestablishment of all base lines or centerlines shown in the Plans.

All land ties (i.e., section corners, fractional section corners, etc.) that may be lost or destroyed during construction shall be carefully referenced and replaced by a licensed Nebraska Land Surveyor with the coordination of the Phelps County Surveyor. A copy of the completed survey and references to the corner or accessory shall be filed with the State Surveyor and with the County.

The CONTRACTOR shall make final survey to determine conformance with final lines, grades and elevations shown on the Drawings.

The CONTRACTOR shall correct any deficient staking or construction work which resulted from inaccuracies in the staking operations or from the CONTRACTOR'S failure to report inaccuracies in the plans or survey data furnished by the PROGRAM.

Notify CONTRACTOR'S surveyor sufficiently in advance of operations (minimum of 48 HRS) to allow completion of surveying for assignment of personnel and for scheduled completion of survey.

CONTRACTOR'S Survey Qualifications:

Conducted by personnel who are trained and experienced in construction layout and staking of the type and kind required in the Contract.

Work will be conducted under the direction of a registered Professional or registered Land Surveyor.

It is recommended that the crew chief to be NSPS - CST or NICET Certified Level III or a registered Land Surveyor.

It is recommended that 50 percent of the survey crew be NSPS - CST or NICET Certified Level II.

Definitions:

CONTRACTOR'S Surveyor: An independent professional surveying firm or service hired by Contractor to perform construction surveying as provided in the Contract Documents.

Name and qualifications of the CONTRACTOR'S Surveyor are to be presented in the Contractor's list of subcontractors.

Owner's Surveyor: An independent professional surveying firm hired by Owner.

Survey for Line and Grade:

Contractor's Surveyor to:

Provide and maintain weekly, centerline stakes at 100 FT stations.

Install slope stakes at the berm and seepage berm toe, at a minimum, at 100-FT stations. Slope stakes (cut stakes) on the outside of the overflow spillway and inspection trench shall have intermediate stakes placed between the 50 FT stations.

During the installation of the toe drains, survey shall record sufficient elevations and stations to plot lines and grades. Horizontal coordinates or offset distances orthogonal to the berm centerline shall be recorded at all points of intersection (PIs) along the centerline of the drain pipe.

Finish staking (hubs) shall be done when the earthwork is being completed and shall, as a minimum, be at all changes in grade normal and parallel to the centerline of the structure being staked. Finish stakes on all earthfill structures shall be placed at a maximum of 50 FT intervals.

Finish stakes (hubs) or off-set stakes shall be referenced to provide planned alignment and elevations for water level flume control structures. A stake shall be referenced at the upstream and downstream ends.

Finish stakes (hubs) in overflow spillways shall be placed on 30 FT intervals as measured along centerline, and at each change in grade along the profile. Stakes shall be placed normal to the centerline on the inside and outside edges of the bottom, with intermediate rows if the distance between rows exceeds 50 FT. Staking for the overflow spillway finish grade shall be done prior to placement of topdressing to verify sufficient undercut. Notes shall reflect both undercut elevations as well as finish grade elevations.

Final cross sections of earthfill shall be taken after finish operations are completed to determine compliance. The minimum number of sections to be taken shall be the length of the structure (centerline) in feet divided by 200.

16. PROJECT LAYOUT AND CONTROLS

The PROGRAM is responsible for verification of CONTRACTOR's work against the Project Drawings and specifications.

17. CONTACTS

Administrative Point of Contact (Foundation):

Diane M. Wilson
Chief Financial and Administrative Officer
Nebraska Community Foundation
PO Box 83107
Lincoln, Nebraska 68501-3107
Phone: (402) 323-7330
Fax: (402) 323-7349
Email: dwilson@nebcommfound.org

Technical Point of Contact (Program):

Kevin Werbylo, Engineer
Platte River Recovery Implementation Prog.
Headwaters Corporation
4111 4th Ave., Suite 6
Kearney, Nebraska 68845
Phone: (308) 237-5728
Fax: (308) 237-4651
Email: werbylok@headwaterscorp.com

Admin. Point of Contact (Program):

Jason Farnsworth, Executive Director
Platte River Recovery Implementation Prog.
Headwaters Corporation
4111 4th Ave., Suite 6
Kearney, Nebraska 68845
Phone: (308) 237-5728
Fax: (308) 237-4651
Email: farnsworthj@headwaterscorp.com

Media Point of Contact (Program):

Dr. Bridget Barron, Director
Platte River Recovery Implementation Prog.
Headwaters Corporation
4111 4th Ave., Suite 6
Kearney, Nebraska 68845
Phone: (308) 237-5728
Fax: (308) 237-4651
Email: barronb@headwaterscorp.com

END OF SPECIAL PROVISIONS

AFFIDAVIT ON BEHALF OF CONTRACTOR

STATE OF _____

COUNTY _____

CITY _____

DATE _____

I CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT ALL WORK HAS BEEN performed and materials supplied in strict accordance with the terms and conditions of the corresponding Contract Documents between NEBRASKA COMMUNITY FOUNDATION, INC., the OWNER, AND _____

THE CONTRACTOR, DATED DATE _____ for the Cottonwood Ranch Broad-Scale Recharge Project

And further declare that all bills, for materials, supplies, utilities and for all other things furnished or caused to be furnished by the above named CONTRACTOR and used in the execution of the above contract have been fully paid, and that there are no unpaid claims or demands of State Agencies, sub-contractors, material men, mechanics, laborers or any other resulting from or arising out of any work done or ordered to be done by said CONTRACTOR under the above identified contract.

In consideration of the prior and final payments made and all payments made for authorized changes, the CONTRACTOR releases and forever discharges the OWNER from any and all obligations and liabilities arising by virtue of said contract and authorized changes between the parties hereto, either verbal or in writing, and any and all claims and demands of every kind and character whatsoever against the OWNER, arising out of or in any way relating to said contract and authorized changes.

This statement is made for the purpose of inducing the OWNER to make FINAL PAYMENT under the terms of the Contract, relying on the truth and statement contained therein.

CONTRACTOR: _____

DATE: _____

ADDRESS _____ CITY _____ STATE _____ ZIP CODE _____

SIGNATURE AND PRINTED NAME _____

TITLE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS ____ DAY OF _____, 2018.

NOTARY PUBLIC _____

My Commission Expires: _____

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CERTIFICATE OF FINAL COMPLETION

Project: Cottonwood Ranch Broad-Scale Recharge Project

CONTRACTOR: _____ ENGINEER: _____

Contract Date: _____

This Certificate of Final Completion applies to all Work under the Contract Documents, or to the following specified parts thereof:

To: Nebraska Community Foundation, Inc. (Owner)

And To _____ (Contractor)

The Work to which this Certificate applies has been inspected by authorized representatives of the OWNER, CONTRACTOR, and ENGINEER, and that Work is hereby declared to be complete in accordance with the Contract Documents on:

(Date of Final Completion)

The Affidavit on Behalf of Contractor is attached to and made a part of this Certificate.

Executed by ENGINEER on _____, 2018

(Engineer)

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Final Completion on _____, 2018

(Contractor)

By: _____

OWNER accepts this Certificate of Final Completion on _____, 2018

(Nebraska Community Foundation, Inc.)

By: _____

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: Cottonwood Ranch Broad-Scale Recharge Project

CONTRACTOR: _____ ENGINEER: _____

Contract Date: _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents, or to the following specified parts thereof:

To: Nebraska Community Foundation, Inc. (OWNER)

And to: _____
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on:

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be complete or corrected by CONTRACTOR within _____ days of the above date of Substantial Completion.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

RESPONSIBILITIES:

OWNER: _____

CONTRACTOR: _____

The following documents are attached to and made a part of this Certificate:

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____, 2018

(Engineer)

By _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on _____, 2018

(Contractor)

By _____
(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____, 2018

Nebraska Community Foundation, Inc.

By _____

FINAL WAIVER OF LIEN

To All Whom It May Concern:

WHEREAS, the undersigned has been employed by _____ (Contractor) to furnish labor and/or materials for work, under a contract **DATED** _____ for the Cottonwood Ranch Broad-Scale Recharge Project (Project) in Phelps, County, STATE OF Nebraska of which the Nebraska Community Foundation, Inc. is the Owner.

NOW, THEREFORE, this _____ day of _____, 2018, for and in consideration of the sum of _____

Dollars paid simultaneously herewith (if any payment is due at this time), the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien rights to, or claim of lien with respect to and on said above described premises, and the improvements thereon, and on the monies or other considerations due to become due from the OWNER, on account of labor, services, material, fixtures, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.

Affix Corporate
Seal here

_____(SEAL)
(Name of Sole Ownership, Corporation
Partnership)

_____(SEAL)
(Signature of Authorized Representative)

Printed Name

Title

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NOTICE OF AWARD

Dated Month Day, Year

TO: _____
(BIDDER)

ADDRESS: _____

PROJECT: Cottonwood Ranch Broad-Scale Recharge Project

You are notified that your Bid dated DATE for the above Contract has been considered. You are the apparent successful bidder and have been awarded a contract for the full project to include:

Construction of low head berms and water control structures that will be used to pond water for groundwater recharge.

The Amount of your Contract is (\$) _____
(Dollars)

Three copies of each of the proposed Contract Documents accompany this Notice of Award. Also included are three copies of the Contract Agreement.

You must comply with the following within ten days of the date of this Notice of Award:

1. Deliver to the ENGINEER three fully executed counterparts of the Agreement.
2. Deliver the required Insurance Certificates and Performance and Payment Bonds as specified in the Contract Documents.
3. (List other conditions) _____

Failure to comply with these conditions within the time specified will entitle OWNER to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten days after you comply with those conditions, OWNER will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

Please acknowledge your receipt of this notice in the space provided below and return a copy along with any and all future project correspondence to Headwaters Corporation, 4111 4th Avenue, Suite 6, Kearney, Nebraska 68845

Receipt Acknowledged:

(Owner's Authorized Representative)

By: _____
(Contractor Representative)

Title

Title

Date

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NOTICE TO PROCEED

TO: _____
(CONTRACTOR)

DATED: _____

ADDRESS: _____

PROJECT NAME: Cottonwood Ranch Broad-Scale Recharge Project _____

You are notified that the Contract Time under the above contract will commence to run on _____, 2018. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 3 of the Agreement, the dates of Substantial Completion and readiness for final payment are **DATE OF SUBSTANTIAL COMPLETION**. Completion dates may be subject to need for weather shutdown.

Before you may start any Work at the site, you must (add requirements):

By: _____
(Owner's Authorized Representative)

Title

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DIVISION 01

GENERAL REQUIREMENTS



PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS:

The intent of the contract is to provide for the construction and completion in every detail of the work described. The CONTRACTOR shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete work in accordance with the Plans, Specifications, and terms of the contract and provide a complete and satisfactorily operating system.

1.02 CONTRACTOR USE OF PREMISES:

The CONTRACTOR shall confine his operations to the site of the proposed Work or within the right-of-way or construction easements provided and shown on the Drawings.

It shall be understood that the responsibility for protection and safekeeping of equipment and materials on or near the site will be entirely that of the CONTRACTOR and that no claim shall be made against the OWNER by reason of any act of an employee or trespasser. It shall be further understood that should any occasion arise necessitating access by the OWNER to the sites occupied by these stored materials and equipment, the CONTRACTOR owning or responsible for the stored materials or equipment shall immediately remove same. No materials or equipment may be placed upon the property of the OWNER until the OWNER has agreed to the location contemplated by the CONTRACTOR to be used for storage.

The CONTRACTOR shall be solely responsible for obtaining and shall pay all costs in connection with any additional work area, storage sites, access to the site, or temporary right-of-way which may be required for proper completion of the Work.

The OWNER, ENGINEER, representatives of funding agencies, and other designated by the OWNER shall have access to work sites.

CONTRACTOR's use of premises shall comply with all applicable local, state and federal laws.

1.03 PROTECTION OF EXISTING UTILITIES:

Existing underground installations such as water mains, gas mains, sewers, telephone lines, power lines, and buried structures in the vicinity of the Work to be done hereunder are indicated on the Drawings only to the extent such information has been made available to or discovered by the ENGINEER in preparing the drawings. There is no guarantee as to the accuracy or completeness of such information, and all responsibility for the accuracy and completeness thereof is expressly disclaimed. The CONTRACTOR is required to comply with the terms of the Nebraska Statute Sections 76-2301 through 76-2330, "The Once-Call Notification System Act." This includes calling "Diggers Hotline of Nebraska" (1-800-331-5666).

Whenever buried utilities or other obstacles are expected to be encountered, the CONTRACTOR shall excavate ahead to determine the location of the obstacle. Appropriate design modifications, as approved by the ENGINEER, shall be made to avoid the utility or obstacle.

1.04 PROTECTION OF EXISTING STRUCTURES:

Where excavation will be required adjacent to existing structures, the CONTRACTOR shall be solely responsible to maintain the structural integrity of the existing structures. The CONTRACTOR shall take whatever means necessary to insure that the existing structure is not damaged. The CONTRACTOR shall repair all damage to the existing structures at his own expense. Any foundations, walls, fences, trees, road surfacing, drainage ways, landscaping, or the like destroyed or damaged during construction shall be repaired to the satisfaction of the property owner. Any delay, additional work, or extra cost to the CONTRACTOR caused by existing structures shall not constitute a claim for extra work, additional payment or damages.

1.05 FIELD CHECK OF EXISTING STRUCTURES:

The dimensions and elevations of existing structures and locations of existing fences, pipelines, conduits, cables, roads, buildings, and equipment shown on the drawings were taken from available records and survey data and are not guaranteed for accuracy. It shall be the responsibility of the CONTRACTOR to check all dimensions and elevations of existing structures, pipelines, conduits, cables, equipment, or other existing items, both above and below ground, affected by or affecting the Work under this contract, prior to the start of construction or ordering materials and equipment affected thereby.

The CONTRACTOR is required to visit the site of the Work to familiarize himself with the arrangement and condition of existing construction that is to be connected to or that is to remain in place prior to submitting their bid.

1.09 SURFACE DRAINAGE:

Water from such sources as surface runoff, dewatering and flushing of water lines or other project components during project construction shall not be allowed to enter into drainage ways or open areas that will cause flooding of existing structures or violate State Water Quality Regulations.

1.11 WORK SEQUENCE:

The CONTRACTOR shall schedule the work to minimize inconvenience to the OWNER or adjacent landowners. This shall include minimizing obstructions to local traffic.

A proposed project schedule is to be provided and updated as required by Section 00810.

PART 1 - GENERAL

1.01 GENERAL:

The CONTRACTOR shall familiarize himself with all items of the Project requiring coordination and plan the Work to ensure orderly progress and completion within the Contract Time. The CONTRACTOR shall coordinate the work of all subcontractors.

1.02 NOISE IMPACT:

To minimize construction noise impacts on the local residents, no construction activities will be allowed between the hours of 8 p.m. and 7 a.m. unless explicitly allowed by the ENGINEER.

1.03 WORKING HOURS:

The time provided for construction completion of this project is based on Section 0900 Special Provisions Article 10. Hours of Work.

1.04 SCHEDULING REQUIREMENTS:

The sequence of Work will be submitted by CONTRACTOR and updated as required.

1.05 SURFACE RESTORATION:

All roads utilized by the CONTRACTOR are to be maintained and restored according to Section 00810 Special Conditions Article SC-7.12. Clean-up of construction areas shall be kept within 21 days of the construction activities.

1.06 LOCAL PHONES:

The CONTRACTOR shall maintain a local cell phone and fax number.

END OF SECTION 01040

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PART 1 - GENERAL

The CONTRACTOR shall be responsible for obtaining all permits and licenses, except as noted below, necessary for the completion of this Work. This refers to all permits that are required as of the date of the bid opening. Any costs associated with these permits shall be included as part of the Contract Price. No separate payment shall be made for compliance with permits.

Permits to be obtained by OWNER:

- Phelps County Flood Plain Development Permit.
- Phelps County Driveway Permit.
- Phelps County Maintenance Permit.
- Nebraska Department of Natural Resources Dam Permit Exemption.
- Nebraska Department of Environmental Quality NPDES Permit for Storm Water Discharges from Construction Sites.
- United States Army Corps of Engineers Section 404 Permit.

The CONTRACTOR is to abide by all permit conditions of OWNER-obtained permits, as well as his own permits. The OWNER will provide the CONTRACTOR copies of permits he obtains. The CONTRACTOR shall provide the ENGINEER copies of all permits he obtains.

END OF SECTION 01060

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PART 1 - GENERAL

1.01 COORDINATION OF CONTRACT DOCUMENTS:

- A.** The various portions of the Contract Documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in any portion or part is as binding as though occurring in all. All portions are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, the following hierarchy shall be observed:
1. Special Provisions will govern over;
 2. Supplementary Specifications, which will govern over;
 3. Project Drawings, which will govern over;
 4. These specifications and Standard Drawings.
- B.** CONTRACTOR shall not take advantage of any apparent error or omission in the Contract Documents. If CONTRACTOR discovers an error or omission, CONTRACTOR shall immediately notify ENGINEER. ENGINEER will pursue such corrections and interpretations as may be necessary for fulfilling the intent of the Contract Documents. He shall not proceed with the work until the correction is made.

1.02 DEFINITIONS:

- A.** Additional definitions and clarification of terms:
1. Provide: Furnish and install, complete with all necessary ancillary items, ready for intended use. Pay for all related costs.
 2. Approved: Acceptance of an item submitted for approval. Not a limitation or release for compliance with the Contract Documents or any regulatory requirements. Refer to limitations of "Approved" in the EJCDC General Conditions, Paragraph 3.4, if used.
 3. Match Existing: Construct new work to conform to the existing lines and grades of the site and facilities as acceptable to OWNER.
 4. Supplementary Specifications: Permanent additions to and revisions of these Specifications, covering conditions which are not unique to any one project. Supplementary Specifications will govern over these Specifications, including the Standard Drawings, when in conflict therewith.
 5. Special Provisions: Additional and revisions to these specifications covering special conditions on an individual project. Special Provisions will

govern over Project Drawings and supplementary documents, Supplementary Specifications, Standard Drawings, and these Specifications when in conflict therewith.

END OF SECTION 01090

SECTION 01270
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Defines how work items are measured and paid for on Unit Price Contracts. These items include unit price, lump sum price, and allowance payment items.
 - 2. In the case of conflict between this Section and the measurement methods specified in the individual Technical Specification Sections, the measurement methods in Technical Specification Sections shall govern.
 - 3. Receive payment for work after it is installed. Payment for material on hand can only be paid for if allowed by the Agreement, the General and/or Special Conditions.
 - 4. Partial payment may be requested for items partially installed when agreed to by the Owner.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Applications for Payment requirements are included in Specification Section 01060 - Special Conditions.

1.2 UNIT PRICE ITEMS

- A. Quantity and measurement estimates stated in the Bid Form are estimates for bidding purposes only. Actual payments shall be based on actual quantities installed, in-place, as measured and/or verified by the Engineer.
- B. Unless otherwise stated in the Contract Documents, the bid unit prices shall be in effect throughout the contract duration. When the variance between the estimated quantities and the actual installed quantities is more than 25 PCT, the Contractor or the Owner may negotiate a change to the Unit Price. That change will be made in accordance with the Change Order process as defined in the Contract Documents.
- C. Except as defined above, make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any difference between the amounts of work actually completed, or materials or equipment furnished, and the estimated quantities.
- D. The Owner can only pay for quantities that exceed the estimated quantities so long as the total payments to the Contractor do not exceed the Contract Price. If the added quantities will result in payments that exceed the Contract Price, a Change Order will need to be executed before payment can be made for the added quantities.
- E. Assist Engineer by providing necessary equipment, workers, and survey personnel as required to measure quantities.
- F. Unless stated in the Contract Documents, measured quantities shall be rounded to the nearest whole integer.
- G. Measurement:
 - 1. Measurement for progress payment shall be made by, or approved by, the Engineer based on the quantities provided in the plan documents. The actual quantities installed can be adjusted for corrections to previous calculations, incomplete elements or components if agreed to in advance and in writing by the Engineer.
 - 2. Unless otherwise provided for in the Contract Documents, unit price items are all inclusive of all related work, direct and indirect costs, to provide a complete and functional item.

3. The final measurement shall be based on quantities provided in the plan documents and agreed to by the Contractor and the Engineer. Quantities can be adjusted (increased or decreased) based on a final calculation of quantities by the Engineer and Contractor.

H. Payment:

1. Progress payments shall be in accordance with the Contract Documents based on estimated quantities installed paid at the bid unit price.
2. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

1.3 LUMP SUM ITEMS

- A. Progress payments for Lump Sum items in the Bid Schedule will be based on the breakdown prepared by the Contractor and approved by the Engineer and Owner before acceptance of the Application for Payment for the Lump Sum item.
- B. Lump Sum payment will be for the entire item as specified and as indicated in the Contract Documents. Payment for all bid items indicated as Lump Sums shall include the cost of all labor, materials, equipment and incidentals necessary to furnish, install, clean, test, and place each bid item into operation; including permitting, general conditions, overhead and profit.

1.4 APPLICATION FOR PAYMENT

- A. Provide a Summary Sheets and breakdown sheets equivalent to those of EJCDC document C-620, Contractor's Application for Payment forms.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 4 - MEASUREMENT AND PAYMENT

BID ITEM 1 MOBILIZATION/DEMOBILIZATION

- A. This item includes the performance of construction preparatory operations, construction staking of the project features and other items needed to build the project, movement of personnel, equipment, and materials to and from the Project Site, payment of performance bond, payment bond and other insurance premium, for the establishment and subsequent removal of the Contractor's office and other facilities necessary to begin and sustain work. Construction Survey, Quality Control Testing and Protection of Existing Monitoring wells and raise well as required above finish grade. At the completion of work, restore all areas disturbed to the same conditions or better as existed prior to commencement of mobilization.
- B. Basis for Payment:
 1. Lump Sum. Payment will be made in two installations. The first payment of 50 PCT of the lump sum price will be made on the first estimate following partial mobilization including the placement or erection of the Contractor's office and the initiation of construction work. The second and final payment will be made on the estimate following the substantial completion of the Work.
 2. The lump sum price bid for mobilization/demobilization shall not exceed 10 PCT of the total contract bid amount less the bid price for mobilization/demobilization and no payment in excess of 10 PCT of the total contract bid amount less the bid for mobilization/demobilization will be made for this item.

4.2 BID ITEM 2 EROSION AND SEDIMENT CONTROL

- A. The Contract unit price shall be full compensation for any required work for installation, maintenance, recordkeeping, temporary seeding and removal of sediment and erosion control practices as shown on the Contract Documents.

- B. Method of Measurement: Lump Sum.
- C. Basis for Payment: Per Lump Sum (LS).

4.3 BID ITEM 3 CLEARING AND GRUBBING

- A. The Contract unit price shall be full compensation for any required work necessary for clearing, grubbing including but not limited to: Disposing of all vegetation and debris (including earthen materials incidentally removed with vegetation and debris), removing structures and obstructions located within the limits shown on the Drawings or designated by the Engineer, except such objects as are designated to remain in place or are to be removed in accordance with sections of these Specifications. The works shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.
- B. Method of Measurement:
 - 1. Acres, based on the plan quantity shown and items described in the Contract Documents.
- C. Basis for Payment: Per Acre.

4.4 BID ITEM 4 STRIP, STOCKPILE AND REPLACE TOPSOIL

- A. The Contract unit price shall be full compensation for any required work to strip topsoil within limits of borrow areas and areas to be excavated or backfilled such as swales, berms, seepage management berms, interior berms, inlet and outlet channels. Placing and protecting topsoil in temporary stockpiles at on-site upland locations. Replacing and topsoil within limits of borrow areas and areas to be excavated or backfilled such as swales, berms, seepage management berms, and interior berms to depths and finish grades shown and described in the Contract Documents.
- B. Method of Measurement:
 - 1. Cubic Yards, based plan quantity of surface removed to a 6 IN depth for excavation of borrow areas and internal swales and under the footprint extents of the berm and overflow spillway embankments line and grades as shown on the Contract Documents.
- C. Basis for Payment: Per Cubic Yard (CY).

4.5 BID ITEM 5 BERM EMBANKMENT

- A. The Contract unit price shall be full compensation for any required work necessary for constructing berms and interior berms including but not limited to: Diverting water, dewatering, excavating the borrow sites, excavating interior swales, constructing temporary water crossing(s), excavation of the observation trench, subgrade preparation, construction of the overflow spillway, over-excavation, and placement and compaction of suitable berm fill material, including quality control testing of compacted materials.
- B. Method of Measurement:
 - 1. Cubic Yards, based on plan quantity for line, grade, and sections for berms and interior berms as shown in the Contract Documents.
- C. Basis for Payment: Per Cubic Yard (CY).

4.6 BID ITEM 6 SEEPAGE BERM EMBANKMENT

- A. The Contract unit price shall be full compensation for the work necessary for constructing seepage berms including but not limited to: Diverting water, dewatering, selecting one or more onsite material borrow locations, removing and replacing overburden from the borrow sites, excavating seepage berm material, constructing temporary water crossing(s), subgrade preparation, over-excavation, excavating, and placement and compaction of seepage berm fill material.
- B. Method of Measurement:
 - 1. Cubic Yards, based on plan quantity for line, grade, and sections for seepage berm fill as shown on the Contract Documents.
- C. Basis for Payment: Per Cubic Yard (CY).

4.7 BID ITEM 7 TOE DRAIN SYSTEM

- A. The Contract unit price shall be full compensation for the work necessary to install the toe drain system including but not limited to: Record clay blanket depth in the observation trench, excavate, provide and install sight wells, perforated pipe with sock, fittings, caps, locks, and non-perforated pipe necessary to assemble cleanouts and install cleanouts at 300 FT spacing, end caps, concrete pads and marker posts at each cleanout, and refilling and compacting trench.
- B. Method of Measurement: Lump Sum.
- C. Basis for Payment: Per Lumps Sum (LS).

4.8 BID ITEM 8 WATER LEVEL CONTROL FLUME STRUCTURES

- A. The Contract unit price shall be full compensation for the work necessary to, divert water, dewater, excavate the structure pad footing, provide and place filter sand from onsite source, subdrain piping, fittings and sight wells, concrete, steel reinforcing, railing, self-contained solar powered motorized flume gate, and compact backfill for construction of each water level control structure, including quality control testing of concrete materials.
- B. Method of Measurement: Each, as shown on the Contract Documents.
- C. Basis for Payment: Per Each (EA).

4.9 BID ITEM 9 IN-LINE WATER LEVEL CONTROL

- A. The Contract unit price shall be full compensation for the work necessary to divert water, dewater, excavate, install the in-line water level control structure and 24 IN DIA corrugated metal pipe culverts, and compact backfill for construction of each in-line water level control.
- B. Method of Measurement: Each, as shown on the Contract Documents.
- C. Basis for Payment: Per Each (EA).

4.10 BID ITEM 10 RIPRAP

- A. The Contract unit price shall be full compensation for the work necessary to excavate, prepare subgrade, install the rock riprap, aggregate bedding, and geotextile fabric at outlet of the overflow spillways, outlet channels, aprons, and low water crossings as shown on the Contract Documents. Aggregate bedding and geotextile fabric materials, excavation, and installation are subsidiary to riprap.
- B. Method of Measurement:
 - 1. Cubic Yard, based on plan quantity for surface area and riprap depth shown on the Contract Documents.
- C. Basis of Payment: Per Cubic Yard (CY).

4.11 BID ITEM 11 CRUSHED ROCK SURFACING

- A. The Contract unit price shall be full compensation for the work necessary to install crushed rock surfacing at the maintenance route over the outlet of the overflow spillway riprap barrier and low water crossings and to excavate, prepare subgrade, and install crushed rock surfacing and geotextile at the maintenance road locations shown on the Contract Documents.
- B. Method of Measurement:
 - 1. Cubic Yard, based on plan quantity of surface area and thickness of crushed rock surfacing shown on the Contract Documents.
- C. Basis of Payment: Per Cubic Yard (CY).

4.12 BID ITEM 12 ROAD DITCH DRAINAGE CONTROLS

- A. The Contract unit price shall be full compensation for the work necessary to remove and stockpile surfacing materials, excavate and backfill, remove and replace existing county road CMP culvert, install CMP culverts with flap gates, and construct embankment to support the outlet channel riprap, as shown on the Contract Documents, including quality control testing of compacted materials.
- B. Method of Measurement: Lump Sum.
- C. Basis of Payment: Per Lump Sum (LS).

4.13 BID ITEM 13 INTERNAL DRAINAGE CULVERTS

- A. The contract unit price shall be full compensation for the work necessary to install CMP culverts and one canal gate on one culvert as shown on the Contract Documents, including quality control testing of compacted materials.
- B. Method of Measurement: Lump Sum.
- C. Basis of Payment: Per Lump Sum (LS).

4.14 BID ITEM 14 SEEDING AND MULCHING

- A. The Contract unit price shall be full compensation for preparation of the seedbed, seed, fertilizer, mulch and seed mixtures for borrow areas, overflow spillways, berms, seepage berms, internal drains, internal berms, and a 20 FT wide vegetated buffer at the upstream toe of berms and at the downstream toe of the berms or seepage berms.
- B. Method of Measurement:
 - 1. Acres, based on plan quantity of area seeded and mulched to the nearest 0.1.
- C. Basis for Payment: Per Acre.

END OF SECTION

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01300 – SUBMITTALS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mechanics and administration of the submittal process for:
 - a. Shop Drawings.
 - b. Samples.
 - c. Informational submittals.
 - 2. General content requirements for Shop Drawings.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 00900 - Construction Progress Schedule.
 - 4. Section 01700 - Operations and Maintenance Manual.
 - 5. Technical Specification Sections identifying required submittals.

1.2 DEFINITIONS

- A. Shop Drawings:
 - 1. See General Conditions.
 - 2. Product data and samples are Shop Drawing information.
- B. Informational Submittals:
 - 1. Submittals other than Shop Drawings and samples required by the Contract Documents that do not require review and/or approval by the Engineer.
 - 2. Representative types of informational submittal items include but are not limited to:
 - a. Installed equipment and systems performance test reports.
 - b. Manufacturer's installation certification letters.
 - c. Instrumentation and control commissioning reports.
 - d. Warranties.
 - e. Service agreements.
 - f. Construction photographs.
 - g. Survey data.
 - h. Health and safety plans.
 - i. Work plans.
 - j. Delegated designs per performance specification requirements
 - 3. For-Information-Only submittals upon which the Engineer is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

1.3 SUBMITTAL SCHEDULE

- A. Schedule of Shop Drawings:
 - 1. Submitted and approved within 20 days of receipt of Notice to Proceed.
 - 2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

- B. Shop Drawings: Submittal and approval prior to 30 percent completion of project.
- C. Informational Submittals:
 - 1. Reports and installation certifications submitted within seven (7) days of conducting testing, installation, or examination.
 - 2. Submittals showing compliance with required qualifications submitted twenty (20) days prior to any work beginning using the subject qualifications.
- D. The submittal schedule shall include the following columns as a minimum:

Submittal Section	Submittal Description	Planned Submittal Date	Submittal Need Date	Actual Submittal Date	Actual Return Date	Disposition

1.4 PREPARATION OF SUBMITTALS

- A. General:
 - 1. All submittals and all pages of all copies of a submittal shall be completely legible.
 - 2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without review.
 - 3. Minimize extraneous information for equipment and products not relevant to the submittal.
 - 4. Contractors or vendors written comments on the submittal drawings shall be in green
- B. Shop Drawings, Product Data, and Samples:
 - 1. Scope of any submittal and letter of transmittal:
 - a. Limited to one (1) Specification Section.
 - b. Submittals with more than one Specification section included will be rejected.
 - c. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Specification Section.
 - 2. Numbering letter of transmittal:
 - a. Include as prefix the Specification Section number followed by a series number, "-xx", beginning with "01" and increasing sequentially with each additional transmittal for that Specification Section.
 - b. If more than one (1) submittal under any Specification Section, assign consecutive series numbers to subsequent transmittal letters.
 - 3. Describing transmittal contents:
 - a. Provide listing of each component or item in submittal capable of receiving an independent review action.
 - b. Identify for each item:
 - 1) Manufacturer and Manufacturer's Drawing or data number.
 - 2) Contract Document tag number(s).
 - 3) Unique page numbers for each page of each separate item.

- c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
- 4. Contractor certification of review and approval:
 - a. Contractor's review and approval certification stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
 - 1) Stamp may be either a wet ink stamp or electronically embedded.
 - 2) Clearly identify the person who reviewed the submittal and the date it was reviewed.
 - 3) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated in the General Conditions."

or

- b. Execute Exhibit AA, Contractor's Submittal Certification form, to indicate Contractor has reviewed and approved the submittal contents.
 - 1) Clearly identify the person who reviewed the submittal and the date it was reviewed."
- c. Submittals containing multiple independent items shall be prepared with each item listed on the letter of transmittal or on an index sheet for all items listing the discrete page numbers for each page of each item, which shall be stamped with the Contractor's review and approval stamp.
 - 1) Each independent item shall have a cover sheet with the transmittal number and item number recorded.
 - a) Provide clear space of 3 IN SQ for Engineer stamping.
 - 2) Individual pages or sheets of independent items shall be numbered in a manner that permits the entire contents of a particular item to be readily recognized and associated with Contractor's certification.
- 5. Resubmittals:
 - a. Number with original Specification Section and series number with a suffix letter starting with "A" on a (new) duplicate transmittal form.
 - b. Do not increase the scope of any prior transmittal.
 - c. Provide cover letter indicating how each "B", "C", or "D" Action from previous submittal was addressed and where the correction is found in the resubmittal.
 - d. Account for all components of prior transmittal.
 - 1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
 - a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
 - 2) Indicate "Outstanding-To Be Resubmitted at a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
 - a) Obtain Engineer's approval to exclude items.
- 6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide five (5) copies of each submittal for Engineer plus the number required by the Contractor.
 - a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed three (3).
 - b. All other size sheets:

- 1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
 - 2) Utilize mailing tube; do not fold.
 - 3) The Engineer will mark and return the reproducible to the Contractor for reproduction and distribution.
7. Do not use red color for marks on transmittals.
 - a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
 - b. Engineer will use red marks or enclose marks in a cloud.
 8. Transmittal contents:
 - a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
 - b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.
 - 1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.
 - c. Identify equipment or material project use, tag number, Drawing detail reference, weight, and other Project specific information.
 - d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
 - e. Do not modify the manufacturer's documentation or data except as specified herein.
 - f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets not exceeding 11 x 17 IN pages.
 - 1) Indicate exact item or model and all options proposed by arrow and leader.
 - g. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
 - 1) Arrange data and performance information in format similar to that provided in Contract Documents.
 - 2) Provide, at minimum, the detail specified in the Contract Documents.
 - h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.
 9. Samples:
 - a. Identification:

- 1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.
 - 2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
 - b. Include application specific brochures, and installation instructions.
 - c. Provide Contractor's review and approval certification stamp or Contractor's Submittal Certification form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
 - d. Resubmit revised samples of rejected items.
- C. Informational Submittals:
1. Prepare in the format and detail specified in Specification requiring the informational submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings and Samples:

1. Transmit all submittals to:

HDR
301 S 13th Street
Lincoln, NE 68508
Attn: John Cambridge

2. Utilize two (2) copies of attached Exhibit A to transmit all Shop Drawings and samples.
3. All submittals must be from Contractor.
 - a. Submittals will not be received from or returned to subcontractors.

B. Informational Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit to:

HDR
301 S 13th Street
Lincoln, NE 68508
Attn: John Cambridge

C. Electronic Transmission of Submittals:

1. Transmittals shall be made electronically.
 - a. Use email.
 - b. Protocols and processes will be determined at the Pre-Construction Conference.
2. Provide documents in Adobe Acrobat Portable Document Format (PDF), latest version.
3. Do not password protect or lock the PDF document.

4. Drawings or other graphics must be converted to PDF file format from the original Drawing file format and made part of the PDF document.
 - a. Scanning of Drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 dpi or greater.
 - b. Required signatures may be applied prior to scanning for transmittal.
5. Electronic drawings shall be formatted to be at full-scale (or half-scale when printed to 11x17).
 - a. Do not reduce Drawings by more than 50 PCT in size.
 - b. Reduced Drawings shall be clearly marked "HALF-SIZE" and shall scale accurately at that size.
6. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.
7. Create bookmarks in the bookmarks panel for the cover, the Table of Contents, and each major section of the document.
8. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
 - a. Select File → Properties → Initial View.
 - b. Select the Navigation tab: Bookmarks Panel and Page.
 - c. Select the Page layout: Single Page.
 - d. Select the Magnification: Fit Page.
 - e. Select Open to page: 1.
 - f. Set the file to open to the cover page with bookmarks to the left, and the first bookmark linked to the cover page.
9. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
 - a. To do this:
 - 1) Select Edit → Preferences → Documents → Save Settings.
 - 2) Check the Save As optimizes for Fast Web View box.
10. File naming conventions:
 - a. File names shall use a "ten dot three" convention (XXXXXX-YY-Z.PDF) where XX XX XX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.
11. Labeling:
 - a. As a minimum, include the following labeling on all CD-ROM discs and jewel cases:
 - 1) Project Name.
 - 2) Equipment Name and Project Tag Number.
 - 3) Project Specification Section.
 - 4) Manufacturer Name.
 - 5) Vendor Name.
12. Binding:
 - a. Include labeled CD(s) in labeled jewel case(s).
 - 1) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.
 - 2) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

1.6 ENGINEER'S REVIEW ACTION

- A. Shop Drawings and Samples:
1. Items within transmittals will be reviewed for overall design intent and will receive one (1) of the following actions:
 - a. A - FURNISH AS SUBMITTED.
 - b. B - FURNISH AS NOTED (BY ENGINEER).
 - c. C - REVISE AND RESUBMIT.
 - d. D - REJECTED.
 - e. E - ENGINEER'S REVIEW NOT REQUIRED.
 2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
 - a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.
 3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
 - a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
 - 1) Review and approval will be limited to the single item described on the transmittal letter.
 - 2) Other items identified in the submittal will:
 - a) Not be logged as received by the Engineer.
 - b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
 - c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
 - b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
 - 1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
 4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
 - a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
 - b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
 5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
 - a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
 - 1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
 - a) Correct and resubmit items so marked.

- b. Items marked "A" or "B" will be fully distributed.
- c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
 - 1) This is at the sole discretion of the Engineer.
 - 2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
 - 3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
- 6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
- 7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been stamped by the professional as defined in the specifications and for limited purpose of checking conformance with given performance and design criteria. The Engineer is not responsible for checking the accuracy of the calculations and the calculations will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
- 8. Furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
- 9. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" action in a prior submittal, will be returned with action "E. Engineer's Review Not Required."
- 10. Samples may be retained for comparison purposes.
 - a. Remove samples when directed.
 - b. Include in bid all costs of furnishing and removing samples.
- 11. Approved samples submitted or constructed, constitute criteria for judging completed work.
 - a. Finished work or items not equal to samples will be rejected.

PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION



EXHIBIT A Shop Drawing Transmittal No. _____ - _____
(Spec Section) (Series)

Project Name:				Date Received:	
Project Owner:				Checked By:	
Contractor:		HDR Engineering, Inc.		Log Page:	
Address:		Address:		HDR No.:	
				Spec Section:	
				Drawing/Detail No.:	
Attn:		Attn:		1st. Sub	ReSub.
Date Transmitted:		Previous Transmittal Date:			
Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*
Remarks:					
* The Action designated above is in accordance with the following legend:					

<p>A - Furnish as Submitted</p> <p>B - Furnish as Noted</p> <p>C - Revise and Submit</p> <ol style="list-style-type: none"> 1. Not enough information for review. 2. No reproducibles submitted. 3. Copies illegible. 4. Not enough copies submitted. 5. Wrong sequence number. 6. Wrong resubmittal number. 7. Wrong spec. section. 8. Wrong form used. 9. See comments. <p>D - Rejected</p>	<p>E - Engineer's review not required</p> <ol style="list-style-type: none"> 1. Submittal not required. 2. Supplemental Information. Submittal retained for informational purposes only. 3. Information reviewed and approved on prior submittal. 4. See comments. 5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal. <p>Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.</p>
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Comments:

By	Date	
Distribution: Contra Fil Fiel Own Oth		

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Shop Drawing Transmittal
No.:

Contract/Project Name:

Company Name:

has

1. reviewed and coordinated this Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
3. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
4. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

- ☐ This Submittal **does not** contain any variations from the requirements of the Contract Documents.
- ☐ This Submittal **does** contain variations from the requirements of the Contract Documents. A separate description of said variations and a justification for them is provided in an attachment hereto identified as:

"Shop Drawing Transmittal No. _____ Variation and
Justification Documentation"

Insert picture file or electronic signature of
Authorized Representative

Authorized Representative

Date

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DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 COMPLETION OF WORK:

It is understood that, except as otherwise specifically stated in the Contract Documents, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and satisfactorily deliver the Work within the specified time.

1.02 CONTRACTOR RESPONSIBILITY:

Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection. The CONTRACTOR shall be responsible for the condition of all materials which he has furnished, and shall replace at his own expense all such material found to be defective or which has been damaged. This includes the replacement of material which is found to be defective at any time prior to expiration of the warrantee period.

Storage areas for all material and equipment shall be furnished on the job, and all CONTRACTOR'S equipment, including refueling and service areas, are to comply with all applicable local, state and federal regulations, including those relating to water pollution. No volatiles or oils are to reach a surface water or leave the CONTRACTOR'S work site.

1.03 MANUFACTURER'S RECOMMENDATIONS:

Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

All suppliers of material and equipment shall review the design drawings and specifications regarding the use of the proposed material or equipment. If the supplier believes the material or equipment is not being used correctly or believes additional considerations are required for its use, they shall notify the ENGINEER in writing of such concerns. If no concerns are raised, it is assumed the supplier agrees with the proposed use.

The CONTRACTOR shall make arrangements whenever required, to have manufacturer's representatives on-site to assure proper installation, operation and start-up of all components.

1.04 SAMPLES:

Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

END OF SECTION 01600

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PART 1 - GENERAL

1.01 DESCRIPTION:

The following Specifications include all work involved in final closeout of this Project. Included are items such as post-construction inspection, acceptance of the Work, closeout records, and cleaning.

1.02 RELATED WORK:

- A. Section 01300 – Submittals.
- B. Section 00700 - General Conditions.
- C. Section 00810 - Supplementary Conditions.

1.03 SUBMITTALS:

All required closeout submittals shall be received, reviewed, and found to be acceptable by the ENGINEER prior to final payment. Items to be submitted are:

- A. Guarantees and Bonds. Provide guarantees and bonds as required herein and as provided by manufacturers of all products and equipment.
- B. Operation and Maintenance Manuals: Furnish in triplicate, complete manufacturer's literature, operating instructions, installation instructions, maintenance instructions, parts lists, and technical data on all items furnished and installed on this project, or required by the ENGINEER.
- C. Post Construction Maintenance Personnel: CONTRACTOR shall submit plans for maintenance of the system during the one-year correction period and shall name the individual who will have the power and responsibility to act for the CONTRACTOR in this regard.
- D. Contractors Certification of Completion: Certifying completion of construction, compliance with the Contract Documents, and waiver of any claims.
- E. Insurance Certificate: Certificate to indicate which insurance coverages required by Sections 00700 and 00810 that are to remain in effect after project is completed.
- F. Lien Releases: Affidavit of Release Liens, and lien releases from all subcontractors, suppliers, or others that may have provided labor, materials or services for the project. Also, provide a lien release from the CONTRACTOR.
- G. Other Certificates: Certificate of Substantial Completion, Certificate of Final Completion and Warranty Certificate.

PART 2 - PRODUCTS

2.01 CLEANING PRODUCTS:

Use cleaning materials recommended by the manufacturer of the surface to be cleaned. Follow the instructions on the container.

PART 3 - EXECUTION

3.01 CLEANING:

Clean or rake all areas used by the CONTRACTOR during the course of construction. The cleaning and reclamation of these areas shall be to the satisfaction of the OWNER.

3.02 SUBSTANTIAL COMPLETION AND FINAL INSPECTION:

Submit written certification that the project, or designated portion of Project, is substantially complete and request, in writing, a final inspection. The ENGINEER, OWNER, and representatives of funding agencies will make an inspection within 10 days of receipt of request. Should the ENGINEER determine the Work is substantially complete, a punch list of deficiencies that need to be corrected before final acceptance will be prepared, a Notice of Substantial Completion with the deficiencies noted will be issued.

Should the ENGINEER determine the Work is not substantially complete, ENGINEER will immediately notify the CONTRACTOR, in writing, stating reasons. After the CONTRACTOR completes the Work, CONTRACTOR shall submit certification and request a second inspection.

3.03 ACCEPTANCE OF THE WORK:

After all deficiencies have been corrected, a Letter of Final Acceptance will be issued. If only designated portions of the project have been inspected, a Letter of Partial Acceptance will be issued for that portion corrected.

Acceptance may be given prior to correction of deficiencies which do not preclude operation and use of the facility; however, final payment will be withheld until all deficiencies are corrected. Until receipt of the Letter of Final Acceptance, the CONTRACTOR shall be responsible for the Work completed under this Contract.

3.04 POST-CONSTRUCTION INSPECTION:

Prior to expiration of one year from date of final acceptance, the ENGINEER and OWNER will inspect the project to determine whether corrective work is required. The CONTRACTOR will be notified in writing of all deficiencies. Notices of deficiencies can be presented to the CONTRACTOR any time during the warranty period, as necessary. Corrective work must start on noted deficiencies within 10 days of receipt of notification to CONTRACTOR.

In the event that a separate Warranty is issued for both Substantial Completion and Final Completion due to a winter shutdown, a separate inspection will be performed for each warranty period.

END OF SECTION 01700



DIVISION 02

SITE WORK



SECTION 02110

SITE CLEARING AND TOPSOIL REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Site clearing, tree protection, stripping topsoil and removals.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 - Earthwork.
 - 4. Section 02260 - Topsoiling and Finished Grading.
 - 5. Section 02270 - Soil Erosion and Sediment Control.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing trees and other vegetation to remain against damage.
 - 1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
 - 2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
 - 3. Provide temporary protection as required.
- B. Protect existing monitoring wells to remain against damage.
 - 1. Provide temporary protection as required.
- C. Repair or replace trees and vegetation damaged by construction operations.
 - 1. Repair to be performed by a qualified tree surgeon/licensed arborist.
 - 2. Remove trees which cannot be repaired and restored to full-growth status.
 - 3. Replace with new trees of minimum 4 IN caliper or as required by local tree ordinance.
- D. Owner will obtain authority for removal and alteration work on adjoining property, as applicable.

3.2 SITE CLEARING

- A. Clearing and Grubbing:
 - 1. Clear from within limits of construction all trees not marked to remain.
 - a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
 - 2. Grub (remove) stumps, roots, root mats, logs and debris encountered.
 - 3. Remove from within limits of construction all existing fences, culverts, headwalls, and other structures.
- B. Disposal of Waste Materials:
 - 1. Do not burn combustible materials on site.
 - 2. Remove all waste materials from site.
 - 3. Do not bury organic matter on site.

3.3 TOPSOIL REMOVAL, SALVAGING, AND STOCKPILING:

- A. Topsoil shall be removed from earth surfaces that will be disturbed by construction activities, after designated sites have been cleared and grubbed.
- B. Topsoil shall consist of the existing organic layer of friable surface soil to a depth of 6 IN reasonably free of grass, weeds, sticks, rocks, or other unsuitable material.
- C. Topsoil shall be salvaged and stockpiled at locations acceptable to the Owner. Unsuitable material encountered during removal of topsoil shall be disposed of in sand fill mined areas, at locations approved by the Owner, or it will be otherwise hauled and disposed of at locations removed from the construction site.
- D. The Contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from the disposal at locations outside the construction work limits.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Earthwork - Excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, sheeting, bracing, dewatering and other Earthwork related Work.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 00900 - Special Provisions.
 - 4. Section 01300 - Submittals.
 - 5. Section 02221 - Trenching, Backfilling and Compacting for Utilities.
 - 6. Section 02270 - Soil Erosion and Sediment Control.
 - 7. Section 02271 - RipRap.
 - 8. Section 02423 - Storm Drainage System.
 - 9. Section 02512 - Subsurface Drain System.
 - 10. Section 02778 - Geotextiles.

1.2 QUALITY CONTROL AND ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-lbf/ft³).
 - b. D1140, Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) sieve in Soils by Washing.
 - c. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - f. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soil.
 - g. D6913, Standard Test Method for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 - h. D7928, Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
 - 2. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR Part 1926.650, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
- B. The Owner will perform quality assurance testing and observations.
 - 1. Quality assurance testing and observations will be used to validate the effectiveness of the Contractor's quality control program.
 - 2. If the Owner determines the Contractor's quality control program is deficient. The Contractor shall stop production until corrective action is taken.

1.3 DEFINITIONS

- A. Excavation:
 - 1. Consists of removal of material encountered to subgrade elevations required or indicated.
 - 2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.
- B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.
- C. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.
- D. Structure: Foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.
- E. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.
- F. Unauthorized Excavation:
 - 1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.
 - a. Unauthorized excavation, as well as associated remedial work as directed by Engineer, shall be at Contractor's expense.
 - 2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the Engineer.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Certifications.
- B. Samples:
 - 1. Coordinate samples and testing for approval of off-site materials with the Engineer.
 - 2. Test reports.
 - a. Report and certification of off-site aggregate fill.
 - b. Test reports on borrow material.
 - c. Verification tests for suitability of each material, in accordance with specified requirements.
 - d. Field reports; in-place soil density and moisture tests.
 - e. Moisture-density curve.
 - f. Maximum and minimum relative density curve.
 - g. Other documentation necessary for Engineer to approve earthwork.

1.5 PROJECT CONDITIONS

- A. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- B. Dispose of waste materials, legally, off site.
 - 1. Burning, as a means of waste disposal, is not permitted.

C. Site Information:

1. Data in subsurface investigation reports were used for the basis of the design. A copies of these reports are available for review in the Owners office.
 - a. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings.
 - b. The Owner or Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.
2. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
3. Site data provided is not contractual and shall be considered "for information only."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill:

1. Selected material approved by Engineer from site excavation or from offsite borrow.
2. Embankment Fill for Berm:
 - a. Free of organic matter, frozen material and debris.
 - b. Low volume change cohesive soil:
 - 1) ASTM D2487 classification: SC, CL-ML or CL.
 - 2) ASTM D4318 Liquid limit: Less than 45.
 - 3) ASTM D4318 Maximum plasticity index: 20.
 - 4) ASTMD D4318 Minimum plasticity index: 4.
 - 5) ASTM D1140 Minimum fines content: 35 PCT.
3. Embankment Fill for Seepage Berm:
 - a. Free of organic matter, frozen material, and debris.
 - b. Granular soil:
 - 1) ASTM D2487 classification: SP, SW, SP-SM, SW-SM, SM, GP, GW, GP-GM, GW-GM, or GM.
 - 2) ASTM D1140 Maximum fines content: 25 PCT.
4. Fill under Flume Structure Slab:
 - a. Free of organic matter, frozen material, and debris.
 - b. Granular soil:
 - 1) ASTM D2487 classification: SP, SW, SP-SM, SW-SM, SM, GP, GW, GP-GM, GW-GM, or GM.
 - 2) ASTM D1140 Maximum fines content: 15 PCT.
5. Non-Structural Fill:
 - a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
 - b. ASTM D4318 Liquid limit: Less than 45.
 - c. ASTM D4318 Maximum plasticity index: 20.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. See Specification Section 02270.
2. Clean roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 3. Verify location of utilities.
 - a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
 - b. Secure and examine local utility records for location data.
 - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
 - 1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
 - 3) Obtain Owner's approval prior to disconnecting any utility service.
 - d. Repair damages to utility items at own expense.
 - e. In case of damage, notify Engineer at once so required protective measures may be taken.
 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 ROAD SUBGRADE

- A. Subgrade Preparation:
1. Scarify and recompact top 6 IN.
 2. Compact subgrade as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
 - a. Compact cohesive soils by sheep'sfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - b. Control moisture to meet requirements of compaction.
 3. Remove soft or spongy areas as directed by the Engineer.

3.3 SITE EXCAVATION AND GRADING

- A. The site excavation and grading work includes the offsite disposition of all material:
1. That exceed quantities required for earthwork on the project.
 2. That the Engineer classifies as unclassified excavation.
 3. That the Engineer classifies as unacceptable.
 4. That the Engineer classifies as potentially contaminated.
- B. Excavation and Grading:
1. Perform as required by the Contract Drawings.

2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.
 3. Inspection Trench Excavation:
 - a. Excavate inspection trench as shown on Drawings or as directed by the Engineer.
 - 1) The Engineer shall be allowed to observe the excavation and will prepare a report that documents the location and depth along the alignment of the soil layers and any anomalies such as drain tile, rubbish, organics, sand lenses, or other material that could adversely impact the performance of the earthen berm.
 - 2) Where the excavation is located adjacent to a toe drain, at an interval of every 100 FT, the bottom of the excavation shall be potholed to the surface of the underlying sand containing a maximum of 5 PCT fines, as determined by the Engineer. The potholes shall be backfilled immediately after excavation.
 - 3) Assist the Engineer in locating features observed in the inspection trench.
 - b. Excavated materials suitable for placement may be placed in the designated final location directly from the excavation, or may be placed in temporary stockpiles and later placed in the final location. Any material not suited for placement shall be wasted in a manner approved by the Engineer.
 - 1) Excavated materials which after draining or drying are suitable for placement, but which when excavated are too wet for immediate compaction, shall be mixed with drier materials from other sources in temporarily stockpiles until the moisture content is reduced sufficiently to permit the material to be placed.
 - 2) Excavated materials which are suitable material for placement, but which when excavated are too chunky or blocky for immediate compaction, shall be processed in temporary stockpiles until the material is of suitable consistency and moisture content to permit placement.
 - c. All excavation for the inspection trench with the exception of the potholes, shall be performed in the dry. If groundwater is encountered, excavation shall be halted and backfill immediately placed to a height of 1 FT above the groundwater.
 - d. Do not backfill the Inspection Trench until directed by the Engineer.
 - e. Backfill the inspection trench with suitable material meeting the requirements Embankment Fill for Berm and compacted to the requirements of Berm fill.
 4. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
 5. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 2. Include cost of all borrow material in original proposal.
 3. Fill material to be approved by Engineer prior to placement.

- D. Construct Berm embankments and non-structural fills as required by the Contract Drawings:
 - 1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
 - 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
 - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
 - b. Do not place material in layers greater than 8 IN loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 - 3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
 - a. Compact cohesive soils by sheepfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - b. Control moisture for each layer necessary to meet requirements of compaction.
- E. Construct Seepage Berm Fills as Required by the Contract Drawings:
 - 1. Suitable granular soil materials shall be mined from within on-site borrow areas shown on the Contract Documents. Overburden shall be temporarily removed and stockpiled to expose the underlying granular soil. Stockpiled overburden shall be replaced within the mined area.
 - 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
 - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of berm.
 - b. Do not place materials in layers greater than 12 IN loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 - 3. Compaction should be achieved by the controlled movement of the hauling and spreading equipment to create a stable surface for each lift of fill.
 - a. Control moisture for each layer such that the material is stable under the hauling and spreading equipment without creating ruts greater than 4 IN in a single pass of a truck or 2 IN in a single pass of a tracked dozer.
 - 4. The gradation and distribution of materials shall be such that the embankment will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material occur in the spread material, the layer shall be mixed by harrowing or any approved method to blend the materials.
 - 5. Equipment traffic on the new seepage berm shall be routed to distribute the compactive effort as much as practicable. Ruts formed in the surface of any layer of spread material will be filled before that material is compacted. If, in the opinion of the Engineer, the compacted surface of any layer of material is too smooth to bond properly with the succeeding layer, the surface shall be loosened by scarifying or other approved methods before material from the succeeding layer is placed.

F. Grading Tolerances: Minus 0.0 FT plus 0.1 FT.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Engineer.
- D. Stabilize subgrade as directed by Engineer.

E. Assure by results of testing that compaction densities comply with the following requirements:

1. Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Inside of structures under foundations and under slabs	75 PCT relative density per ASTM D4253 and ASTM D4254 or 98 PCT of ASTM D698	-2 to +3 PCT of optimum
Outside structures next to walls and any other structure exterior member	95 PCT per ASTM D698	-2 to +3 PCT of optimum

2. Specific areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Berm Embankment Fill	95 PCT per ASTM D698	-2 to +3 PCT of optimum
Seepage Berm Embankment Fill	No compaction or moisture control other than that obtained by and necessitated by the controlled movement of the hauling equipment	
Non-Structural Fill and Backfill	65 PCT relative density per ASTM D4253 and ASTM D4254 or 92 PCT of ASTM D698	-2 to +3 PCT of optimum
Road Subgrade	75 PCT relative density per ASTM D4253 and ASTM D4254 or 98 PCT of ASTM D698	-2 to +3 PCT of optimum

3.5 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
 - a. Materials and source to be approved by Engineer.
 - b. Excavated material approved by Engineer may also be used for fill and backfill.
3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:
 - a. Do not commence excavation for foundations for structures until Engineer approves:
 - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
 - 2) Density and moisture content of site area compacted fill material meets requirements of Specifications.
 - b. Engineer grants approval to begin excavations.
2. Dimensions:
 - a. Excavate to elevations and dimensions indicated or specified.
 - b. Allow additional space as required for construction operations and inspection of foundations.
 - c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
 - d. Excavation slopes shall be no steeper than 2H:1V.

- e. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- 3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
 - a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Engineer.
 - b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:
 - 1) Distance equal to depth of overexcavation below bottom of foundations.
 - 2) As directed by Engineer.
 - c. When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions.
 - 1) If Engineer determines that bearing materials at required subgrade elevations are unsuitable, stabilize as directed by the Engineer.
- 4. Level off bottoms of excavations to receive foundations, floor slabs or compacted fill.
 - a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
 - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.
 - c. Do not carry excavations lower than shown for foundations except as directed by Engineer.
 - d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:
 - 1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 - a) Concrete fill may be used to bring elevations to proper position.
 - 2) In locations other than those above, including slabs on grade, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.
 - 3) No extra compensation will be made to Contractor for correcting unauthorized excavations.
- 5. Make excavations large enough for working space, forms, and inspection.
- 6. Notify Engineer as soon as excavation is completed in order that subgrades may be inspected.
 - a. Do not commence further construction until subgrade under compacted fill material and under foundations has been inspected and approved by the Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation and fill to be placed thereon.
 - b. Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
 - c. Place fill material and foundations as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
 - d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

7. Dewatering:
 - a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
 - b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
 - c. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
 - d. Employ dewatering specialist for selecting and operating dewatering system.
 - e. Install groundwater monitoring wells at the mid-point between each dewatering well and outside the limits of the wells, if needed, to determine if the groundwater is at the acceptable absolute minimum level or lower. A minimum of 1 groundwater monitoring well shall be installed with each dewatering system. The observed groundwater elevations in the groundwater monitoring wells shall be reported to the Engineer prior to beginning excavation.
 - f. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
 - g. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1) Install groundwater monitoring wells as necessary.
 - h. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
 - i. Upon removal of the dewatering system, the top 3 FT disturbed by the installation and removal of the dewatering wells shall be overexcavated and recompacted.
8. Subgrade stabilization:
 - a. If subgrade under foundations, fill material, slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Engineer.
 - b. Provide compaction density of replacement material as stated in this Specification Section.
 - c. Loose, wet, or soft materials, when approved by Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
 - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
 - e. Remove and replace frozen materials as directed by Engineer.
 - f. Method of stabilization shall be performed as directed by Engineer.
 - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Engineer.
9. Do not place slabs-on-grade until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
 - a. Do not place slabs-on-grade when temperature of air surrounding the slab and pads is or is expected to be below 40 DEGF before structure is completed and heated to a temperature of at least 50 DEGF.
10. Protection of structures:
 - a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
 - b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
11. Shoring:
 - a. Shore, slope, or brace excavations as required to prevent them from collapsing.
 - b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.

- c. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.
 - d. Upon removal of the shoring system, the top 3 FT disturbed by the installation and removal of the shoring system shall be overexcavated and recompacted.
12. Drainage:
- a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
 - b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
 - c. Provide pumping required to keep excavated spaces clear of water during construction.
 - d. Should any water be encountered in the excavation, notify Engineer.
 - e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
13. Frost protection:
- a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
 - b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
 - c. Protect excavation from frost if placing of concrete or fill is delayed.
 - d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
 - e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DEGF.
- C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs and Piping:
- 1. General:
 - a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Engineer and scarified to a depth of 6 IN and compacted to density specified herein.
 - b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 PCT.
 - c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Engineer as being free of undesirable material and compacted to specified density.
 - 2. Obtain approval of fill and backfill material and source from Engineer prior to placing the material.
 - 3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Engineer.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
 - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
 - d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes.
 - 1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use hand operated equipment for filling and backfilling next to walls.
 - f. Do not place fill and backfill when the temperature is less than 40 DEGF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment to compact granular material; do not use water.

4. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content as required to fill the specified overexcavation to bottom of foundation.
- D. Filling and Backfilling Outside of Structures:
1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
 2. Provide material as approved by Engineer for filling and backfilling outside of structures.
 3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Engineer.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
 - c. Compact material with equipment of proper type and size to obtain density specified.
 - d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes.
 - 1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum.
 - 2) Contractor is responsible for method of compaction so as not to damage wall.
 - e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - f. Do not place fill or backfill material when temperature is less than 40 DEGF and when subgrade to receive material is frozen, wet, loose, or soft.
 - g. Use vibratory equipment for compacting granular material; do not use water.
 4. Backfilling against walls:
 - a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
 - b. Do not start backfilling until concrete forms have been removed and trash is removed from excavations.
 - c. Do not place fills against walls until floor slabs at bottom and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
 - 1) See Contract Drawings for specific exceptions.
 - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures under Piping:
1. When backfilling outside of structures requires placing backfill material under piping, the material shall be placed from bottom of excavation to underside of piping at the density required for fill under piping or paving as indicated in this Specification Section.
 2. This compacted material shall extend transversely to the centerline of piping a horizontal distance each side of the exterior edges of piping equal to the depth of backfill measured from bottom of excavation to underside of piping.
 3. Provide special compacted bedding or compacted subgrade material under piping as required by other Specification Sections for the Project.

3.6 FIELD QUALITY CONTROL

- A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.
- A. Refer to Specification Section 00900 for additional requirements.

B. Contractor Testing:

1. Moisture-density relations in accordance with ASTM D698, grain size distribution with hydrometer in accordance with ASTM D6913 and D7928, and plasticity tests in accordance with ASTM D4318, to be established by the Contractor's Testing Agency, are required for all berm embankment materials to be compacted.
2. Grain size distribution in accordance with ASTM D6913, to be established by the Contractor's Testing Agency, are required for all seepage berm embankment materials to be compacted.
3. Moisture-density relations in accordance with ASTM D698, to be established by the Contractor's Testing Agency, are required for all backfill materials to be compacted.
4. Extent of field compaction testing will be as necessary to assure compliance with Specifications.
 - a. Field compaction tests will be conducted at a frequency of one test per 1,000 CY, with a minimum of two tests per day of placement and one test per lift.
 - b. The Engineer reserves the right to increase or decrease the frequency of testing due to the Contractor's operation.
 - c. Record the location tests were performed by station, offset, and elevation to the nearest foot.
5. Provide a minimum of 24 HR advance notice to Engineer when ready for compaction or subgrade testing and inspection.
6. Should any field compaction test or subgrade inspection fail to meet Specification requirements, perform corrective work as necessary.
7. Contractor responsible for all costs associated with corrective work and retesting resulting from failing field compaction tests.
8. Assure Owner has immediate access for quality assurance testing of all soils related work.
9. Ensure excavations are safe for testing personnel.
10. Maintain a log of failing tests, corrective action, and retesting.

C. Owner Testing:

1. As part of the Quality Assurance program, the Engineer will be performing quality assurance field compaction testing. If tests performed by the Engineer show that the material does not meet the specified compaction density and moisture requirements, the Contractor will be informed and corrective action required.
2. Refer to Specification Section 00900 for additional requirements.

END OF SECTION

SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation, trenching, backfilling and compacting for all underground utilities.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03002 - Concrete
 - 4. Section 02200 - Earthwork.
 - 5. Section 02284 – Precast Concrete Utility Structures.
 - 6. Section 02660 - Water Main Construction.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-lbf/ft³ (600 kN-m/m³)).
 - b. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - c. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

- A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
 - 4. Submit sieve analysis reports on all granular materials.
- B. Informational Submittals:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Trench shield (trench box) certification if employed:
 - a. Specific to Project conditions.
 - b. Re-certified if members become distressed.
 - c. Certification by registered professional structural engineer, registered in the state where the Project is located.
 - d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
 - 1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Material:
 - 1. As approved by Engineer.
 - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - b. Moisture content at time of placement: 3 PCT plus/minus of optimum moisture content as specified in accordance with ASTM D698.
- B. Subgrade Stabilization Materials: Provide subgrade stabilization material consisting of 1.5 IN minus crushed limestone.
 - 1. Flowable fill:
 - a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
 - b. Material characteristics:
 - 1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
 - a) Cement (Type I or II): 50 LBS.
 - b) Fly ash: 200 LBS.
 - c) Fine sand: 2,700 LBS.
 - d) Water: 420 LBS.
 - e) Air content: 10 PCT.
 - 2) Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.
 - 3) Approximate compressive strength should be 85 to 175 PSI.
 - 4) Fine sand shall be an evenly graded material having not less than 95 PCT passing the No. 4 sieve and not more than 5 PCT passing the No. 200 sieve.
 - 5) Mixing and handling of the material shall be in accordance with Specification Section 03002.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer to site provided by Owner.

3.2 EXCAVATION

- A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Geotechnical Engineer.
- B. Excavation for Appurtenances:
 - 1. 12 IN (minimum) clear distance between outer surface and embankment.

2. See Specification Section 02200 for applicable requirements.

C. Groundwater Dewatering:

1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
2. Groundwater shall be drawn down and maintained at least 1 FT below the bottom of any trench or manhole excavation prior to excavation.
3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation to include all items discussed in Section 2240, Groundwater Dewatering.

D. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility.
2. Open trench outside buildings, units, and structures:
 - a. No more than the distance between two manholes, structures, units, or 800 LF, whichever is less.
 - b. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
 - a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
 - a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
 - a. Trench size:
 - 1) Excavate width to accommodate free working space.
 - 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

- 3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
- 4) Keep trenches free of surface water runoff.
 - a) Include cost in Bid.
 - b) No separate payment for surface water runoff pumping will be made.

- E. Trenching for Electrical Installations:
 - 1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
 - 2. Modify for electrical installations as follows:
 - a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
 - b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
 - c. Do not over excavate trench.
 - d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
 - e. See Division 26 for additional requirements.
- F. Flowable Fill:
 - 1. Flowable fill shall be:
 - a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
 - b. Placed in 4 FT maximum lifts to the elevations indicated.
 - 1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
 - 2) Place flowable fill lifts in such a manner as to prevent flotation of the pipe.
 - 2. Flowable fill shall not be placed on frozen ground.
 - 3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
 - 4. Conform to appropriate requirements of Specification Section 02200.
 - 5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DEGF and rising.
 - 6. At the time of placement, flowable fill must have a temperature of at least 40 DEGF.
 - 7. Mixing and placing shall stop when the air temperature is 38 DEGF or less and falling.
 - 8. Each filling stage shall be as continuous an operation as is practicable.
 - 9. Prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
 - 10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

- A. Over-Excavation:
 - 1. Backfill and compact to 90 PCT of maximum dry density per ASTM D698.
 - 2. Backfill with granular bedding material as option.
- B. Rock Excavation:
 - 1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
 - 2. Backfill to grade with suitable earth or granular material.
 - 3. Form bell holes in trench bottom.
- C. Subgrade Stabilization:
 - 1. Stabilize the subgrade when directed by the Owner.
 - 2. Observe the following requirements when unstable trench bottom materials are encountered.
 - a. Notify Owner when unstable materials are encountered.
 - 1) Define by drawing station locations and limits.
 - b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
 - 1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

- A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

- B. Carefully Compacted Backfill:
 - 1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
 - 2. Comply with the following:
 - a. Place backfill in lifts not exceeding 8 IN (loose thickness).
 - b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
 - c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - d. Compact each lift to specified requirements.
- C. Common Trench Backfill:
 - 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
- D. Water flushing for consolidation is not permitted.
- E. Backfilling for Electrical Installations:
 - 1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
 - 2. Modify for electrical installation as follows:
 - a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

- A. General:
 - 1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
 - 2. In no case shall degree of compaction below minimum compactions specified be accepted.
- B. Compaction Requirements:
 - 1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
 - a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75 PCT relative density by ASTM D4253 and ASTM D4254

- b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95 PCT of maximum dry density by ASTM D698
	Cohesionless soils	75 PCT relative density by ASTM D4253 and ASTM D4254

c. Toe drain bedding and backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	60 PCT relative density by ASTM D4253 and ASTM D4254

d. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95 PCT of maximum dry density by ASTM D698
	Cohesionless soils	60 PCT of relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded, plant seeded, non-traffic areas	Cohesive soils	85 PCT of maximum dry density by ATM D698
	Cohesionless soils	40 PCT of relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests as directed in the Specifications.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Perform additional tests as directed until compaction meets or exceeds requirements.
4. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
5. Assure Owner has immediate access for testing of all soils related work.
6. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dewatering system.
 - 2. Surface water control system.
 - 3. Monitoring wells.
 - 4. System operation and maintenance.
 - 5. Water disposal.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02221 – Trenching, backfilling, and Compacting for Utilities.
 - 4. Section 02270 - Soil Erosion and Sediment Control.

1.2 DEFINITIONS

- A. Dewatering:
 - 1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering excavations, trenches and structures.
 - 2. Disposing of removed water.
- B. Surface Water Control: Removal of surface water within open excavations.
- C. Foundations:
 - 1. Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Dewatering plan design data and Drawings including the following:
 - a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.
 - b. Arrangement, locations, and depths of system components.
 - c. Pipe sizes and capacities.
 - d. Filter types and sizes.
 - e. Water disposal method and location.
 - f. Surface water control devices.
 - g. System operation, monitoring, and maintenance procedures.
 - h. Method of monitoring water quality.
 - i. Signed and sealed by Professional Engineer.
 - 3. Product technical data including:
 - a. Dewatering pump data including the following:
 - 1) Size, capacity, and means of operation of engine and motor.
 - b. Pumping equipment for control of surface water within excavation.

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

- A. Select dewatering equipment to meet specified performance requirements.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Erosion Control:
 - 1. See Specification Section 02270.
 - 2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
 - 3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
 - a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.
- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
 - 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 - 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 - 3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - c. All repairs to be made and paid for by Contractor.
 - 4. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

3.2 DEWATERING

- A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
- B. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
 - 1. Employ dewatering specialist for selecting and operating dewatering system.
 - 2. Groundwater shall be maintained at least 1 FT below the bottom of any excavation.
 - 3. Install groundwater monitoring wells as necessary.
 - 4. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
- C. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
 - 2. Discharge water into existing drainage channels.

3.3 SURFACE WATER CONTROL SYSTEMS

- A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Specification Section 02270.
- B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels, storm drains and settling basins in accordance with requirements of the agencies having jurisdiction.
- C. Control and remove unanticipated water seepage into excavation.

END OF SECTION

SECTION 02260

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Topsoiling and finished grading.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02110 - Site Clearing.
 - 4. Section 02200 - Earthwork.
 - 5. Section 02270 - Soil Erosion and Sediment Control.
 - 6. Section 02930 – Seeding and Mulching.
- C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Project Data: Test reports for furnished topsoil.

1.3 SITE CONDITIONS

- A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Original surface soil typical of the area.
 - 2. Existing topsoil stockpiled under Specification Section 02110.
 - 3. Friable, loamy soil capable of supporting native plant growth.

2.2 TOLERANCES

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Correct, Adjust and/or Repair Rough Graded Areas.
 - 1. Cut off mounds and ridges.
 - 2. Fill gullies and depressions.
 - 3. Perform other necessary repairs.
 - 4. Bring all sub-grades to specified contours, even and properly compacted.
- B. Loosen surface to depth of 2 IN, minimum.
- C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

- A. Reviewed by Engineer in Specification Section 02110.

3.3 PLACING TOPSOIL

- A. Do not place when subgrade is wet or frozen enough to cause clodding.
- B. Spread and lightly compact to a depth of 6 IN organic layer thickness for all disturbed earth areas.
- C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.
- D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- E. Provide finished surface smooth and true to required grades.
- F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

- A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.
- B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Soil erosion and sediment control.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02930 - Seeding and Mulching.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. NDEQ General NPDES Permit Number NER160000 for Storm Water Discharges from Construction Sites to Waters of the State of Nebraska.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Coir Log: See Drawings.
- B. Silt Fence: See Drawings.
- C. Rock Check Dam and Rock Berm: See Drawings.
- D. Pipe Entrance Stone Filter: See Drawings.
- E. Temporary Seeding: See Specification Section 02930.
- F. Storm Drain Inlet Protection: See Drawings.
- G. Construction Entrance: See Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. See Drawings for Storm Water Pollution Prevention Plan (SWPPP) and construction scheduling.
- B. Temporarily seed basin slopes and topsoil stockpiles per Specification Section 02930.

3.2 DURING CONSTRUCTION PERIOD

- A. Maintain Basins, Dikes, Traps, Stone Filters, Coir Logs, etc.:
 - 1. Inspect regularly especially after rainstorms.
 - 2. Repair or replace damaged or missing items.

- B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.
- C. Construct inlets as soon as possible.
 - 1. Excavate and tightly secure straw bales completely around inlets as detailed on Drawings.
- D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.
- E. Do not disturb existing vegetation (grass and trees).
- F. Excavate sediment out of basins and traps when capacity has been reduced by 50 PCT.
 - 1. Remove sediment from behind bales to prevent overtopping.
- G. Topsoil and Fine Grade Slopes and Swales, etc.: Seed and mulch as soon as areas become ready.

3.3 NEAR COMPLETION OF CONSTRUCTION

- A. Eliminate basins, dikes, traps, etc.
- B. Grade to finished or existing grades.
- C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Riprap for protection of slopes and drainage ways against erosion.
 - a. Outlet Channel.
 - b. Apron.
 - c. Low Flow Crossings.
 - d. Overflow Riprap Barrier.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 - Earthwork.
 - 4. Section 02270 - Soil Erosion and Sediment Control.
 - 5. Section 02778 - Geotextile.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T103, Soundness of Aggregates by Freezing and Thawing.
 - 2. ASTM International (ASTM):
 - a. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - b. C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - 3. Corps of Engineers (COE):
 - a. CRD-C100, Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing.
 - 4. Nebraska Department of Transportation (NDOT):
 - a. Standard Specifications for Highway Construction, 2017 Edition.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - 3. Certifications.
 - 4. Test reports.
 - 5. Submit all tests and certification in a single coordinated submittal.
 - a. Partial submittals will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Riprap:
 - 1. Durable broken quarry run stone.
 - 2. Does not disintegrate on exposure to water or weathering.

3. Free from structural fractures and defects.
 4. Not containing shale, unsound sandstone, or other material which will disintegrate.
 5. Graded within limits specified.
 6. Breadth and thickness of any stone: Not less than one-third of its length.
 7. Ensure that dirt and fines accumulated from interledge layers or from blasting or handling operation is less than 2 PCT by weight.
 8. Gradation of the material:
 - a. Angular and well-graded Nebraska Department of Transportation (NDOT) Type B Riprap.
- B. Geotextile Fabric: See Specification Section 02778.
- C. Crushed Rock: Meeting the requirements of NDOT Surfacing Aggregates.
1. Gradation of Material: See Drawings.

2.2 SOURCE QUALITY CONTROL

- A. Perform all tests at an approved independent laboratory.
- B. Obtain samples in conformance with COE CRD-C100.
- C. Source Tests:
1. Supply certified tests and service records to determine acceptability and application of stone materials.
 2. In event suitable test reports or a service record that is satisfactory are not available, as in case of newly operated sources, subject material to tests necessary to determine its acceptability for use.
 3. Tests to which materials to be subjected include:
 - a. Specific gravity.
 - b. Soundness in magnesium sulfate.
 - c. Soundness in freezing and thawing.
 - d. Such other tests as may be considered necessary to demonstrate satisfactorily that materials are acceptable including petrographic analysis, abrasion, absorption, and wetting and drying.
- D. Material Acceptability Tests:
1. Initial test: On material from each ledge sampled prior to start of construction.
 - a. Specific gravity.
 - b. Soundness in magnesium sulfate.
 - c. Soundness in freezing and thawing.
 2. Control tests:
 - a. Perform control tests including one specific gravity, one soundness in magnesium sulfate, and one soundness in freezing and thawing for each type of riprap material at the direction of the Engineer.
- E. Specific Gravity Test:
1. Conform with ASTM C127.
 2. Saturated surface-dry (SSD) bulk specific gravity not less than 2.55.
- F. Soundness in Magnesium Sulfate:
1. Conform with ASTM C88, except maintain samples immersed in solution at a temperature of 80 DEGF (26 DEGC) +2 DEGF.
 2. Not more than 8 PCT loss at five cycles.
- G. Soundness of Aggregates in Freezing and Thawing:
1. Conform with AASHTO T103 method as modified herein.
 2. Ensure loss at 12 cycles of not more than 10 PCT.
 3. Maintain temperature of cold liquid in range of -5 to 0 DEGF (-20 to -18 DEGC).
 4. Maintain thaw fluid temperature in range of 45 to 50 DEGF (7 to 10 DEGC).

5. Permit length of freezing and of thawing cycles of 2 HRS with 1 HR of freezing following by 1 HR of thawing.
6. Perform thawing by circulating thaw fluid around pan containing stone immersed in a depth of 1/4 IN rather than by total immersion.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Trim and dress all areas to required cross sections.
- B. Bring areas that are below allowable minus tolerance limit to grade by filling with material similar to adjacent material.
- C. Compact to density specified for backfill in accordance with Specification Section 02200.
- D. Do not place any riprap material on prepared base prior to inspection by Engineer.
- E. For channels, swales, outlet protection or other drainage protection areas, top of material at design edges shall match adjoining grade. Top of riprap shall match final design grades. Set grades to channel stormwater and not create a barrier.

3.2 PLACING

- A. Place riprap material on prepared foundation within limits indicated.
- B. Ensure final tolerance within 3 IN from indicated slope and grade lines.
- C. Place on prepared base to produce a well-graded mass of riprap with minimum percentage of voids.
- D. Place to required thickness and grades.
- E. Place to full thickness in a single operation to avoid displacing the underlying material.
- F. Begin placement at the bottom of the area to be covered and continued up slope.
- G. Do not drop riprap through air from a height greater than 3 FT.
- H. Distribute entire mass to conform to gradation specified.
 1. Do not place riprap by dumping into chutes or by similar method likely to cause segregation.
 2. Do not place riprap by dumping it at the top of the slope and pushing down the slope.
- I. Keep finished riprap free from objectionable pockets of small stones or clusters of larger stone.
 1. Hand place as necessary to obtain a well-graded distribution.
- J. Place riprap in conjunction with embankment construction to prevent mixture of embankment and stone revetment materials.
- K. Maintain riprap until accepted.
- L. Replace any displaced material to lines and grades shown.

END OF SECTION

SECTION 02284
PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast concrete utility structures, non-circular in plan, and appurtenant items.
 - a. Valve and meter vaults.
 - b. Energy Dissipater Structures.
 - 2. Design and fabrication of precast concrete utility structures.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 - Earthwork.
 - 4. Section 03002 - Concrete.
 - 5. Section 08305 - Access Doors.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C857, Standard Practice for Minimum Design Loading for Underground Precast Concrete Utility Structures.
 - b. C858, Standard Specification for Underground Precast Concrete Utility Structures.
 - c. C890, Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
 - d. C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Concrete mix design(s):
 - a. Include submittal information defined in Specification.
 - b. Certification in accordance with ASTM C858, Section 12.
 - 4. Fabrication and/or Layout Drawings:
 - a. Include detailed diagrams of utility structures showing typical components and dimensions, reinforcement, and other details.
 - b. Itemize, on separate schedule, elevations or sectional breakdown of each utility structure with all components and refer to Drawing Identification Number or notation.
 - c. Indicate required penetration details for all piping entering each structure.
 - 5. Drawings and calculations: All Drawings, including Layout Drawings, certifications and calculations shall be provided to engineer.
 - a. Provide certification stating that calculations provided have been prepared specifically for this Project and that they match and pertain to the Shop Drawings provided.

- b. Provide a summary document as part of the above certification listing the design criteria used for precast design including:
 - 1) Codes and standards.
 - 2) Soil load.
 - 3) Exterior groundwater load.
 - 4) Live loads.
 - 5) Other loads.
- 6. Test Reports:
 - a. Copies of source quality control tests, including compressive strength and air content, for units provided.

1.4 SITE CONDITIONS

- A. Design groundwater elevation for precast structure design shall be the 100-year flood elevation shown on the Contract Documents.
 - 1. If the 100-year flood elevation is not shown on the Contract Documents, the design groundwater elevation shall be equal to the ground surface elevation at the structure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Access doors:
 - a. Conform to requirements of Specification Section 08305.
 - 2. Premolded joint sealant:
 - a. NPC Bidco, Inc., C-56.
 - b. Ram-Nek, Henry Co.
 - c. EZ-Stik, Press-Seal Gasket Corp.
 - d. CS-102, Conseal.
 - 3. Elastomeric joint seals:
 - a. Kent Seal.
 - 4. External joint wrap.
 - a. NPC, Bidco, Inc.
 - b. EZ-Wrap, Press-Seal Gasket Corp.
 - c. RUBR-Nek, Henry Co.
 - 5. Emulsified fibrated asphalt compound:
 - a. Sonneborn Hydrocide 700B Semi-Mastic.

2.2 PRECAST UTILITY STRUCTURE COMPONENTS

- A. Provide utility structures with interior dimensions as shown on the Drawings.
- B. Provide the following components for each utility structure:
 - 1. Precast base section with integral or cast in place base slab.
 - 2. Precast wall section(s).
 - 3. Precast flat top.
 - a. Where reinforcement is shown for top slab, furnish slab with reinforcing as designed, but not less than reinforcing shown on Drawings.
- C. Provide openings and appurtenances as shown on Drawings.
 - 1. Access doors:
 - a. Cast access doors into top slab.
 - b. Where access door frames have drainage channels, cast PVC drain lines in top slab to drain location shown on Drawings. If no drain location is shown, drain frames to outer edge of top slab.
 - c. Protect doors and frames from damage during concrete placement and shipping.
 - d. See Specification Section 08305.

2. Manhole frames and covers: Cast frames into top slab.

D. Concrete:

1. Conform to requirements of Specification.
2. Conform to requirements of ASTM C858, where stricter than Specification.
 - a. Minimum 28-day compressive strength 4500 PSI.
 - b. All portions of precast utility structure are considered to be exposed to freeze-thaw cycles.

E. Joints:

1. Joints of precast riser and top sections:
 - a. Preformed flexible joint sealants: ASTM C990.
 - b. Exterior joint wrap.
2. Pipe and conduit entry for utility structures.
 - a. Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.

**SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE
FOR NEW CONSTRUCTION**

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I ⁽¹⁾	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I ⁽¹⁾	7 Not Req 7	C F I ⁽¹⁾	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H ⁽²⁾ I ⁽¹⁾	4 3 4	F H ⁽²⁾ I ⁽¹⁾	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I ⁽¹⁾	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I ⁽¹⁾	1 Not Req Not Req 1	F I ⁽¹⁾	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H ⁽²⁾	1 Not Req Not Req 1	C F H ⁽²⁾ I ⁽¹⁾	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req

Through exterior wall above grade	A B C	6 6 6	A B D H ⁽²⁾	5 5 Not Req 5	C H ⁽²⁾	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

F. Coatings:

1. Vertical wall surfaces:
 - a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type I for all vertical wall exterior surfaces.

2.3 DESIGN

A. General Design Requirements:

1. Design precast units and appurtenances in accordance with ASTM C858.
 - a. Notify Engineer and furnish cast-in-place structures if sizes of precast utility structures shown on Drawings cannot be designed or fabricated.

B. Design loads:

1. Design precast units for all loads and load cases described in ASTM C857, with the following values and selections:
 - a. Minimum uniform live load for exposed roof slabs shall be 150 PSF.
 - b. Wheel loads shall be considered.
 - 1) Use wheel load designation HS20 as shown in ASTM C857, Table 1.
 - 2) Wheel loads and uniform live load do not act concurrently.
 - c. Unit weight of soil W shall be taken as no less than 100 LB/CU FT.
 - d. Minimum lateral soil pressure coefficient (K_0): 0.50.

C. Specific Design Requirements:

1. Out-of-plane shear:
 - a. Out-of-plane shear shall be shown in the calculations.
 - b. Wall thickness shall be determined based on meeting design requirements for out-of-plane shear resulting from soil and groundwater loads.
 - c. Wall sections shall be designed as one-way spans between corners for calculation of out-of-plane shear. Transfer of shear or bending load shall not be considered to be transferred across joints between precast units or between walls and slabs, unless unit as integrally cast together.
 - d. Use of shear steel reinforcement to increase out-of-plane shear capacity shall be prohibited.
2. The distribution of moments in adjacent walls of different lengths in rectangular structures shall be considered.
3. Design precast units taking into account reduced cross section at openings and penetrations.
4. Structure shall be checked for buoyancy.
 - a. The minimum factor of safety for uplift with the design groundwater elevation shall be 1.25, unless a larger factor of safety is required by the local governing body or Building Code.
 - b. The minimum factor of safety for uplift at the fully submerged condition shall be no less than 1.0.

- c. If the buoyant weight of soil above base slab extensions beyond the external dimensions of the structure is used to resist uplift, the volume of soil considered to resist uplift shall be limited to soil within the vertical projection of the edge of the base slab extensions.

PART 3 - EXECUTION

3.1 PRECAST UTILITY STRUCTURE CONSTRUCTION

- A. General:
 - 1. Prepare subgrade for base as required by Specification Section 02221
 - a. For precast base slabs, place and compact 6 IN of Granular Fill or Bedding Material as shown on Drawings.
 - b. For cast-in-place concrete base slabs, support base section and prepare bottom joint with preformed strip-type hydrophilic waterstop in accordance with Specification.
 - c. Confirm that base is level and fully supported by stable material.
 - 2. For structures with open pipe flow, make inverts with non-shrink cement grout and conform with pipe radius.
 - 3. Ensure accurate vertical placement and leveling prior to placement of interior grout.
 - a. Provide vertical alignment tolerance of maximum 1 IN horizontal to 10 FT vertical.
- B. Build each structure to dimensions shown on plans and at such elevation that pipe sections built into wall of structure will be true line of pipe extensions.
- C. For all horizontal mating surfaces between precast concrete units, apply premolded flexible joint sealant to clean mating surfaces in accordance with sealant manufacturer's written instructions. Apply sufficient pressure to each concrete unit to seat unit in sealant.
- D. Seal all pipe penetrations in manhole.
 - 1. Where post-installed seals are permitted, form pipe openings smooth and well shaped.
 - 2. After installation, seal exterior of penetration with non-shrink grout.
 - 3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 IN to ensure complete seal.
- E. Set top slab level to elevation shown on Drawings.

3.2 FIELD QUALITY CONTROL

- A. Any proposed repairs of precast components or structures shall be submitted to Engineer for approval.
- B. Structures shall be observed for signs of leakage during periods of high groundwater.
- C. No leakage that includes visible flow through joints between precast concrete sections or through pipe penetrations shall be permitted.
- D. Damp spots on interior wall surfaces shall be considered leakage and shall not be permitted.
 - 1. Damp spots shall be defined as spots where moisture from a source outside the structure can be picked up on a dry hand.
 - 2. Locate the source of water movement through the wall and permanently seal.
- E. Dampness on the top of the base slab will not be construed as leakage.

END OF SECTION

SECTION 02423

STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Internal Berm and Swale Culverts.
 - 2. Road Ditch Drainage Control Culvert.
 - 3. Inline Water Level Control Structure Culvert.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 – Earthwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
 - b. M190, Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
 - 2. ASTM International (ASTM):
 - a. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - 3. Certifications.
 - 4. Test reports.
 - 5. Submit all tests and certification in a single coordinated submittal.
 - a. Partial submittals will not be accepted.
- B. Submit schedules and details for structures and joints.

1.4 WARRANTY

- A. Warrant that the infiltration will not exceed the amount specified in the Exfiltration Test paragraph in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section during the one (1) year correction period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Corrugated Metal Pipe (CMP):
 - 1. AASHTO M36 (ASTM A760), 16 GA.
 - 2. Bituminous coated: AASHTO M190, Type A.
 - 3. Jointing: Connecting bands of same base metal coated as pipe.

- B. CMP Joint Sealer:
 - 1. Cold applied asphalt joint compound.
 - 2. Preformed flexible pipe joint sealing compound.
- C. Gates:
 - 1. Flap Gate: See Contract Documents.
 - 2. Canal Gate: See Contract Documents.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with Specification Section 02200.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Comply with Specification Section 02200.

3.3 FIELD QUALITY CONTROL

- A. Verify and coordinate installation.

END OF SECTION

SECTION 02444

CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Chain link fencing and gates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03002 - Concrete.
 - 4. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - c. A824, Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain-Link Fence.
 - d. F552, Standard Terminology Relating to Chain Link Fencing.
 - e. F567, Standard Practice for Installation of Chain-Link Fence.
 - f. F626, Standard Specification for Fence Fittings.
 - g. F900, Standard Specification for Industrial and Commercial Steel Swing Gates.
 - h. F1043, Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
 - i. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
 - 2. American Welding Society (AWS).
 - 3. National Fire Protection Association (NFPA):
 - a. NFPA 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL).
- B. Qualifications:
 - 1. Installer bonded and licensed in the Project state.
 - 2. Installer shall have a minimum two (2) years experience installing similar fencing.
 - 3. Utilize only AWS certified welders.
 - 4. Electric gate operators to be UL listed.
 - 5. Grounding by an electrician licensed in Project state.

1.3 DEFINITIONS

- A. See ASTM F552.
- B. NPS: Nominal pipe size, in inches.
- C. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
 - 4. Mill certificates.
 - 5. Source quality control test results.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Chain Link Fabric:
 - 1. Fabric type:
 - a. ASTM A392 zinc-coated steel:
 - 1) Coated before weaving, 2.0 OZ/SF.
 - 2. Wire gage: 9.
 - 3. Mesh size: 2 IN.
 - 4. Selvage treatment:
 - a. Top: Knuckled.
 - b. Bottom: Knuckled.
- B. Concrete: See Specification Section 03002, Concrete.
- C. Line Post:
 - 1. ASTM F1083 pipe: Schedule 40, NPS 2.
- D. Corner or Terminal Posts:
 - 1. ASTM F1083 pipe: Schedule 80, NPS 2-1/2.
- E. Brace and Rails:
 - 1. ASTM F1083 pipe: Schedule 40, NPS 1-1/4.
- F. Tension Wire:
 - 1. Top and bottom of fabric: ASTM A824, galvanized steel, Class 3.
- G. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods):
 - 1. ASTM F626.
- H. Swing Gate:
 - 1. ASTM F900.
 - 2. Materials as specified for fence framework and fabric.
 - 3. Hardware:
 - a. Galvanized per ASTM A153/A153M.
 - b. Hinges to permit 90 DEG in and out gate opening.

2.2 SOURCE QUALITY CONTROL

- A. Test related fence construction materials to meet the following standards:
 - 1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with:
 - 1. Manufacturer's instructions.
 - 2. Lines and grades shown on Drawings.
 - 3. ASTM F567.
- B. Do not start fence installation before final grading is complete and finish elevations are established.
- C. Drill holes in firm, undisturbed or compacted soil in cured structure.
- D. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.
 - 1. Correct minor irregularities in earth to maintain maximum clearance.
- E. Space line posts at equal intervals not exceeding 10 FT OC or per Drawings.
- F. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.
- G. Install tension bars full height of fabric.
- H. Rails:
 - 1. Fit rails with expansion couplings of outside sleeve type.
 - 2. Rails continuous for outside sleeve type for full length of fence.
- I. Provide expansion couplings in top rails at not more than 20 FT intervals.
- J. Anchor top rails to main posts with appropriate wrought or malleable fittings.
- K. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts.
 - 1. Locate compression members at mid-height of fabric.
 - 2. Extend diagonal tension members from compression members to bases of posts.
 - 3. Install so that posts are plumb when under correct tension.
- L. Pull fabric taut and secure to posts and rails.
 - 1. Secure so that fabric remains in tension after pulling force is released.
 - 2. Secure to posts at not over 15 IN OC, and to rails at not over 24 IN OC, and to tension wire at not over 24 IN OC.
 - 3. Use U-shaped wire conforming to diameter of pipe to which attached, clasp pipe and fabric firmly with ends twisted at least two (2) full turns.
 - 4. Bend ends of wire to minimize hazards to persons or clothing.
- M. Install post top at each post.
- N. Gates:
 - 1. Construct with fittings or by welding.
 - 2. Provide rigid, weatherproof joints.
 - 3. Assure right, non-sagging, non-twisting gate.
 - 4. Coat welds with rust preventive paint, color to match pipe.
- O. Install electric gate operator in accordance with NFPA 70.

END OF SECTION

SECTION 02512

SUBSURFACE DRAIN SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Subsurface drain systems.
 - a. Subdrain system.
 - b. Toe drain system.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 - Earthwork.
 - 4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M278, Standard Specification for Class PS46 Polyvinyl Chloride (PVC) Pipe.
 - b. M294, Standard Specification for Corrugated Polyethylene Pipe, 12 to 60 IN Diameter.
 - 2. ASTM International (ASTM):
 - a. A702, Standard Specification for Steel Fence Posts, Hot Wrought.
 - b. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - c. D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - d. D6707, Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.
 - e. F667, Standard Specification for 3 through 24 IN Corrugated Polyethylene Pipe and Fittings.

1.3 SYSTEM DESCRIPTION

- A. Subdrain System:
 - 1. System of subdrains next to foundation walls which drains by gravity and connects into sight wells as shown on Drawings.
- B. Toe Drain System:
 - 1. System next to berms which drains by gravity and connects to and drains into sight wells as shown on Drawings.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Fabrication and/or Layout Drawings:
 - a. Layout diagram of drainage system(s).
 - b. Sight wells.
 - 3. Written installation plan including:
 - a. Equipment proposed for installation of each system.
 - b. Method of installation proposed for each system.
 - c. Backfill placement procedures for each system.
 - d. Inspection and acceptance procedures for each system.

4. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Type, size and manufacturer of drain pipe.
 - d. Type, size and gradation of filter material.
 - e. Type and manufacturer of filter fabric.
 - f. Type, size, and manufacturer of sight wells.
5. Certifications.
6. Test Report.
 - a. Grain-size distribution reports.
 - b. Video inspection reports.

PART 2 - PRODUCTS

2.1 DRAIN PIPE

- A. Drain Pipe:
 1. Inside diameter: 6 IN.
 2. Provide fittings so that thickness, weight, material and quality correspond to that of the drain pipe approved for use.
 - a. Toe drain pipe, HDPE:
 - 1) ASTM F667.
 - 2) Perforations in accordance with AASHTO M294, Class 2.
 - b. Subdrain pipe, PVC:
 - 1) ASTM D3034, SDR 35.
 - 2) Slotted pipe with a maximum slot width of 0.05 IN and a minimum slot width of 0.031 IN. The length of individual slots shall not exceed 10 PCT of the pipe diameter. Rows of slots shall be symmetrically spaced so that they are fully contained in two quadrants of the pipe. The wall inlet shall be a minimum of 0.5 SQIN/LF of pipe.
 - c. Subdrain outlet. See Contract Documents.
- B. Subdrain Filter Material: Graded gravel or crushed stone meeting the following sieve analysis:

COARSE FILTER SAND	
SIEVE SIZE	PERCENT PASSING
2 IN	100
1/2 IN	35 to 100
#4	10 to 50
#10	8 to 10
#200	0 to 5

FINE FILTER SAND	
SIEVE SIZE	PERCENT PASSING
2 IN	100
1/2 IN	80 to 100
#4	65 to 95
#10	45 to 75
#30	15 to 60
#200	0 to 5

- C. Toe Drain Filter Sock:
 1. ASTM D6707 Type A.
 2. Resistant to the chemical actions of the soil and water and non-biodegradable.

3. Fabric to prevent the migration of soil particles into the filter material while allowing the free flow of water from the subsoil to the drain pipe.
- D. Rodent Guard. See Contract Documents.
- E. Sight Well for Toe Drain: See Contract Documents.
- F. Sight Well for Subdrain: See Contract Documents.
- G. Marker Posts:
1. ASTM A702.
 2. Steel, tee-style fence posts, with reflective top, minimum length 6.5 FT.
 3. Install such that 4 FT remains exposed above ground.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Subdrain System.
1. Lay drain pipe lines firmly bedded in fine filter material to true grades and alignment with invert elevation shown on Drawings.
 - a. Unless indicated otherwise on Drawings, install pipes level to point of discharge with perforations down and joints closed.
 - b. Make joints with sleeve type couplings or tapered couplings.
 - c. Provide couplings suitable for holding pipe firmly in alignment without use of sealing compounds or gaskets.
 - d. Face bells upgrade away from point of discharge.
 - e. Use 1/8 bends for change in direction; use Y fittings at intersections.
 - f. Terminate with cap ends.
 2. Test subdrain pipe with water to assure free flow before covering.
 - a. Remove obstructions and retest until satisfactory.
 3. Provide Fine Filter Sand around drain pipes of depths and thicknesses shown on Drawings.
 - a. Compact filter material with vibrator tamper to density necessary to preclude settlement and to avoid damage to drain pipe.
 - b. Avoid damage to foundation.
 4. Install standard pipe (non-slotted) to sight well.
- B. Toe Drain System.
1. Lay toe drain pipe fitted with filter sock with chain-type trencher, plow, or other suitable means, such that the top of the pipe is a minimum of 1 FT into sand layer, with a 4 FT minimum depth.
 - a. Depth to top of sand layer will be provided by Engineer from measurements in adjacent observation trench excavated for the respective berm.
 - b. Dewater excavations, as necessary, to facilitate construction. See Section 02200 – Earthwork.
 - c. Unless indicated otherwise on Drawings, install pipes level to point of discharge with perforations down and joints closed.
 - d. Make joints with sleeve type couplings or tapered couplings.
 - e. Provide couplings suitable for holding pipe firmly in alignment without use of sealing compounds or gaskets.
 2. Backfill with Coarse Filter Sand to a thickness of 1 FT over the pipe, Fine Filter Sand to a depth of 0.5 FT below grade, and topsoil to the ground surface immediately following pipe installation, where installation procedure results in a void over the top of the pipe.
 - a. Compact to density necessary to preclude settlement and avoid damage to drain pipe and to filter sock.
 3. Install non-perforated pipe to sight well.

3.2 VIDEO INSPECTION

- A. General:
 - 1. Video inspection shall be performed on the first 3 toe drain system installations after placement of backfill.
 - 2. The toe drain shall be reconstructed if the pipe is found to be damaged, not properly constructed, or not functioning.
 - 3. Any blockage shall be flushed to allow complete video inspection of the pipe.
 - 4. Video inspection shall continue until 3 consecutive toe drain system installations are found to be properly constructed, undamaged, and free of obstructions.
- B. Video Camera Requirements:
 - 1. The video camera will be high-resolution color with adjustable iris focus.
 - 2. The camera shall have pan and tilt capabilities.
 - 3. Lighting will be suitable to allow proper illumination and a clear video image of the entire periphery of the pipe.
 - 4. The video camera will be operative in 100 PCT humidity conditions.
 - 5. The video camera and other video components of the video system will produce a high quality video image.
 - 6. The video inspection equipment shall be capable of displaying on-screen footage distance measured.
 - a. The distance measured shall be accurate within 1 PCT.
 - 7. The inspection shall be recorded in color on a standard compact disc.
- C. Inspection Procedure:
 - 1. The inspection shall begin at one end of the project and will continue in the same direction until the inspection is complete.
 - 2. The video inspection rate shall not exceed a rate of 30 FT per minute.
 - 3. Dewatering equipment, shall be utilized, if necessary, to maintain the ground water level below the pipe invert.
- D. Inspection Reporting:
 - 1. Provide Engineer a copy of the video inspection, recorded in color on compact disc.
 - a. The video recording shall include on screen, continuous footages, pipe diameter, direction of viewing, and structure location.
 - 2. Provide Engineer a written report of each inspection.

3.3 FIELD QUALITY CONTROL

- A. Contractor Testing:
 - 1. Grain-Size distribution report in accordance with ASTM C136 for all filter material to verify compliance with Specifications.
 - a. Frequency of 1 test per 2,000 CY.

END OF SECTION

SECTION 02660

WATER MAIN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coordination and interface with existing facilities and utilities.
 - 2. Connections to existing water mains.
 - 3. Testing, flushing and disinfection.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02260 - Topsoiling and Finished Grading.
 - 4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 5. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Water Work Association (AWWA):
 - a. B300, Standard for Hypochlorites.
 - b. B301, Standard for Liquid Chlorine.
 - c. C651, Standard for Disinfecting Water Mains.

1.3 SUBMITTALS

- A. Submit results of the leakage tests, identifying the specific length of pipe tested, the test pressure, the duration of test and the amount of leakage.
- B. Submit satisfactory bacteriological test reports on disinfection requirements.
- C. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01300 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe: Refer to Specification Section 15060.
- B. In-Line Valves:
 - 1. Provide adjustable valve boxes.
 - a. Include price of valve boxes in price of valve installed complete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water main to the line and grade on the Drawings.
 - 1. Water mains to be staked at a minimum 100 FT interval with depth of cuts monitored.
- B. Field verify depth of utilities that will be crossed.
 - 1. Adjust water main elevation as required during construction.

2. No separate payment will be made for field verification or adjustment of main depths as required.
- C. Contractor will restore all existing structures or services damaged by Contractor's operations at no cost to Owner.

3.2 UNDERGROUND SERVICES

- A. Notify utility representative prior to construction to obtain available information on location of existing utilities.
 1. Contractor shall be responsible for locating all utilities.

3.3 GRAVEL SURFACED DRIVES AND ROADWAYS

- A. Restore all damaged gravel surfaced drives and roadways to a condition equal to or better than original.
 1. Payment to be at bid unit price for this item.
 2. Replacement gravel gradation.

3.4 PROTECTION OF EXISTING UTILITIES

- A. Contractor to verify the location of all underground utilities.
 1. Omission from, or the inclusion of utility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground utilities.
- B. A representative of the underground utilities shall be notified 24 HRS in advance of crossings.

3.5 CONNECTIONS TO EXISTING WATER MAINS

- A. Make connections to existing water mains as shown on Drawings, by attaching to existing or changed fitting.
 1. Cost for making connections shall include cost of all fittings including flexible couplings, and shall be included in the bid unit price of the water main.
- B. Where the connection is made to an existing water main which can be adequately isolated from the distribution system, it shall be termed a "dry connection."
- C. Contractor is responsible for controlling and disposing of water in the trench at no additional cost to the Owner.

3.6 TREES

- A. Do not remove trees without written instructions from the Engineer unless tree removal is shown on drawings.
 1. No separate payment will be made for tree removal and the cost shall be included in the bid unit price for transmission main.

3.7 FENCES, SIGNS, MAILBOXES, ETC.

- A. Restore all damaged fences, signs, mailboxes, etc., to their original conditions.
 1. No separate payment will be made for these items.

3.8 FIELD QUALITY CONTROL

- A. Sealing, Flushing, and Disinfection of Potable Water Systems:
 1. Maintain interior of all pipes, fittings and other accessories free from dirt and foreign material at all times.
 - a. If, in the opinion of the Engineer, the pipe contains dirt that will not be removed by flushing, the pipe interior shall be cleaned and swabbed with bactericidal solution.
 - b. At close of day's work or whenever workmen are absent from jobsite, plug, cap or otherwise provide watertight seal from open ends of pipe to prevent ingress of foreign material.
 - c. If water is in trench, seal shall remain in place until trench is pumped dry.

2. After favorable performance of pressure test and prior to final acceptance, thoroughly flush the entire potable water piping system and perform disinfection as prescribed.
 - a. Perform all work including preventative measures during construction in full compliance to AWWA C651.
3. Flush each segment of the system to provide a flushing velocity of not less than 2.5 FT per second.
4. Drain flushing water to location approved by the Owner.
5. Perform disinfection using one of the following forms:
 - a. Application of chlorine gas-water mixture by means of solution-feed chlorinating device.
 - 1) Liquid chlorine shall comply with AWWA B301.
 - b. Application of calcium hypochlorite, or sodium hypochlorite.
 - 1) Chlorine compounds shall comply with AWWA B300.
6. Disinfect pipe with chlorinated water as per AWWA C651.
 - a. Method of application of chlorine shall be by continuous feed method or slug method.
 - b. During disinfection procedure, ensure that initial and residual chlorine concentrations meet AWWA C651 requirements by testing by an approved method as directed by the Owner.
 - c. Cost of testing shall be included in the Bid Unit Price for water mains and no separate payment will be made for this item.
7. Tag the system during the disinfection procedure.
8. Following disinfection for required contact period, neutralize chlorine residual in water by treating with reducing agent.
 - a. Refer to AWWA C651.
 - b. Flush all treated water from pipeline at its extremities until replacement water throughout pipe, upon test is proved comparable in quality to water in existing system.
 - c. Take two (2) samples to test for bacteriological quality as directed by Engineer.
 - d. Repeat disinfection procedure until two (2) satisfactory results are obtained.
 - e. Quality of water delivered by the new water main to remain satisfactory for a minimum period of two (2) days.
9. Secure satisfactory bacteriological reports on samples from the system.
 - a. Ensure all sampling and testing procedures are in full compliance to AWWA C651, and applicable requirements of the State of Nebraska.
 - 1) No separate payment will be made for this item.
10. The Owner will provide the water required to fill the main initially and will pay for the water required to flush the main once.
 - a. Filling and flushing shall be performed during periods of low usage, between the hours of midnight and 4:00 AM.
 - b. Flushing water will be based on a maximum of 8 HRS total.
 - c. Any additional refilling or refushing to be at the Contractor's expense at the City's commercial water rates.

END OF SECTION

SECTION 02778

GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Woven and Non-woven geotextile material.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02200 - Earthwork.
 - 4. Section 02271 – Riprap.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway Transportation Officials (AASHTO):
 - a. M288, Standard Specification for Geotextile Specification for Highway Applications.
 - 2. ASTM International (ASTM):
 - a. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- B. Qualifications:
 - 1. Each manufacturing, fabricating firm shall demonstrate five (5) years continuous experience, including a minimum of 10,000,000 SQ FT of geotextile installation in the past three (3) years.
 - 2. Installing firm shall demonstrate that the site Superintendent or Foreman has had responsible charge for installation of a minimum of 1,000,000 SQ FT of geotextile.
 - 3. Installer shall attend pre-installation conference.

1.3 DEFINITIONS

- A. Manufacturer: Manufacturer producing geotextile sheets from resin and additives.
- B. Installer: The Installers are the individuals actually performing the hands-on work in the field.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Manufacturer's documentation that raw materials and roll materials comply with required geotextile physical properties.
 - 3. Manufacturer and Installer quality control manuals.
 - 4. Original test results for resins, roll material and factory seam tests at frequency specified in respective quality control manuals.
 - a. Results shall include or bracket the rolls delivered for use in the Work.
 - 5. Geotextile layout plan with proposed size, number, position and sequencing of geotextile rolls and direction of all field seams.
 - 6. Proposed details of anchoring and overlapping if different than included in Contract Documents.
- B. Informational Submittals:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.

2. Submit written certification that:
 - a. The geotextile delivered to site meets the requirements of this Specification.
 - b. The geotextile was received and accepted in undamaged condition from shipper.
 - c. The subgrade has been properly prepared and acceptable for the placement of the geotextile.
 - d. The geotextile was installed in accordance with this Specification and with the approved Shop Drawings.
 - e. The drainage composite or granular base course on top of the geotextile was placed.
3. For needle punched geotextiles, the manufacturer shall certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers.
4. Qualification documentation specified in the QUALITY ASSURANCE Article in PART 1 of this Specification Section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Label, handle, and store geotextiles in accordance with ASTM D4873 and as specified herein.
- B. Wrap each roll in an opaque and waterproof layer of plastic during shipment and storage.
 1. Do not remove the plastic wrapping until deployment.
- C. Label each roll with the manufacturer's name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight).
- D. Repair or replace geotextile or plastic wrapping damaged as a result of storage or handling, as directed.
- E. Do not expose geotextile to temperatures in excess of 160 DEGF or less than 32 DEGF unless recommended by the manufacturer.
- F. Do not use hooks, tongs or other sharp instruments for handling geotextile.
 1. Do not lift rolls lifted by use of cables or chains in contact with the geotextile.
 2. Do not drag geotextile along the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Geotextile under Riprap:
 1. Geotextile shall meet the requirements of AASHTO M288 Class 1 (non-woven) with a maximum apparent opening size equal to #60 and a minimum permittivity of 0.2 sec^{-1} for use as a riprap underlay where shown on the Drawings.
- B. Geotextile under Maintenance Road:
 1. Geotextile shall meet the requirements of AASHTO M288 Class 2 (woven) with a maximum apparent opening size equal to #30 and minimum permittivity of 0.02 sec^{-1} .

PART 3 - EXECUTION

3.1 PREPARATION

- A. Construct the surface underlying the geotextiles smooth and free of ruts or protrusions which could damage the geotextiles.

3.2 INSTALLATION

- A. Install geotextiles in accordance with manufacturer's written recommendations.
- B. Hand Place Geotextile:
 1. No equipment will be permitted to traffic in direct contact with the geotextile.
- C. Lay geotextile smooth so as to be free of tensile stresses, folds, and wrinkles.

- D. Place geotextile under rip rap perpendicular to the direction of flow and shingled in the down-gradient direction.
- E. Overlap seams in accordance with manufacturer's recommendations and a minimum of 2 FT.
- F. Backfill anchor trenches in accordance with Specification Section 02200.
- G. Place cover soil in accordance with Specification Section 02200.
- H. Protect geotextiles from clogging, tears, and other damage during installation.
- I. Geotextile Repair:
 - 1. Repair in accordance with manufacturer's written recommendations.
 - 2. Replace geotextile which cannot be repaired.
- J. Use adequate ballast (e.g., sand bags) to prevent uplift by wind.
- K. Do not use staples or pins to hold the geotextile in place.
- L. Do not leave geotextile uncovered for more than 14 days.

END OF SECTION

SECTION 02930

SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding, sodding and landscape planting:
 - a. Soil preparation.
 - b. Mulching.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02260 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. AOAC International (AOAC).
 - 2. ASTM International (ASTM):
 - a. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.
- B. Quality Control:
 - 1. Fertilizer:
 - a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
 - b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
 - c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
 - d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
 - e. Source and location of plants, and plant material, as per Paragraph 3.1 and Paragraph 3.2.
 - 3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.
- B. Informational Submittals:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

- A. Installation Schedule:
 - 1. Provide schedule showing when seeding and other plant materials are anticipated to be planted.
 - 2. Indicate planting schedules in relation to schedule for finish grading and topsoiling.
 - 3. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.
- B. Pre-installation Meeting:
 - 1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND SUPPLIERS

- A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

- A. Native Grass Seeding: Certified seed of locally adapted strains.
- B. Temporary Grass Seed: Annual Ryegrass.
- C. Asphalt Binder: Emulsified asphalt per State Specifications.
- D. Water:
 - 1. Water free from substances harmful to grass or sod growth.
 - 2. Provide water from source approved prior to use.
- E. Mulch:
 - 1. Straw mulch shall consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in Section 7. The mulch material shall be air-dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The Contractor shall provide a method satisfactory to the contracting officer for determining weight of mulch furnished.
 - 2. Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh, are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. General:
 - 1. Limit preparation to areas which will be planted soon after.
 - 2. Provide facilities to protect and safeguard all persons on or about premises.
 - 3. Protect existing trees designated to remain.
 - 4. Verify location and existence of all underground utilities.
 - a. Take necessary precaution to protect existing utilities from damage due to construction activity.
 - b. Repair all damages to utility items at sole expense.
 - 5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
 - a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

- B. Preparation for Seeding:
1. Loosen surface to minimum depth of 4 IN.
 2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
 3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
 4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
 5. Distribute fertilizer uniformly over areas to be seeded:
 - a. For mesic area seeding: 200 LBS per acre.
 6. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.
 7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
 8. Grade a smooth, even surface with a loose, uniformly fine texture.
 - a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - b. Limit fine grading to areas which can be planted soon after preparation.
 9. Restore grassed areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.
- C. Local Seed Mix
1. Mesic Seed Mixture Wetland-Prairie Mix provided by Miller Seed or Approved Equal. Apply at a rate of 16 LBS/Acres. Broadcast or drilled seeding method acceptable.

COMMON NAME	Percent of Seed Mix
Water Plantain	2.68
Swamp Milkweed	4.46
Nodding Bur Marigold	0.71
Canada Bluejoint	0.09
Bristly Sedge	0.45
Canada Anemone	0.18
Franks Sedge	6.25
Nebraska Sedge	7.14
Awl Fruited Sedge	0.45
Tussock Sedge	0.02
Fox Sedge	17.85
Spike Rush	1.79
Soft Stem Bulrush	0.71
Rice Cutgrass	1.79
Dark Green Bulrush	8.93
Prairie Cord Grass	6.25
Cardinal Flower	0.18
Monkeyflower	0.09
New England Aster	0.18

Blue Vervain	0.36
Great Blue Lobella	0.18
Hard Stem Bulrush	0.09
Riverbank Wildrye	17.85
Virginia Wildrye	17.85
Blue Flag Iris	0.09
Hop Sedge	0.36
Giant Bur Reed	0.18
Fowl Mannagrass	0.18
Arrowhead	2.68

2. Upland Seed Mixture: Seed mixture B: Native Mix #1 supplied by Miller Seed Company or Approved Equal. Apply at a rate of 8 LBS/Acre. Drilled seeding method. Broadcast method is not acceptable.

COMMON NAME (BOTANICAL NAME)	LBS PLS PER ACRE
Big bluestem(Andropogon gerardi)	2.4
Indian grass(Sorghastrum nutans)	1.2
Little bluestem 'Blaze' (Andropogon scoparius 'Blaze')	1.4
Sideoats grama(Bouteloua curtipendula)	0.8
Switchgrass(Panicum virgatum)	1.0
Western wheatgrass(Agropyron smithii)	1.5

3.2 INSTALLATION

A. Seeding:

1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area at rate of application not less than 50 PCT sown in one direction, remainder at right angles to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
 - a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
 - a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.

8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
 - a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface.

3.3 MULCHING

A. General:

1. The rate, amount, and kind of mulching or mesh shall be as specified below. Mulches shall be applied uniformly to the designated areas. They shall be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material shall be stabilized within 24 HRS of application using a mulch crimper or equivalent anchoring tool. When the mulch crimper or equivalent anchoring tool is used, it shall have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it shall be operated on the contour. Hand methods shall be used where equipment cannot safely operate to perform the work required.
2. Mulching: Area to be mulched will be the same as seeded.
3. Mulching operations will be completed after the grass seeding operation.
4. Hay mulch shall be free of noxious weed seeds and other invasive pests and shall consist of native prairie, weeping lovegrass, introduced bluestem, or fescue. Hay mulch should have been harvested at a time when stems are available.
5. Mulch shall be applied in a reasonably continuous unbroken cover of uniform thickness at a rate of not less than 1 LBS/SY (approximately 2 1/2 tons/acre). Area of coverage shall be a minimum of 80 PCT of the soil surface covered.
6. Anchoring will be performed immediately after application and will be accomplished by using a straight serrated disc machine (similar to the Imco landscape Soil Erosion Mulch Tiller) with discs spaced not more than 8 IN apart, weighted to press the mulch into the soil. Operation of the mulch anchoring machine on slopes is to be on the approximate contour whenever possible. The operation shall be such that approximately 50 PCT of the mulch material remains on the soil surface after anchoring.

3.4 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
 - a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
 - b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded Areas:

1. Maintain seeded areas: 90 days, minimum, after installation and review of entire project area to be planted.
2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
3. Engineer will review seeded area after installation for initial acceptance.
4. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
 - a. Anchor as required to prevent displacement.

5. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
6. Replant bare areas using same materials specified.
7. Engineer will review final acceptability of installed areas at end of maintenance period.
8. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION



DIVISION 03

CONCRETE



SECTION 03002

CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cast-in-place concrete and grout.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03151 - Anchorage to Concrete.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 117, Specification for Tolerances for Concrete Construction and Materials.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - c. 212.3R, Chemical Admixtures for Concrete.
 - d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - e. 304.2R, Placing Concrete by Pumping Methods.
 - f. 305.1, Hot Weather Concreting.
 - g. 306.1, Cold Weather Concreting.
 - h. 318, Building Code Requirements for Structural Concrete.
 - i. 347, Guide to Formwork for Concrete.
 - j. CT-13, Concrete Terminology.
 - 2. ASTM International (ASTM):
 - a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - d. A1064, Standard Specification for Steel Wire and Welded Wire Replacement, Plain and Deformed, for Concrete.
 - e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - f. C33, Standard Specification for Concrete Aggregates.
 - g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - h. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
 - k. C150, Standard Specification for Portland Cement.
 - l. C172, Standard Practice for Sampling Freshly Mixed Concrete.
 - m. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - n. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - o. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - p. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - q. C494, Standard Specification for Chemical Admixtures for Concrete.

- r. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - s. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
 - t. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - u. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - v. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - w. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - x. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - y. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - z. E96, Standard Test Methods for Water Vapor Transmission of Materials.
 - aa. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- 3. Corps of Engineers (COE):
 - a. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
 - 4. National Ready Mixed Concrete Association (NRMCA).
- B. Quality Control:
- 1. Concrete testing agency:
 - a. Contractor to employ and pay for services of a testing laboratory to:
 - 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - b. Concrete testing agency to meet requirements of ASTM E329.
 - 2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
 - 3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
 - 4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
- C. Qualifications:
- 1. Ready mixed concrete batch plant certified by NRMCA.
 - 2. Formwork and shoring for slabs except where cast on ground to be designed by a Professional Engineer currently registered in the State of Nebraska.

1.3 DEFINITIONS

- A. Per ACI CT-13 except as modified herein:
- 1. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
 - 2. Exposed concrete: Exposed to view after construction is complete.
 - 3. Indicated: Indicated by Contract Documents.
 - 4. Non-exposed concrete: Not exposed to view after construction is complete.
 - 5. Required: Required by Contract Documents.
 - 6. Specified strength: Specified compressive strength at 28 days.
 - 7. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
2. Concrete mix designs proposed for use.
 - a. Concrete mix design submittal to include the following information:
 - 1) Sieve analysis and source of fine and coarse aggregates.
 - 2) Test for aggregate organic impurities.
 - 3) Test for deleterious aggregate per ASTM C1293.
 - 4) Proportioning of all materials.
 - 5) Type of cement with mill certificate for cement.
 - 6) Type of fly ash with certificate of conformance to specification requirements.
 - 7) Slump.
 - 8) Air content.
 - 9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - 10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturers and types:
 - 1) Joint fillers.
 - 2) Curing agents.
 - 3) Chemical sealer.
 - 4) Bonding and patching mortar.
 - 5) Construction joint bonding adhesive.
 - 6) Non-shrink grout with cure/seal compound.
 - 7) Waterstops.
 - 8) Proposed form release material.
 - 9) Void forms including compressive strength.
4. Reinforcing steel:
 - a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
 - b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
 - c. Obtain approval of Shop Drawings by Engineer before fabrication.
 - d. ICC reports for manufactured mechanical splice and adhesive anchor.
 - e. Manufacturer and type of proprietary reinforcing mechanical splices.
 - f. Locations where proprietary reinforcing mechanical splices are required or proposed for use.
 - g. Mill certificates.
5. Scaled (minimum 1/8 IN/FT) Drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint dimensions.
6. Strength test results of in place concrete including slump, air content and concrete temperature.
7. Certifications:
 - a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
 - b. Certification that the material and sources submitted in the mix design will be used in the concrete for this project.
8. Test reports:
 - a. Cement mill reports for all cement to be supplied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage of Material:
 - 1. Cement and pozzolan:
 - a. Store in moisture proof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
 - 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 IN of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
 - 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
 - 4. Reinforcing steel: Support and store all rebars above ground.
- B. Delivery:
 - 1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to Engineer at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Time of delivery.
 - 7) Time of discharge.
 - 8) Numerical sequence of the delivery.
 - 9) Amount of water that may be added at the site without exceeding the specified water/cement ratio.
 - 10) Amount of water added.
 - 2. Reinforcing steel:
 - a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
 - b. Mark numbers to match Shop Drawing mark number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - 1. Non-shrink, non-metallic grout:
 - a. Sika "SikaGrout 212."
 - b. Euclid Chemical "NS Grout."
 - c. BASF Admixtures, Inc. "Masterflow 713."
 - 2. Epoxy grout:
 - a. BASF Admixtures, Inc. "Brutem MPG."
 - b. Euclid Chemical Company, "E3-G."
 - c. Fosroc, "Conbextra EPHF".
 - 3. Waterstops, Preformed - Strip-Type:
 - a. Greenstreak (Hydrotite).
 - b. Adeka Ultra Seal (2010MN).
 - c. DeNeef (Swellseal Plus).

4. Waterstops, PVC:
 - a. Greenstreak Plastic Products, Inc.
 - b. W R Meadows.
 - c. Vinylex Corporation.
5. Reinforcing mechanical splices:
 - a. Lenton Rebar Splicing by Erico, Inc.
 - b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
 - c. Bar-Grip Systems by Barsplice Products, Inc.
6. Void forms:
 - a. SureVoid Products, Inc.
 - b. Deslauriers, Inc.
7. Form coating:
 - a. Richmond "Rich Cote."
 - b. Industrial Lubricants "Nox-Crete Form Coating."
 - c. Euclid Chemical "Kurez DR VOX."
8. Bonding agent:
 - a. Euclid Chemical Co.
 - b. BASF Admixtures, Inc.
 - c. L&M Construction Chemicals Inc.

2.2 MATERIALS

- A. Portland Cement: Conform to ASTM C150 Type II.
- B. Fly Ash:
 1. ASTM C618, Class F.
 2. Non-staining.
 - a. Hardened concrete containing fly ash to be uniform light gray color.
 3. Maximum loss on ignition: 6 PCT.
 4. Compatible with other concrete ingredients.
 5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
- C. Admixtures:
 1. Air entraining admixtures: ASTM C260.
 2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
 - a. 0.10 All concrete.
 4. Do not use calcium chloride.
 5. Pozzolanic admixtures: ASTM C618.
 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
- D. Water: Potable, clean, free of oils, acids and organic matter.
- E. Aggregates:
 1. Normal weight concrete: ASTM C33, except as modified below.
 2. Fine aggregate:
 - a. Clean natural sand.
 - b. No manufactured or artificial sand.

3. Coarse aggregate:
 - a. Crushed rock, natural gravel, or other inert granular material.
 - b. Maximum amount of clay or shale particles: 1 PCT.
 4. Gradation of coarse aggregate:
 - a. All concrete: Size #57 or #67.
- F. Concrete Grout:
1. Non-Shrink, Non-metallic Grout:
 - a. Non-metallic, non-corrosive, non-staining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of non-shrink grout at 28 days: 6500 PSI.
 - e. In accordance with COE CRD-C621.
 2. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at jobsite.
- G. Reinforcing Steel:
1. Reinforcing bars: ASTM A615, Grade 60.
 2. Proprietary Reinforcing Mechanical Splices: To develop in tension and compression a minimum of 125 PCT of the yield strength of the reinforcing bars being spliced.
 3. Protective plastic caps at mechanical splices.
- H. Forms:
1. Prefabricated or job built.
 2. Wood forms:
 - a. 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
 3. Metal forms:
 - a. Metal forms may be used except for aluminum in contact with concrete.
 - b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
 4. Chamfer strips: Clear white pine, surface against concrete planed.
- I. Form Ties:
1. Commercially fabricated for use in form construction.
 - a. Field fabricated ties are unacceptable.
 2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
 3. 3/4 IN minimum to 1 IN maximum diameter cones on both ends.
 4. Embedded portion of ties to be not less than 1-1/2 IN from face of concrete after ends have been removed.
 5. Cone size:
 - a. 3/4 IN minimum to 1 IN maximum diameter cones on both ends.
 - b. Depth of cone not to exceed the concrete reinforcing cover.
 6. Provide ties with built-in waterstops in all walls.
 7. Through-wall ties that are designed to be entirely removed are not allowed in all walls.
 8. Form release: Non-staining and shall not prevent bonding of future finishes to concrete surface.
- J. Void Forms:
1. Continuous void forms.
 2. Specially designed and manufactured for the purpose of creating a void area directly under concrete members which will allow a space for soil vertical upward movement.
 3. Able to support the weight of concrete and construction loads to be placed thereon with no decrease in required void form depth.

4. Constructed from double faced corrugated cardboard or fiberboard which is wax impregnated and laminated with moisture-resistant adhesive.
 5. Capable of resisting moisture with no loss of load carrying strength or change in depth or configuration.
- K. Waterstops:
1. Plastic: COE CRD-C572.
 2. Serrated with center bulb.
 3. Thickness: 3/8 IN.
 4. Length (general use): 6 IN unless indicated otherwise.
 5. Greenstreet Plastic Products, Style #705, or equal.
- L. Waterstop, Preformed Strip Type:
1. Materials:
 - a. Hydrophilic type waterstop manufactured solely for the purpose of preventing water from traveling through construction joints.
 - b. Non-bentonite composition.
 - c. Hypotite type CJ-0725-3K.
- M. Water Swelling Sealant:
1. Compatible with strip-type waterstop.
 2. Single component, gun applied.
 3. Moisture cured.
 4. Minimum 70 PCT volumetric expansion swelling capability.
- N. Chairs, Runners, Bolsters, Spacers, and Hangers:
1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
- O. Membrane Curing Compound:
1. ASTM C309, Type II-B.
 2. Resin based, dissipates upon exposure to UV light.
 3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
- P. Bonding Agent:
1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
 2. Euclid Chemical Co. "Flex-Con."
 3. BASF Admixtures, Inc. "Acryl-Set."
 4. L&M Construction Chemicals "Everbond."

2.3 CONCRETE MIXES

- A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94/C94M.
 2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
 3. All concrete to be normal weight concrete.
 4. Provide pozzolan content for all cast-in-place construction.
- B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
All general use concrete	Normal weight	4,500 PSI

* Minimum 28-day compressive strength.

C. Air Entrainment:

1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 IN or 3/4 IN	6 ±1-1/2
<3/4 IN	6-1/2 ±1-1/2

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 IN maximum, 1 IN minimum:

1. Measured at point of discharge of the concrete into the concrete construction member.
2. 8 IN maximum after addition of superplasticizer (if used).
3. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
4. Pumped concrete:
 - a. Provide additional water at batch plant to allow for slump loss due to pumping.
 - b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
5. Determine slump per ASTM C143.

E. Selection of Proportions:

1. General:
 - a. Proportion ingredients to:
 - 1) Produce proper workability, durability, strength, and other required properties.
 - 2) Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	TARGET CEMENT, MAXIMUM AGGREGATE SIZE			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	1/2 IN	3/4 IN	1 IN	
4500	611	611	--	0.42

3. Fly ash:
 - a. For cast-in-place concrete only, a maximum of 25 PCT by weight of Portland cement content per cubic yard may be replaced with fly ash at rate of 1 LB fly ash for 1 LB of cement.
 - b. When fly ash is used, the water to cementitious materials ratio shall not exceed the maximum value specified herein.
4. Concrete mix proportioning methods for normal weight concrete:
 - a. Proportion mixture to provide desired characteristics using one of methods described below:
 - 1) Method 1 (Trial Mix):
 - a) Per ACI 318, Chapter 5, except as modified herein.
 - b) Air content within range specified above.
 - c) Record and report temperature of trial mixes.
 - d) Proportion trial mixes per ACI 211.1.
 - 2) Method 2 (Field Experience):
 - a) Per ACI 318, Chapter 5, except as modified herein:
 - b) Field test records must be acceptable to Engineer to use this method.
 - c) Test records shall represent materials, proportions and conditions similar to those specified.

5. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Chapter 5 of ACI 318 using the standard deviation of the proposed concrete production facility.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:

1. Contractor is responsible for design and erection of formwork.
2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
 - a. Allowable tolerances: As recommended in ACI 347.
3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 - b. Do not place floor drains through beams.
4. Openings:
 - a. Provide openings in formwork to accommodate work of other trades.
 - b. Accurately place and securely support items built into forms.
5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
6. Clean and adjust forms prior to concrete placement.
7. Tighten forms to prevent mortar leakage.
8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
9. Void Forms:
 - a. After void forms are in place and before concrete is placed thereon, cover joints between abutting form sections and cover ends of forms to prevent intrusion of soil, concrete or any other materials.
 - b. Install void forms in accordance with manufacturer's instructions.

B. Reinforcement:

1. Position, support and secure reinforcement against displacement.
2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
 - a. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer.
 - 1) Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.
5. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
6. Minimum concrete protective covering for reinforcement.
7. Unless otherwise indicated, provide minimum concrete cover as follows:
 - a. Concrete deposited against earth: 3 IN.
 - b. Formed surfaces exposed to weather or in contact with earth: 2 IN.
8. Do not weld reinforcing bars.

C. Construction, Expansion, and Contraction Joints:

1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.
 - a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in Paragraph below, submit proposed construction joint location in conformance with this Specification Section.
2. Unplanned construction joints will not be allowed.

3. Locate wall vertical construction joints at 30 FT maximum.
 4. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
 5. Locate construction joints in walls:
 - a. At the underside of floor panels.
 6. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
 7. At least 72 HRS shall elapse between placing of adjoining concrete construction.
 8. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
 9. Before new concrete is placed, dampen concrete surfaces.
- D. Embedments:
1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
 2. See Specification Section 03151 - Anchorage to Concrete.
 3. Use setting diagrams, templates and instructions for locating and setting.
 4. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.
- E. Waterstops, General:
1. Lap all types of waterstop to create continuous water tight joints.
 2. Do not mix different types of waterstop materials in the same structure without specific approval from the Engineer.
 3. Contractor is responsible for waterstop selection and installation to provide leak-tight joints, to the minimum standard shown in the Contract Documents.
 4. Base selection on anticipated differential movement of mating surfaces.
 5. Waterstop manufacturer's representative shall provide on-site training of waterstop installation, splicing, welding and inspection procedures prior to construction, and at no additional cost.
- F. Waterstops - Preformed StripType:
1. Install in a bed of swelling sealant on a smooth surface of hardened concrete by use of nails, screws or other means as recommended by manufacturer to prevent movement of waterstop during placement of new concrete.
 2. Roughened joints shall be specially prepared during concrete placement to provide smooth surface for proper waterstop installation.
 3. Unless otherwise noted, use in joints against existing concrete and where indicated on Drawings.
- G. Placing Concrete:
1. Place concrete in compliance with ACI 304R and ACI 304.2R.
 2. Place in a continuous operation within planned joints or sections.
 3. Begin placement when work of other trades affecting concrete is completed.
 4. Place concrete by methods which prevent aggregate segregation.
 5. Do not allow concrete to free fall more than 4 FT.
 6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.
- H. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.
- I. Protection:
1. Protect concrete from physical damage or reduced strength due to weather extremes.
 2. In cold weather comply with ACI 306.1 except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.

- b. Do not place heated concrete that is warmer than 80 DEGF.
 - c. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DEGF for 7 days or 70 DEGF for 3 days.
 - d. Do not allow concrete to cool suddenly.
- 3. In hot weather comply with ACI 305.1 except as modified herein.
 - a. At air temperature of 90 DEGF and above, keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 DEGF at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305.1, Figure 2.1.5.
- J. Curing:
 - 1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
 - 2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
 - 3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
 - 4. Provide curing for minimum of 14 days.
 - 5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
 - 6. In hot weather follow curing procedures outlined in ACI 305.1.
 - 7. In cold weather follow curing procedures outlined in ACI 306.1.
 - 8. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Allow the preceding coat to completely dry prior to applying the next coat.
 - c. Apply the first coat of curing compound immediately after form removal.
 - d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
- K. Form Removal:
 - 1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
 - 2. Leave forms used to support concrete until it has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

- A. Tolerances: 1/4 IN in 10 FT.
- B. Surfaces Exposed to View:
 - 1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
 - a. To be covered with a coating or covering material applied directly to concrete.
 - b. Scheduled for grout cleaned finish.
 - 2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
 - 3. Cementitious concrete coating:
 - a. Form facing material shall produce a smooth, hard, uniform texture.
 - 1) Use forms specified for surfaces exposed to view.
 - b. Prepare the surface in accordance with manufactures printed installation instructions.
 - c. Brush on coating to entire surface.
 - 1) As a mixing liquid for the coating, use bonding agent and water mixture as recommended by the manufacture.
 - 2) Apply two (2) coats at 2 LB/SQ YD per coat.
 - d. When second coat is set, float to a uniform texture with a sponge coat.
 - e. Provide this finish at the following locations:
 - 1) Walls exposed to view.

- C. Surfaces Not Exposed to View:
 - 1. Patch voids, air pockets and honeycomb areas with cement grout.
 - 2. Fill tie holes with non-shrink, non-metallic grout.
- D. Slab Float Finish:
 - 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
 - 2. Do not use water to aid in finishing.
 - 3. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
 - 4. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
 - 5. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
 - 6. Refloat slab immediately to a uniform sandy texture.
- E. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

3.3 GROUT

- A. Preparation:
 - 1. Non-shrinking, non-metallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
- B. Application:
 - 1. Non-shrinking, non-metallic grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce flowable grout.
 - c. Place in accordance with manufacturer's instructions.
 - d. Completely fill all spaces and cavities below the bottom of baseplates.
 - e. Provide forms where baseplates and bedplates do not confine grout.
 - f. Where exposed to view, finish grout edges smooth.
 - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
 - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
 - i. Wet cure grout for seven (7) days, minimum.
 - 2. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Completely fill all cavities and spaces around dowels and anchors without voids.
 - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

- A. Contractor will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
 - 1. Contractor to cooperate with Owner in obtaining and testing samples.
- B. Owner will conduct Quality Assurance testing of concrete.
- C. Tests During Construction:
 - 1. Strength test:
 - a. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
 - 1) Cylinder size: Per ASTM C31.
 - a) 4 IN cylinders may not be used for concrete mixes with concrete aggregate size larger than 1 IN.
 - 2) Quantity:
 - a) 6 IN DIA by 12 IN high: Four (4) cylinders.

- b) 4 IN DIA by 8 IN high: Six (6) cylinders.
 - b. Field cure one (1) cylinder for the seven (7) day test.
 - 1) Laboratory cure the remaining.
 - c. Test cylinders in accordance with ASTM C39.
 - 1) 6 IN DIA cylinders:
 - a) Test two (2) cylinders at 28 days for strength test result and the one (1) field cured sample at seven (7) days for information.
 - b) Hold remaining cylinder in reserve.
 - 2) 4 IN DIA cylinders:
 - a) Test three (3) cylinders at 28 days for strength test result and the one (1) field cured cylinder at seven (7) days for information.
 - b) Hold remaining cylinders in reserve.
 - d. Strength test result:
 - 1) Average of strengths of two (2) 6 IN DIA cylinders or three (3) 4 IN DIA cylinders from the same sample tested at 28 days.
 - 2) If one (1) cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
 - 3) Should all cylinders in any test show any of above defects, discard entire test.
 - e. Frequency of tests:
 - 1) All concrete:
 - a) One (1) strength test to be taken not less than once a day, nor less than once for each 60 CU YD or fraction thereof placed in any one (1) day.
 - b) Once for each 5000 SQ FT of slab or wall surface area placed each day.
 - c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five (5) strength tests for each concrete mix, tests shall then be made from at least five (5) randomly selected batches or from each batch if fewer than five (5) batches are provided.
 - 2. Slump test:
 - a. Per ASTM C143.
 - b. Determined for each strength test sample.
 - c. Additional slump tests may be taken.
 - 3. Air content:
 - a. Per ASTM C231, ASTM C173, and ASTM C138.
 - b. Determined for each strength test sample.
 - 4. Temperature: Determined for each strength test sample.
- D. Evaluation of Tests:
- 1. Strength test results:
 - a. Average of 28-day strength of two cylinders from each sample.
 - 1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.
 - 2) If both cylinders show any of above defects, test will be discarded.
- E. Acceptance of Concrete:
- 1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 PSI.
 - 2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
 - a. Perform additional tests and/or corrective measures at no additional cost to Owner.
- F. Concrete tolerances per ACI 117.

3.5 SCHEDULES

- A. Form Types:
 - 1. Surfaces exposed to view:
 - a. Prefabricated or job-built wood forms.
 - b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
 - c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
 - d. Construct forms sufficiently tight to prevent leakage of mortar.
 - 2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
 - 3. Other types of forms may be used:
 - a. For surfaces not restricted to plywood or lined forms.
 - b. As backing for form lining.
- B. Grout:
 - 1. Non-shrinking, non-metallic grout: General use.
 - 2. Epoxy grout: Other uses indicated on Drawings.
- C. Concrete:
 - 1. Normal weight concrete: All concrete.
 - 2. General use concrete: All locations.
- D. Concrete Finishes:
 - 1. Slab finishes:
 - a. Use following finishes as applicable, unless otherwise indicated:
 - 1) Floated finish: Surfaces intended to receive broom finish.
 - 2) Broom finish: All horizontal surfaces.

END OF SECTION

SECTION 03151

ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for all cast-in-place anchor bolts, anchor rods, reinforcing adhesive anchorage, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
 - 2. Design of all concrete anchors not indicated on the Drawings including, but not limited to, installation of anchors into concrete for the following structural and nonstructural components:
 - a. Structural members and accessories.
 - b. Metal fabrications.
 - c. Mechanical equipment and components.
 - d. All other components requiring attachment to concrete.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03002 – Concrete.
 - 4. Section 05522 – Aluminum Railing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete and Commentary.
 - b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - 2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
 - a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
 - 3. American Institute of Steel Construction (AISC):
 - a. 303, Code of Standard Practice for Steel Buildings and Bridges.
 - 4. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - i. F436, Standard Specification for Hardened Steel Washers.
 - j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - k. F594, Standard Specification for Stainless Steel Nuts.
 - l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

- m. F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
 - 5. ICC Evaluation Service (ICC-ES):
 - a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 - b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
 - 6. Building Code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.
- B. Qualifications:
 - 1. Anchor designer for Contractor-designed post-installed anchors shall be a Professional Structural Engineer licensed in the State of Nebraska.
 - 2. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.
 - 3. Installer for adhesive anchors installed in horizontal, upward incline, or overhead applications shall be certified by ACI-CRSI Adhesive Anchor Installation Certification Program.
- C. Post-installed anchors and related materials shall be listed by the following agencies:
 - 1. ICC-ES.
 - 2. Engineer approved equivalent.

1.3 DEFINITIONS

- A. Adhesive Anchors:
 - 1. Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
 - 2. Includes anchors using acrylics, epoxy and other similar adhesives.
- B. Hardware: As defined in ASTM A153.
- C. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.
- D. MPII: Manufacturer's printed installation instructions.
- E. Mechanical Anchors:
 - 1. Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
 - 2. Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
 - 3. Drop-in anchors and other similar anchors are not allowed.
- F. Post-Installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that submitted products meet requirements of referenced standards.
 - b. Manufacturer material data sheet for each anchor.
 - 1) Clearly indicate which products on the data sheet are proposed for use on the Project.

- c. Manufacturer's printed installation instructions.
 - d. Current ICC-ES report for each post-installed anchor system indicating the following:
 - 1) Certification that anchors meet all requirements indicated in this Specification.
 - 2) Performance data showing that anchor is approved for use in cracked concrete.
 - 3) Seismic design categories for which anchor system has been approved.
 - 4) Required installation procedures.
 - 5) Special inspection requirements for installation.
 - e. Anchorage layout drawings and details:
 - 1) Indicate anchor diameter, embedment, length, anchor type, material and finish.
 - 2) Drawings showing location, configuration, spacing and edge distance.
 - f. Contractor Designed Post-Installed Anchors:
 - 1) Show diameter and embedment depth of each anchor.
 - 2) Indicate compliance with ACI 350 Appendix D.
 - 3) Design tension and shear loads used for anchor design.
 - 4) Engineering design calculations:
 - a) Indicate design load to each anchor.
 - b) When the design load is not indicated on Drawings, include calculations to develop anchor forces based on Design Criteria listed herein.
 - c) Sealed and signed by Contractor's Professional Structural Engineer.
 - d) Calculations will be submitted for information purposes only.
 - 5) Type of post-installed anchor system used.
 - a) Provide manufacturer's ICC-ES report for the following:
 - (1) Mechanical anchorage per ICC-ES AC193.
 - (2) Adhesive anchorage per ICC-ES AC308.
- B. Samples:
- 1. Representative samples of concrete anchors may be requested by Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusively the responsibility of the Contractor.
- C. Informational Submittals:
- 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Certification of qualifications for each installer of post-installed anchors.
 - a. Indicate successful completion or certification for each type of approved post-installed anchor as required by the Contract Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to job site in manufacturer's or distributor's packaging undamaged and complete with installation instructions.
- B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.
- C. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Post-Installed Mechanical and Adhesive Concrete Anchors:
 - 1. Stainless steel with matching nut and washer.
 - 2. Submerged application: ASTM F593, Type 316.
 - 3. Non-submerged application: ASTM F593, Type 304 or Type 316.
- B. Reinforcement: See Section 03002.
- C. Washers: Follow manufacturer's requirements for all post-installed anchorage.

- D. Nuts: Follow manufacturer's requirements if using post-installed anchorage.

2.2 CONTRACTOR DESIGNED ANCHORAGE

- A. Acceptable Manufacturers:
1. Post-installed anchor systems for the listed manufacturers will be considered only if a current ICC-ES evaluation report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section and if the anchor system is approved by the Engineer.
 - a. Hilti.
 - b. Powers Fasteners.
 - c. Simpson Strong-Tie.
- B. Design the anchorage when any of the following occur:
1. When specifically required by the Contract Documents.
 2. When an anchorage is required but not specified in the Drawings.
 3. When anchorage is shown on Drawings other than Structural Drawings.
- C. Anchorage Design Loads:
1. Determine all of the design loads, including wind and seismic loads, per the Building Code.
 - a. Anchorage of equipment and non-structural components: Use the actual dead and operating loads provided by the manufacturer.
- D. When Contract Drawings, other than the Structural Drawings, indicate an anchor diameter or length, the Contractor design shall incorporate these as "minimums."
- E. Post-installed Concrete Anchors:
1. Provide the manufacturer's system name/type, nominal diameter, embedment depth, spacing, minimum edge distance, cover, and design capacity to resist the specified or calculated load based on requirements given in the Building Code, ACI 350, Appendix D and current ICC-ES report, for the anchor to be used.
 2. Design assuming cracked concrete.

2.3 ENGINEER DESIGNED ANCHORAGE

- A. When the size, length and details of anchorages are shown on Contract Structural Drawings, Contractor design of anchorage is not required unless otherwise indicated.
- B. Acceptable Manufacturers:
1. Additional newer post-installed anchor systems for the listed manufacturers will be considered only if a current evaluation agency report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section, the anchor system is certified by ICC-ES for cracked concrete conditions, and if approved by the Engineer.
 2. Mechanical Anchors: Hilti:
 - 1) Kwik Bolt TZ (ICC-ES ESR-1917).
 3. Adhesive Concrete Anchors:
 - a. Hilti: HIT RE 500 V3 (ICC ESR-3814).
 4. Concrete Screw Anchors:
 - a. Hilti: Kwik HUS-EZ Screw (ICC-ES ESR-3027).
 5. Submit request for substitution in accordance with Division 01.
 - a. Substitution request to indicate the proposed anchor has the at least the same tension and shear strength as the specified anchor installed as indicated in the Contract Drawings.
 - b. Calculations to be stamped by a Professional Structural Engineer registered in the State of Nebraska.

PART 3 - EXECUTION

3.1 GENERAL

- A. Adhesive Anchorage:
 - 1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
 - 2. May be used where subjected to vibration or where buried or submerged.
 - 3. Do not use in overhead applications or sustained tension loading conditions such as utility hangers.
 - 4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.
- B. Mechanical Anchorage:
 - 1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
 - 2. Do not use where subjected to vibration.
 - 3. May be used in overhead applications.
 - 4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.
- C. Do not use powder actuated fasteners and other types of bolts and fasteners not specified herein for structural applications unless approved by the Engineer or specified in Contract Documents.

3.2 PREPARATION

- A. Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed.
 - 1. Notify Engineer of conditions detrimental to proper and timely completion of work.
 - 2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Special Inspection is required in accordance with the Building Code for all concrete anchorage.
 - 1. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
 - 2. See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section for additional requirements.
- C. Post-installed anchor manufacturer's representative shall demonstrate and observe the proper installation procedures for the post-installed anchors at no additional expense to the Owner.
 - 1. Follow such procedures to assure acceptable installation.

3.3 INSTALLATION

- A. Do the following after nuts are snug-tightened down:
 - 1. If using post-installed anchorage, follow manufacturer's installation procedures.
- B. For post-installed anchors, comply with the MPII on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar.
 - 1. Use hammer drills to create holes.
 - 2. Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Special Inspector.

3.4 FIELD QUALITY CONTROL

- A. Special Inspection:
 - 1. See Section 00900.
 - 2. See Section 03002.

3.5 CLEANING

- A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.
- B. Provide surface acceptable to receive field applied paint coatings when specified in Specification Section 05522.

END OF SECTION



DIVISION 05

METALS



SECTION 05522

ALUMINUM RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum handrail.
 - 2. Aluminum guardrail gates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03151 – Anchorage to Concrete.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM 1, Aluminum Design Manual.
 - 2. American Society of Mechanical Engineers (ASME):
 - a. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
 - 3. ASTM International (ASTM):
 - a. B108, Standard Specification for Aluminum-Alloy Permanent Mold Castings.
 - b. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - c. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - d. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
 - e. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - f. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - 4. American Welding Society (AWS):
 - a. C5.5, Recommended Practices for Gas Tungsten Arc Welding.
 - b. D1.2, Structural Welding Code - Aluminum.
 - 5. National Association of Architectural Metal Manufacturers (NAAMM):
 - a. AMP 521, Pipe Railing Systems Manual.
 - 6. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
 - a. Americans with Disabilities Act (ADA):
 - 1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - 7. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
 - 8. Building code:
 - a. International Code Council (ICC):
 - 1) International Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.
- B. Qualifications:
 - 1. Qualify welding procedures and welding operators in accordance with AWS and ASME Section IX.

1.3 DEFINITIONS

- A. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.
- B. Railing: A generic term referring to guardrail.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Fabrication and/or Layout Drawings:
 - a. Drawings showing profile, location, sections and fabrication details including all welding information of each railing.
 - b. Type and details of anchorage.
 - c. Location and type of expansion joints.
 - d. Materials of construction, shop coatings and all third-party accessories.
 - 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation details.
 - 4. Certification that railings have been designed and fabricated to meet the loading requirements specified.
 - 5. Calculations for all proposed deviations from the Specification.
 - a. Calculations shall be performed, sealed, signed and dated by a registered Professional Structural Engineer licensed in the State of Nebraska.
 - b. Calculations shall be specific to this Project and shall include all assumptions, references and design interpretations used to achieve the results obtained by the Engineer.
 - c. Reduction in load criteria is not acceptable as reason for deviation from sizes indicated in the Specification.
- B. Informational Submittals:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Certification of welders and welding procedures indicating compliance with AWS requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and handle railings to preclude damage.
- B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect against corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Welded railing systems:
 - a. Any manufacturer meeting this Specification Section.

2.2 MATERIALS

- A. Alloy 6061-T6, 32,000 PSI tensile yield strength minimum.
 - 1. ASTM B209 for sheets and plates.
 - 2. ASTM B221 and ASTM B308 for shapes - beams, channels, angles, tees, and zees.
 - 3. ASTM B247 for forgings.

- B. Alloy 6063-T5 or T6, 15,000 PSI tensile yield strength minimum.
 - 1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
- C. Cast Fittings: Aluminum, ASTM B108.
- D. Shims: Aluminum of same alloy as component being shimmed.
- E. Expansion and Adhesive Anchors: See Specification Section 03151.
- F. Electrodes for Welding:
 - 1. Aluminum: AWS D1.2.
 - 2. Filler alloy 5356 or 4043.

2.3 FABRICATION

- A. General:
 - 1. Verify field conditions and dimensions prior to fabrication.
 - 2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
 - a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
 - 3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
 - a. Ease exposed edges to a radius of approximately 1/32 IN.
 - b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - c. Drill or punch holes with smooth edges.
 - 4. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding.
 - a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
 - 5. Provide for anchorage of type indicated on Drawings or as required by field conditions.
 - a. Drill or punch holes with smooth edges.
 - 6. Design railings and anchorage system in accordance with NAAMM AMP 521 to resist loading as required by Building Code.
 - a. Maximum allowable stresses per AA ADM 1.
 - 7. Design railings in accordance with accessibility requirements per the Building Code and ADAAG.
- B. Custom fabricate railings to dimensions and profiles indicated.
 - 1. Guardrails:
 - a. Schedule 40 pipe.
 - b. Top rails: 2 IN nominal diameter.
 - c. Intermediate rails: 1-1/2 IN nominal diameter.
 - d. Vertical posts:
 - 1) 2 IN nominal diameter.
 - 2) Vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.
 - 2. Where details are not indicated, space intermediate rails to requirements of the Building Code or OSHA Standards, whichever requires the more restrictive design.
 - 3. Space vertical posts as required by loading requirements but not more than 4 FT on center.
 - a. Avoid locating vertical posts at changes in direction of railing.
 - b. Hold vertical post back from corner and provide radiused corners.
 - 4. Base plate for vertical guardrail posts mounted to top of concrete surface:
 - a. 3/8 x 6 x 6 IN square plate.
 - b. Predrilled to accept four (4) anchors.
 - c. Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
 - d. Fit the vertical post over the solid rod and weld the post to the base plate.

C. Railing Fabrication:

1. All railings are to be welded systems.
2. Use wire welding for all joints.
3. All welding to be continuous in accordance with AWS C5.5 and AWS D1.2.
 - a. All welded railing joints shall have full penetration welds unless noted otherwise.
4. All exposed welds to be ground smooth and flush to match and blend with adjoining surfaces.
 - a. NAAMM AMP 521, Type 2.
5. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
6. Finishing joints with filler is not acceptable.
7. Provide flush weld fittings using locking weld connectors or coped drive-on connectors.
8. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.
9. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
 - a. Drill 1/4 IN weep hole in railings closed at bottom:
 - 1) 1 IN above walkway surface at bottom of posts set in concrete.
 - 2) 1 IN above solid aluminum rod at posts having base plate.
 - 3) At low point of intermediate rails.
 - b. Do not drill weep holes:
 - 1) In bottom of base plate.
10. Expansion joints:
 - a. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
 - 1) Top rail splices and expansion joints shall be located within 8 IN of post or other support.
 - b. Provide expansion joints in any continuous run exceeding 20 FT in length.
 - 1) Space expansion joints at not more than 40 FT OC.
 - c. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DEGF differential between installation temperature and maximum design temperature.
 - 1) Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
 - a) Provide additional expansion joints as required to limit expansion joint width.
 - d. Provide slip-joint with internal sleeve.
 - 1) Extend slip joint min 2 IN beyond joint at maximum design width.
 - 2) Fasten internal sleeve securely to one side
 - a) Provide Allen-head set screw located in bottom of rail.
 - b) Rivets or exposed screw heads are not acceptable.

D. Finish: Mill.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installation, inspect and verify condition of substrate.
- B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
 1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

- A. Install guardrails to meet loading requirements of the Building Code.
- B. Install products in accordance with manufacturer's instructions.

- C. Set work accurately in location, alignment and elevation; plumb, level and true.
 - 1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.
- D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
 - 1. Provide shims as required.
- E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.
 - 1. Lubricate expansion joint splice bar for smooth movement of railing sections.
- F. Provide removable railing sections where indicated on Drawings.
- G. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents.
 - 1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
 - a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
 - b. Bevel the top of the bolt after cutting to provide a smooth surface.
- H. Coat aluminum in contact with dissimilar metal or concrete with Polyamidoamine Epoxy, 4.5 to 5.5 MIL, Series 66 HS Epoxoline.

END OF SECTION



DIVISION 08

DOORS AND WINDOWS



SECTION 08305

ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceiling access doors.
 - 2. Floor access doors.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 03002 – Concrete.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO).
 - 2. ASTM International (ASTM):
 - a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - d. A480, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - e. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - f. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - g. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - h. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 DEFINITIONS

- A. Clear Opening Size: Space within the opening having no obstructions. Furnish model that will provide the minimum clear opening indicated.
- B. Standard Duty: Will support live load of 150 PSF.
- C. Heavy Duty: Will support live load of 300 PSF.
- D. H-20 loading: As defined in AASHTO Guidelines.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.

- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 0130001342 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Floor and Ceiling access doors:
 - a. Bilco Company.
 - b. Halliday Products.
 - c. USF Fabrication Inc.

2.2 MATERIALS

- A. Aluminum:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extruded shapes: ASTM B221.
- B. Stainless Steel: ASTM A240 or ASTM A666.

2.3 MANUFACTURED UNITS

- A. General:
 - 1. All access doors shall be provided by the same manufacturer when possible.
 - 2. Coat all aluminum components in contact with concrete or masonry with manufacturer's standard bituminous coating.
- B. Standard Duty Floor Access Doors:
 - 1. Frame: 1/4 IN mill finished aluminum.
 - a. Fabricate frame with built-in neoprene cushion and strap anchors bolted to exterior.
 - 2. Cover: 1/4 IN mill finished diamond plate aluminum.
 - a. Reinforce cover with aluminum stiffeners.
 - 1) Live load: 150 PSF.
 - 2) Deflection: Maximum 1/150 of span.
 - b. Fabricate doors to open to 90 DEG and automatically lock into open position.
 - 3. Hardware:
 - a. All hardware to be stainless steel.
 - b. Positive hold open arm that engages automatically when door reaches full 90 degree open position.
 - c. Slam lock and removable key handle.
 - d. Bolt hinges to underside of door.
 - 1) Pivot on torsion bars.
 - 4. SlamBilco Company, Type "K" or "KD."
 - a. Size(s): Refer to the SCHEDULES Article in PART 3 of this Specification Section.
- C. Heavy Duty Floor Access Doors:
 - 1. Frame: 1/4 IN mill finish aluminum channel with anchor tabs.
 - a. 1-1/2 IN DIA drain coupling.
 - 2. Cover:
 - a. 1/4 IN mill finished diamond plate aluminum.
 - b. Reinforce cover with aluminum stiffeners.
 - 1) Live load: 300 PSF.
 - 2) Deflection: Maximum 1/150 of span.
 - 3. Hardware:
 - a. All hardware to be stainless steel.

- b. Positive hold open arm that engages automatically when door reaches full 90 degree open position.
 - c. Slam lock and removable key handle.
- 4. Bilco Company, Type "J-AL" or "JD-AL."
 - a. Size(s): Refer to the SCHEDULES Article in PART 3 of this Specification Section.

2.4 ACCESSORIES

- A. Secondary Fall Protection System:
 - 1. Design and install system such that when in the open position, no part of the system obstructs the clear opening size
 - 2. Platform: Design grating to meet OSHA 29 CFR 1910.23 requirements for protection for floor openings.
 - 3. Finish:
 - a. Powder coated.
 - b. Color: Safety Orange or Safety Yellow.
 - 4. Hardware:
 - a. Stainless steel Type 316.
 - b. Tamper proof Type 316 stainless steel bolts.
 - 5. Provide positive latch to hold grating in upright position.
 - 6. Size: Allow 6 IN clear space on each unhinged side for visual observation.
 - 7. Provide padlock hasp for Owner provided padlock.
 - 8. Double leaf openings:
 - a. Provide two (2) individual grating platforms hinged on the same side of the hatch frame but independent from one another.
 - 1) Provide each platform with a padlock hasp and positive latch to hold grating in upright position.
 - 9. Install secondary fall protection system at the factory.
- B. Load Rating Plates:
 - 1. Minimum 18 GA Type 316 stainless steel, ASTM A666.
 - 2. Engraved with maximum design live load allowed for unit on which it will be mounted.
 - 3. Display load in English units as well as metric units.
 - 4. Size as required for text as needed.
 - 5. Text:
 - a. Font: Helvetica Narrow, all caps.
 - b. Size: 1/4 IN height.
 - c. Depth of engraving: 3 MILS.
 - 6. Finish:
 - a. Text:
 - 1) Black epoxy baked on paint.
 - 2) Plate to have finish conductive to paint application.
 - b. Coat entire plate with baked on clear coat on front and back side.
 - 7. Attach to top of all floor or vault access doors using stainless steel screws in location determined by manufacturer.
 - a. Provide a neoprene gasket under the plate to separate the stainless steel from the aluminum cover or frame.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

3.2 SCHEDULES

A. See Design Drawings.

END OF SECTION



DIVISION 10

SPECIALTIES



SECTION 10400

IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items, and hazard and safety signs.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. A13.1, Scheme for the Identification of Piping Systems.
 - 2. The International Society of Automation (ISA).
 - 3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
 - a. Z535.1, Safety Color Code.
 - b. Z535.2, Environmental and Facility Safety Signs.
 - c. Z535.3, Criteria for Safety Symbols.
 - d. Z535.4, Product Safety Signs and Labels.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 5. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Catalog information for all identification systems.
 - b. Acknowledgement that products submitted meet requirements of standards referenced.
 - 3. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. W.H. Brady Co.
 - 2. Panduit.
 - 3. Seton.
 - 4. National Band and Tag Co.
 - 5. Carlton Industries, Inc.

2.2 MANUFACTURED UNITS

- A. Type A1 - Round Metal Tags:
 - 1. Materials:
 - a. Aluminum or stainless steel.
 - b. Stainless steel shall be used in corrosive environments.
 - 2. Size:
 - a. Diameter: 1-1/2 IN minimum.
 - b. Thickness: 0.035 IN (20 GA) minimum.
 - 3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Stamped and filled with black coloring.
 - 4. Color: Natural.
- B. Type A2 - Rectangle Metal Tags:
 - 1. Materials: Stainless steel.
 - 2. Size:
 - a. 3-1/2 IN x 1-1/2 IN minimum.
 - b. Thickness: 0.036 IN (20 GA) minimum.
 - 3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Stamped and filled with black coloring.
 - 4. Color: Natural.
- C. Type A3 - Metal Tape Tags:
 - 1. Materials: Aluminum or stainless steel.
 - 2. Size:
 - a. Width 1/2 IN minimum.
 - b. Length as required by text.
 - 3. Fabrication:
 - a. 3/16 IN minimum mounting hole.
 - b. Legend: Embossed.
 - 4. Color: Natural.
- D. Type B1- Square Nonmetallic Tags:
 - 1. Materials: Fiberglass reinforced plastic.
 - 2. Size:
 - a. Surface: 2 x 2 IN minimum.
 - b. Thickness: 100 MILS.
 - 3. Fabrication:
 - a. 3/16 IN mounting hole with metal eyelet.
 - b. Legend: Preprinted and permanently embedded and fade resistant.
 - 4. Color:
 - a. Background: Manufacturer standard or as specified.
 - b. Lettering: Black.
- E. Type B2 - Nonmetallic Signs:
 - 1. Materials: Fiberglass reinforced or durable plastic.
 - 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 60 MILS minimum.
 - 3. Fabrication:
 - a. Rounded corners.
 - b. Drilled holes in corners with grommets.
 - c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
 - 4. Color:
 - a. Background: Manufacturer standard or as specified.

- b. Lettering: Black.
- 5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- F. Type C - Laminated Name Plates:
 - 1. Materials: Phenolic or DR (high impact) acrylic.
 - 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 1/16 IN.
 - 3. Fabrication:
 - a. Outdoor rated and UV resistant when installed outdoors.
 - b. Two (2) layers laminated.
 - c. Legend: Engraved through top lamination into bottom lamination.
 - d. Two (2) drilled side holes, for screw mounting.
 - 4. Color: Black top surface, white core, unless otherwise indicated.
- G. Type D - Self-Adhesive Tape Tags and Signs:
 - 1. Materials: Vinyl tape or vinyl cloth.
 - 2. Size:
 - a. Surface: As required by text.
 - b. Thickness: 5 MILS minimum.
 - 3. Fabrication:
 - a. Indoor/Outdoor grade.
 - b. Weather and UV resistant inks.
 - c. Permanent adhesive.
 - d. Legend: Preprinted.
 - e. Wire markers to be self-laminating.
 - 4. Color: White with black lettering or as specified.
 - 5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
- H. Type E - Heat Shrinkable Tape Tags:
 - 1. Materials: Polyolefin.
 - 2. Size: As required by text.
 - 3. Fabrication:
 - a. Legend: Preprinted.
 - 4. Color: White background, black printing.
- I. Type F - Underground Warning Tape:
 - 1. Materials: Polyethylene.
 - 2. Size:
 - a. 6 IN wide (minimum).
 - b. Thickness: 3.5 MILS.
 - 3. Fabrication:
 - a. Legend: Preprinted and permanently imbedded.
 - b. Message continuous printed.
 - c. Tensile strength: 1750 PSI.
 - 4. Color: As specified.
- J. Type G - Stenciling System:
 - 1. Materials:
 - a. Exterior type stenciling enamel.
 - b. Either brushing grade or pressurized spray can form and grade.
 - 2. Size: As required.
 - 3. Fabrication:
 - a. Legend: As required.
 - 4. Color: Black or white for best contrast.

2.3 ACCESSORIES

- A. Fasteners:
 - 1. Bead chain: #6 brass, aluminum or stainless steel.
 - 2. Plastic strap: Nylon, urethane or polypropylene.
 - 3. Screws: Self-tapping, stainless steel.
 - 4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

- A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install identification devices at specified locations.
- B. All identification devices to be printed by mechanical process, hand printing is not acceptable.
- C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.
- D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
 - 1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.
- E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
 - 1. Several items of equipment mounted in housing to be individually tagged inside the compartment.

3.2 SCHEDULES

- A. Process Systems:
 - 1. Trenches with piping:
 - a. Tag type: Type F - Underground Warning Tape.
 - b. Location: Halfway between top of piping and finished grade.
 - c. Letter height: 1-1/4 IN minimum.
 - d. Storm and sanitary sewer lines:
 - 1) Color: Green with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED SEWER LINE BELOW"
 - e. (Non-potable) water piping, except 3 IN and smaller irrigation pipe:
 - 1) Color: Green with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION"
 - b) Second line: "BURIED NONPOTABLE WATER LINE BELOW"
 - 2. Yard valves, buried, with valve box and concrete pad:
 - a. Tag type: Type A2 - Rectangle Metal Tags.
 - b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").

3. Valves and slide gates:
 - a. Tag type:
 - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
 - 2) Indoor noncorrosive:
 - a) Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - 3) Indoor corrosive:
 - a) Stainless steel Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - b. Fastener:
 - 1) Type A1: Chain of the same material.
 - 2) Type B1: Stainless steel chain.
 - c. Color: Per ASME A13.1 corresponding to the piping system.
 - d. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Valve designation as indicated on the Drawings (e.g., "V-xxx").
4. Process equipment (e.g., pumps, pump motors, blowers, air compressors, bar screens, clarifier drive mechanism, etc.):
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Tags and Signs.
 - 3) Type G - Stenciling System.
 - b. Fastener:
 - 1) Self.
 - 2) Screws.
 - 3) Adhesive.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment designation as indicated on the Drawings (e.g., "Primary Sludge Pump P-xxx").
5. Piping systems:
 - a. Tag type:
 - 1) Outdoor locations: Type G - Stenciling System.
 - 2) Indoor locations:
 - a) Type D - Self-Adhesive Tape Tags and Signs.
 - b) Type G - Stenciling System.
 - b. Fastener: Self.
 - c. Color: Per ASME A13.1.
 - d. Legend:
 - 1) Letter height: Manufacturers standard for the pipe diameter.
 - 2) Mark piping in accordance with ASME A13.1.
 - 3) Use piping designation as indicated on the Drawings.
 - 4) Arrow: Single arrow.
6. Equipment that starts automatically:
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener:
 - 1) Type B2 - Screw or adhesive.
 - 2) Type D - Self.
 - c. Size: 5 IN x 7 IN.
 - d. Legend:
 - 1) OSHA Warning Sign.
 - 2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".

B. Instrumentation Systems:

1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
 - a. Tag type:
 - 1) Outdoor locations: Type B1 - Square Nonmetallic Tags.
 - 2) Indoor noncorrosive:
 - a) Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - 3) Indoor corrosive:
 - a) Stainless steel Type A1 - Round Metal Tags.
 - b) Type B1 - Square Nonmetallic Tags.
 - b. Fastener:
 - 1) Type A1: Chain of the same material.
 - 2) Type B1: Stainless steel chain.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Equipment ISA designation as indicated on the Drawings (e.g., "FIT-xxx").
2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
3. Components inside equipment enclosure, (e.g., PLC's, control relays, contactors, and timers):
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description or function of component (e.g., "PLC-xxx" or "CR-xxx").
4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Component ISA tag number as indicated on the Drawings (e.g., "HS-xxx").

C. Electrical Systems:

1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
 - a. Tag type: Type F - Underground Warning Tape.
 - b. Letter height: 1-1/4 IN minimum.
 - c. Location:
 - 1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
 - 2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
 - d. Electrical power (e.g., low and medium voltage):
 - 1) Color: Red with black letters.
 - 2) Legend:
 - a) First line: "CAUTION CAUTION CAUTION".
 - b) Second line: "BURIED ELECTRIC LINE BELOW".
2. Panelboards and transformers:
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.

- c. Legend:
 - 1) Letter height:
 - a) First line: 3/8 IN minimum.
 - b) Subsequent lines: 3/16 IN minimum.
 - 2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
 - 3) Second line (panelboards only): System voltage and phase (e.g., "208/120V, 3PH").
 - 4) Third line:
 - a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
 - b) Include the building name or number if the source is in another building.
 - 5) Fourth line: Date installed (e.g., "INSTALLED JULY 20xx").
- 3. Safety switches, separately mounted circuit breakers and motor starters, VFD's, etc.:
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
- 4. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/2 IN minimum.
 - 2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
- 5. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
 - a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 3/16 IN minimum.
 - 2) Description or function of component (e.g., "M-xxx", "CR-xxx" or "TR-xxx").
- 6. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
 - a. Tag type: Type C - Phenolic Name Plates.
 - b. Fastener: Screws.
 - c. Legend:
 - 1) Letter height: 1/4 IN minimum.
 - 2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
- 7. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Tag conductor at both ends.
 - d. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.
- 8. Conductors in handholes.
 - a. Tag type: Type A3 - Metal Tape Tags.
 - b. Fastener: Nylon strap.
 - c. Tag conductor at both ends.
 - d. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Circuit number or wire number as scheduled on the Drawings.

9. Grounding conductors associated with grounding electrode system in accordance with the following:
 - a. Tag type: Type D - Self-Adhesive Tape Tags.
 - b. Fastener: Self.
 - c. Legend:
 - 1) Letter height: 1/8 IN minimum.
 - 2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
10. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
 - a. Tag type: Type D - Self-Adhesive Tape Signs.
 - b. Fastener: Self.
 - c. Legend: Per NFPA 70.
11. Equipment where more than one (1) voltage source is present:
 - a. Tag type:
 - 1) Type B2 - Nonmetallic Signs.
 - 2) Type D - Self-Adhesive Tape Signs.
 - b. Fastener:
 - 1) Screw or adhesive.
 - 2) Self.
 - c. Size: 1-3/4 IN x 2-1/2 IN.
 - d. Location: Exterior face of enclosure or cubical.
 - e. Legend:
 - 1) OSHA Danger Sign.
 - 2) Description of Danger: "MULTIPLE VOLTAGE SOURCES".

END OF SECTION



DIVISION 13

SPECIAL CONSTRUCTION



SECTION 13440

INSTRUMENTATION FOR PROCESS CONTROL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic requirements for complete instrumentation system for process control.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 13448 - Control System Equipment Panels and Racks.
 - 4. Section 16120 - Wire and Cable - 600 Volt and Below.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Canadian Standards Association (CSA).
 - 2. FM Global (FM).
 - 3. The International Society of Automation (ISA):
 - a. 7.0.01, Quality Standard for Instrument Air.
 - b. S5.1, Instrumentation Symbols and Identification.
 - c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
 - d. S5.4, Standard Instrument Loop Diagrams.
 - e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 - 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 6. National Institute of Standards and Technology (NIST).
 - 7. Underwriters Laboratories, Inc. (UL):
 - a. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.
- B. Qualifications:
 - 1. Instrumentation subcontractor:
 - a. Experience:
 - 1) Have satisfactorily provided a control system for a minimum of five (5) projects of similar magnitude and function.
- C. Miscellaneous:
 - 1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

1.3 DEFINITIONS

- A. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
- B. Calibrate: To standardize a device so that it provides a specified response to known inputs.

1.4 SYSTEM DESCRIPTION

- A. Control System Requirements:
 - 1. This Specification Section provides the general requirements for the instrument and control system.
 - 2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.
- B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.
- C. Single Instrumentation Subcontractor:
 - 1. Furnish and coordinate instrumentation system through a single instrumentation subcontractor.
 - a. The instrumentation subcontractor shall be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of Drawings and Operation and Maintenance Manuals, start-up, training, demonstration of substantial completion and all other aspects of the control system.
 - 2. Ensure coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
 - a. Facsimile information is not acceptable.
 - 3. Limit the scope of each submittal to one (1) Specification Section.
 - a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
 - b. Do not provide any submittals for Specification Section 13440.
 - 4. Product technical data including:
 - a. Equipment catalog cut sheets.
 - b. Instrument data sheets:
 - 1) ISA S20 or approved equal.
 - 2) Separate data sheet for each instrument.
 - c. Materials of construction.
 - d. Minimum and maximum flow ranges.
 - e. Pressure loss curves.
 - f. Physical limits of components including temperature and pressure limits.
 - g. Size and weight.
 - h. Electrical power requirements and wiring diagrams.
 - i. NEMA rating of housings.
 - j. Submittals shall be marked with arrows to show exact features to be provided.
 - 5. Comprehensive set of wiring diagrams as specified in Section 13448.
 - 6. Panel Fabrication Drawings as specified in Section 13448.
 - 7. PLC/DCS Equipment Drawings.
 - 8. HMI graphics.
 - 9. Nameplate Layout Drawings.

10. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
 - a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
 11. All Shop Drawings shall be modified with as-built information/corrections.
 12. All Panel and Wiring Drawings shall be provided in both hardcopy and softcopy.
 - a. Furnish electronic files on CD-ROM or DVD-ROM media.
 13. Provide a parameter setting summary sheet for each field configurable device.
 14. Testing reports: Source quality control reports.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Specification Section 01300 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 2. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

1.7 SITE CONDITIONS

- A. Unless designated otherwise on the Drawings, area designations are as follows:
1. Outdoor area:
 - a. Wet.
 - b. Below grade vaults:
 - 1) Subject to temporary submergence when specifically designated on the Drawings or Specifications.

PART 2 - PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

- A. Provide enclosures/housing for control system components in accordance with the following:
1. Areas designated as wet: NEMA Type 4.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. System Operating Criteria:
1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two (2) cycles per minute or a magnitude of movement of 0.5 PCT full travel.
 2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
 3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 PCT of full scale over a 6:1 operating range.
 4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 PCT of full travel regardless of force required to position final element.
 5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 PCT of full scale.
 6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.

2.3 ACCESSORIES

- A. Provide identification devices for instrumentation system components in accordance with Specification Section 10400.
- B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Clarifiers, Digesters, Reservoirs, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
- B. Install electrical components per the requirements of the Electrical design.
- C. Panel-Mounted Instruments:
 - 1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
 - 2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.
- D. See Specification Section 16120.

3.2 FIELD QUALITY CONTROL

- A. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
 - 1. Documentation requirements include the utilization of the forms located at the end of this Specification Section.
 - a. Loop Check-out Sheet.
 - b. Instrument Certification Sheet.
 - c. Final Control Element Certification Sheet.
- B. Instrumentation Calibration:
 - 1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
 - 2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
 - 3. Calibrate in accordance with the manufacturer's specifications.
 - 4. Bench calibrate pressure and temperature gages.
 - a. Field mount gage within seven (7) days of calibration.
 - 5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 PCT.
 - a. Check for both increasing and decreasing input signals to detect hysteresis.
 - 6. Replace any instrument which cannot be properly adjusted.
 - 7. Calibration equipment shall be certified by an independent agency with traceability to NIST.
 - a. Certification shall be up-to-date.
 - b. Use of equipment with expired certifications shall not be permitted.
 - 8. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.
- C. Loop Check-Out Requirements are as follows:
 - 1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
 - a. Use actual signals where available.

- b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
 - 1) Verify that readings at all loop components are in agreement.
 - 2) Make corrections as required.
 - a) Following any corrections, retest the loop as before.
- 2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.
- 3. Check all interlocks to the maximum extent possible.
- 4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.
- D. Provide verification of system assembly, power, ground, and I/O tests.
- E. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

END OF SECTION

SECTION 13448

CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for control panels and enclosures utilized for RTU as identified on Drawings.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 10400 - Identification Devices.
 - 4. Section 13450 - Flow Measurement.
 - 5. Section 13500 - Programmable Logic Controller (PLC) Control System.
 - 6. Section 13449 - Surge Protection Devices (SPD) for Instrumentation and Control Equipment.
 - 7. Division 26 - Electrical.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI).
 - 2. ASTM International (ASTM):
 - a. B75, Standard Specification for Seamless Copper Tube.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 4, Industrial Control and Systems: Terminal Blocks.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - 1) Article 409, Industrial Control Panels.
 - 2) Article 504, Intrinsically Safe Systems.
 - 5. Underwriters Laboratories, Inc. (UL):
 - a. 508A, Standard for Safety Industrial Control Panels.
 - b. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
 - c. 913, Standard for Safety Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.
- B. Miscellaneous:
 - 1. Approved supplier of Industrial Control Panels under provisions of UL 508A or UL 698A.
 - a. Entire assembly shall be affixed with a UL 508A or UL 698A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.
 - b. Control panel(s) without an affixed UL 508A or UL 698A label shall be rejected and sent back to the Contractor's factory.

1.3 DEFINITIONS

- A. Panel: Control panels or enclosures listed in the schedule included in this Specification Section.
- B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.
- C. Intrinsically Safe:
 - 1. A device, instrument or component that will not produce sparks or thermal effects under normal or abnormal conditions that will ignite a specified gas mixture.

2. Designed such that electrical and thermal energy limits inherently are at levels incapable of causing ignition.
- D. Intrinsically Safe Circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under test conditions as prescribed in UL 913.
- E. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- F. Instrumentation Cable:
 1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
 2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad), and is used for the transmission of low current or low voltage signals.
- G. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.
- H. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices.
- I. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.
- J. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.
- K. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.
- L. Highway Addressable Remote Transducer (HART): An open, master-slave protocol for bus addressable field instruments.
- M. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.
- N. Uninterruptible Power Supply (UPS): A backup power unit that provides continuous power when the normal power supply is interrupted.
- O. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20ma DC analog signals.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Section 01300 for requirements for the mechanics and administration of the submittal process.
 2. See Section 13440.
 3. Prepared with computer aided design (CAD) software.
 4. Printed on 11 by 17 IN sheets.
 5. Drawings shall include a title block containing the following:
 - a. Plant or facility name where panel(s) are to be installed.
 - b. Drawing title.
 - c. Drawing number.
 - d. Revision list with revision number and date.
 - e. Drawing date.
 - f. Drawing scale.
 - g. Manufacturer name, address, and telephone number.

6. Cover sheet for each drawing set shall indicate the following:
 - a. Plant or facility name.
 - b. Project name.
 - c. Submittal description.
 - d. Revision number.
 - e. Issue date.
7. Table of contents sheet(s) shall indicate the following for each Drawing in the set:
 - a. Drawing number.
 - b. Drawing title.
 - c. Sheet number.
8. Legend and abbreviation sheet shall indicate the following:
 - a. Description of symbols and abbreviations used.
 - b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.
 - c. Confirmation that the panel(s) are to be affixed with a UL 508A or UL 698A label prior to shipment from the factory.
9. Bill of Material for each panel shall include the following component information:
 - a. Instrument tag number.
 - b. Quantity.
 - c. Functional name or description.
 - d. Manufacturer.
 - e. Complete model number.
 - f. Size or rating.
10. Panel exterior Layout Drawings to scale and shall indicate the following:
 - a. Panel materials of construction, dimensions, and total assembled weight.
 - b. Panel access openings.
 - c. Conduit access locations.
 - d. Front panel device layout.
 - e. Nameplate schedule:
 - 1) Nameplate location.
 - 2) Legend which indicates text, letter height and color, and background color.
 - 3) Short Circuit Current Rating (SCCR) marking per NFPA 70 or statement of exception. Include any required calculations.
 - f. Alarm annunciator window engraving schedule.
 - g. Layouts of graphic panels or mosaic displays.
11. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
 - a. Sub-panel or mounting pan dimensions.
 - b. Interior device layouts.
 - c. PLC/RTU general arrangement layouts.
 - d. Wire-way locations, purpose, and dimensions.
 - e. Terminal strip designations.
 - f. Location of external wiring and/or piping connections.
 - g. Location of lighting fixtures, switches and receptacles.
12. Wiring diagrams shall consist of the following:
 - a. Panel power distribution diagrams.
 - b. Control and instrumentation wiring diagrams.
 - c. PLC/RTU I/O information:
 - 1) Model number of I/O module.
 - 2) Description of I/O module type and function.
 - 3) Rack and slot number.
 - 4) Terminal number on module.
 - 5) Point or channel number.
 - 6) Programmed point addresses.
 - 7) Signal function and type.
 - d. Wiring diagrams shall identify each wire as it is to be labeled.

- B. Manufacturer catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and accessories.
- C. Electrical Load Calculations for Each Panel:
 - 1. Total connected load.
 - 2. Peak electrical demand for each panel.
- D. Climate Control Calculations for Each Panel.
 - 1. Verify that sufficient dissipation and/or generation of heat is provided to maintain interior panel temperatures within the rated operating temperatures of panel components.
- E. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Division 01 Specifications for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 - 2. See Section 13440.
- F. Informational Submittals:
 - 1. Record Drawings:
 - a. Updated panel drawings delivered with the panel(s) from the Contractor's factory.
 - b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Enclosures:
 - a. Hoffman Engineering Co.
 - b. Rittal.
 - c. Hammond Manufacturing.
 - d. Millbank Mfg. Co.
 - 2. Panel heaters:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - c. Hammond Manufacturing.
 - 3. Heat exchangers and air conditioners:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - c. Hammond Manufacturing.
 - 4. Cooling fans and exhaust packages:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - 5. Internal corrosion inhibitors:
 - a. Hoffman Enclosures, Inc.; Model A-HCI.
 - b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
 - c. Cortec Corporation; Model VpCI Emitting Systems.

2.2 ACCESSORIES

- A. Panel Nameplates and Identification: See Section 10400.

2.3 FABRICATION

- A. General:
 - 1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
 - 2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.

3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
 - a. Devices that cannot be obtained with an adequate NEMA rating shall be installed behind a transparent viewing window.
 - b. The window shall maintain the required NEMA rating of the enclosure.
4. Panel(s) shall be completely assembled at the Contractor's factory.
 - a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
5. Painting:
 - a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
 - 1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.
 - 2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
 - 3) Utilize solvent or chemical methods to clean panel surfaces.
 - 4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
 - 5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
 - 6) Bake powder coating at high temperatures to bond coating to enclosure surface.
 - a) Panel interior shall be white with semi-gloss finish.
 - b) Panel exterior shall be ANSI #61 gray with flat finish.
 - 7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
 - b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
6. Finish opening edges of panel cutouts to smooth and true surface conditions.
 - a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.
7. Panels shall meet all requirements of UL 508A or UL 698A.
 - a. If more than one (1) disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one (1) disconnect switch required to de-energize the equipment before servicing."
8. Provide control panel in accordance with NFPA 70, Article 409.
 - a. In the event of any conflict between NFPA 70, Article 409 and UL 508A or UL 698A, the more stringent requirement shall apply.
9. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - a. Determine the SCCR rating by one of the following methods:
 - 1) Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
 - 2) Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - 3) Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
 - b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.
 - c. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

B. Wall Mounted Panels:

1. Seams continuously welded and ground smooth.
2. Rolled lip around all sides of enclosure door opening.
3. Gasketed dust tight.
4. Door clamps and hasp/staple for padlocking.
5. Key doors alike.

6. Continuous heavy GA hinge pin on doors.
 - a. Hinges rated for 1.5 times door plus instrument weight.
 7. Front full opening door.
 8. Brackets for wall mounting.
- C. Internal Panel Wiring:
1. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip.
 - a. Route wiring within the panel in wire-duct neatly tied and bundled with tie wraps.
 - b. Follow wire-duct manufacturer's recommended fill limits.
 - c. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.
 - d. Wire-duct shall be constructed of nonmetallic materials with rating in excess of the maximum voltage carried therein.
 2. Wiring shall be installed such that if wires are removed from one (1) device, source of power will not be disrupted to other devices.
 3. Splicing and tapping of wires permitted only at terminal blocks.
 4. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire.
 - a. Protect bend area with sleeve.
 5. Arrange wiring neatly, cut to proper length, with surplus wire removed.
 - a. Arrange wiring with sufficient clearance.
 - b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
 6. AC circuits shall be routed separate from analog signal cables and digital signal cables.
 - a. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.
 7. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DEGC.
 - a. Conductor size shall be as required for load and 16 AWG minimum.
 - b. Internal panel wiring color code:
 - 1) AC circuits:
 - a) Power wiring: Black.
 - b) Control interconnections: Yellow.
 - c) Neutral: White.
 - d) Ground: Green.
 - 2) Low voltage DC circuits:
 - a) Power wiring: Blue.
 - b) Control interconnections: Violet.
 - 3) Foreign voltage circuits: Pink.
 - 4) Annunciator circuits: Red.
 - 5) Intrinsically safe circuits: Light Blue.
 8. Analog signal cables shall be of 600 V insulation, stranded copper, twisted-shielded pairs.
 - a. Conductor size: 18 AWG minimum.
 - b. Terminate shield drain conductors to ground only at one (1) end of the cable.
 9. High precision 250 ohm resistors with 0.25 PCT accuracy shall be used where 4 - 20 mA DC analog signals are converted to 1 - 5 VDC signals.
 - a. Resistors located at terminal strips.
 - b. Resistors terminated using individual terminal blocks and with no other conductors.
 - c. Resistor leads shall be un-insulated and of sufficient length to allow test or calibration equipment (e.g., HART communicator, loop calibrator) to be properly attached to the circuit with clamped test leads.
 10. Analog signals for devices in separate enclosures shall not be wired in series.
 - a. Loop isolators shall be used where analog signals are transmitted between control enclosures.

11. Wire and cable identification:
 - a. Wire and cables numbered and tagged at each termination.
 - b. Wire tags:
 - 1) Slip-on, PVC wire sleeves with legible, machine-printed markings.
 - 2) Adhesive, snap-on, or adhesive type labels are not acceptable.
 - c. Markings as identified in the Shop Drawings.
- D. Grounding Requirements:
 1. Equipment grounding conductors shall be separated from incoming power conductors at the point of entry.
 2. Minimize grounding conductor length within the enclosure by locating the ground reference point as close as practical to the incoming power point of entry.
 3. Bond electrical racks, chassis and machine elements to a central ground bus.
 - a. Nonconductive materials, such as paint, shall be removed from the area where the equipment contacts the enclosure.
 4. Bond the enclosure to the ground bus.
 - a. It is imperative that good electrical connections are made between the ground bus and enclosure.
 5. Panel-mounted devices shall be bonded to the panel enclosure or the panel grounding system by means of locknuts or pressure mounting methods.
 6. Sub-panels and doors shall be bonded to ground.
- E. Termination Requirements:
 1. Wiring to circuits external to the panel connected to interposing terminal blocks.
 2. Terminal blocks rigidly mounted on DIN rail mounting channels.
 3. Terminal strips located to provide adequate space for entrance and termination of the field conductors.
 4. One (1) side of each strip of terminal blocks reserved exclusively for the termination of field conductors.
 5. Terminal block markings:
 - a. Marking shall be the same as associated wire marking.
 - b. Legible, machine-printed markings.
 - c. Markings as identified in the shop drawings.
 6. Terminal block mechanical characteristics, and electrical characteristics shall be in accordance with NEMA ICS 4.
 7. Terminal blocks with continuous marking strips.
 - a. Each terminal block shall be identified with machine printed labels.
 8. Terminals shall facilitate wire sizes as follows:
 - a. 120 VAC applications: Conductor size 12 AWG minimum.
 - b. Other: Conductor size 14 AWG minimum.
 9. Analog signal cable shield drain conductors shall be individually terminated.
 10. Install minimum of 20 PCT spare terminals.
 11. Bladed, knife switch, isolating type terminal blocks where control voltages enter or leave the panel.
 12. Fused terminal blocks shall be used in the following circuits:
 - a. Control voltage is used to energize a solenoid valve.
 - b. DC power is connected to 2-wire, loop-powered instruments.
 13. Fused terminal blocks shall be provided with blown fuse indicators.
 14. When control circuits require more than one (1) field conductor connected to a single wiring point, a sufficient number of terminal points shall be connected internally to allow termination of only one (1) field conductor per terminal block.
 15. DIN rail mounting channels shall be installed along full length of the terminal strip areas to facilitate future expansion.
 16. Connections to devices with screw type terminals shall be made using spade-tongue, insulated, compression terminators.

- F. Component Mounting and Placement:
1. Components shall be installed per manufacturer instructions.
 2. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels where practical.
 3. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor, unless otherwise shown in the Contract Documents.
 4. PLC/RTU and I/O rack installation:
 - a. Located such that the LED indicators and switches are readily visible with the panel door open.
 - b. Located such that repair and/or replacement of component can be accomplished without the need to remove wire terminations or other installed components.
 5. Locate power supplies with sufficient spacing for circulation of air.
 6. Where components such as magnetic starters, contactors, relays, and other electromagnetic devices are installed within the same enclosure as the PLC/RTU system components, provide a barrier of at least 6 IN of separation between the “power area containing the electromagnetic devices” and the “control area”.
 7. Components mounted in the panel interior shall be fastened to an interior sub-panel using machine screws.
 - a. Fastening devices shall not project through the outer surface of the panel enclosure.
 8. Excess mounting space of at least 20 PCT for component types listed below to facilitate future expansion:
 - a. Fuse holders.
 - b. Circuit breakers.
 - c. Control relays.
 - d. Time delay relays.
 - e. Intrinsically safe barriers and relays.
 9. Components installed on sub-panels shall be provides with a minimum spacing between component and wire duct of 1 IN.
 - a. Minimum of 2 IN separation between terminal strips and wire ducts.
- G. Power Distribution:
1. Main incoming power circuits shall be protected with a thermal magnetic circuit breaker.
 - a. Limit load to maximum of 80 PCT of circuit breaker rating.
 2. Component types listed below shall be individually fused so that they may be individually de-energized for maintenance:
 - a. PLC/RTU power supply modules.
 - b. Single-loop controllers.
 - c. Recorders.
 - d. Alarm annunciators.
 3. Each control panel with PLC/RTU components shall be furnished with power protection in the form of a double conversion UPS.
 4. Equip each panel with necessary power supplies with ratings required for installed equipment and with minimum 25 PCT spare capacity.
 5. Constant voltage transformers, balancing potentiometers, and rectifiers as necessary for specific instrument requirements.
- H. Internal Panel Lighting and Service Receptacles:
1. Panels less than or equal to 4 FT wide:
 - a. One (1) electrical GFCI duplex receptacle.
 - b. One (1) LED light fixture with manual switch.
- I. Environmental Controls:
1. Outdoor panels:
 - a. Outdoor temperature range of 0 DEGF through 120 DEGF.
 - b. Thermostat controlled heaters to maintain temperature approximately 10 DEGF above ambient dew point for condensation prevention inside the panels.

- c. Thermostat controlled closed-loop heat exchangers or closed-loop air conditioners if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel.
- d. Internal corrosion inhibitors.
- 2. Environmental control components:
 - a. Panel heaters:
 - 1) Thermostat controlled.
 - 2) Fan driven.
 - 3) Components mounted in an anodized aluminum housing.
 - 4) Designed for sub-panel mounting.
 - 5) Powered from 120 VAC and protected with a dedicated circuit breaker.
 - b. Cooling fans and exhaust packages:
 - 1) Cooling fan with louver or grill and replaceable filter.
 - 2) Designed to be mounted within a panel cutout to provide positive airflow through the panel.
 - 3) Cooling fan and exhaust louvers shall be designed and listed to maintain a NEMA 12 enclosure rating.
 - 4) Fitted with replaceable, high-density foam or synthetic fiber.
 - 5) Cooling fan controlled with a separately mounted thermostat with bi-metal sensor and adjustable dial for temperature setting.
 - 6) Powered from 120 VAC and protected with a dedicated circuit breaker.
 - c. Heat exchangers and air conditioners:
 - 1) Dual-loop design to isolate panel interior air from exterior air.
 - 2) Thermostat controlled.
 - 3) Operate from 120 VAC and protected with a dedicated circuit breaker.
 - d. Internal corrosion inhibitors:
 - 1) Contains chemical which vaporizes and condenses on surfaces in the enclosure.
 - 2) Inhibitor shall be applied in accordance with manufacturer instructions for the enclosure volume.
 - 3) Inhibitor shall be applied in the panel(s) prior to shipment from the Contractor's factory.

2.4 MAINTENANCE MATERIALS

- A. Extra Materials:
 - 1. Quantity of 25 PCT replacement lamps for each type installed (minimum of 12 of each type).
 - 2. Minimum 12 replacement filters for each type installed.
 - 3. One (1) quart of exterior finish touch-up paint.
 - 4. One (1) complete set of replacement corrosion inhibitors in sealed packages for each panel.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. Scope: Inspect and test entire panel assembly to verify readiness for shipment.
- B. Location: Contractor's factory.
- C. Factory Tests:
 - 1. Tests shall be fully documented and signed by the Contractor's factory supervisor.
 - 2. The panel shop shall fully test the control panel for correct wiring.
 - a. Each I/O point shall be checked by measuring or connecting circuits at the field terminal blocks.
 - 3. Burn-in test: Panel(s) shall be fully energized for a minimum period of 48 HRS.
 - 4. A PLC Central Processing Unit (CPU) shall be obtained and connected to the panel(s) if necessary for testing purposes.

5. Testing equipment (such as digital multi-meters, analog loop calibrators, and laptop computers with PLC programming software) shall be used as required for testing.
6. The following functions shall be tested as a minimum:
 - a. Demonstrate functions of the panel(s) required by the Contract Documents.
 - b. Correctness of wiring from all panel field terminals to all I/O points and to all panel components.
 - c. Simulate and test each discrete signal at the field terminal strips.
 - d. Simulate and test each analog signal using loop calibrators.
 - e. Correct operation of communications between PLC system Central Processing Units (CPUs) and Remote I/O bases.
 - f. Correct operation of single-loop controllers (including digital communication to microprocessor based devices).
 - g. Correct operation of all digital communication devices.
 - h. Demonstrate online and offline diagnostic tests and procedures.
 - i. Notify the Engineer in writing a minimum of 15 calendar days prior to the Factory Tests.
 - 1) Engineer has the option to witness all required tests.
7. Make following documentation available to the Engineer at test site during the tests:
 - a. Contract Documents.
 - b. Factory Demonstration Testing procedures.
 - c. List of equipment to be testing including make, model, and serial number.
 - d. Shop Drawing submittal data for equipment being tested.
8. Deficiencies shall be corrected prior to shipment from the Contractor's factory.

3.2 INSTALLATION

- A. Install free-standing panels on 4 IN high concrete housekeeping pads.
- B. Obtain approved panel layouts prior to installation of conduits.
- C. Install products in accordance with manufacturer's instructions.

END OF SECTION

SECTION 13449

SURGE PROTECTION DEVICES (SPD) FOR INSTRUMENTATION AND CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Type IC3 SPD - Discrete 120 VAC control signal, control panel mounted.
 - 2. Type IC5 SPD - Analog instrumentation signal, control panel mounted.
 - 3. Type IC6 SPD - Combination 120 VAC circuit and analog signal, field mounted.
 - 4. Type IC7 SPD - Discrete low voltage control signal, control panel mounted.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 13440 - Instrumentation for Process Control: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. LS 1, Low Voltage Surge Protection Devices.
 - 3. Underwriters Laboratories, Inc. (UL):
 - a. 497B, Standard for Safety Protectors for Data Communications and Fire-Alarm Circuits.
 - b. 1283, Standard for Safety Electromagnetic Interference Filters.
 - c. 1363, Standard for Safety Relocatable Power Taps.
 - d. 1449, Standard for Safety Transient Voltage Surge Suppressors.
- B. Qualifications:
 - 1. Provide devices for a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
 - 2. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.3 DEFINITIONS

- A. Clamping Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.
- B. Let-Through Voltage: The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.
- C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

- D. Maximum Surge Current:
1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 PCT deviation of clamping voltage at a specified surge current.
 2. Listed by mode, since number and type of components in any SPD may vary by mode.
- E. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).
- F. Surge Current per Phase:
1. The per phase rating is the total surge current capacity connected to a given phase conductor.
 2. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
 - a. The N-G mode is not included in the per phase calculation.
- G. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 120 V system the L-N peak voltage is 170 V).

1.4 SUBMITTALS

- A. Shop Drawings:
1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 2. For named products, submit only a catalog cut sheet.
 - a. For all other products, submit the data required below.
 3. See Specification Section 13440.
 4. Product technical data for non-specified models:
 - a. Manufacturer's experience.
 - b. Standard catalog cut sheet.
 - c. Electrical and Mechanical Drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
 - d. Create a Product Data Sheet for each different model number of SPD provided.
 - 1) Data in the Product Data Sheet heading:
 - a) SPD Type per PART 2 of the Specification.
 - b) Manufacturer's Name.
 - c) Product model number.
 - 2) Data in the Product Data Sheet body:
 - a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
 - b) Column two: Manufacturer's certified value confirming the product meets the specified value/feature.
 - 3) Data in the Product Data Sheet closing:
 - a) Signature of the manufacturer's official (printed and signed).
 - b) Title of the official.
 - c) Date of signature.
- B. Contract Closeout Information:
1. Operation and Maintenance Data:
 - a. See Division 01 Specifications for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 WARRANTY

- A. The manufacturer shall provide a minimum of a five (5) year Limited Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers model numbers listed in the individual product paragraphs below are acceptable.

2.2 TYPE IC3 SPD

- A. Approved Products:
 - 1. EDCO DRS-130RMS.
 - 2. MTL MA-15/D/1/SI.
 - 3. MTL SD-150X.
 - 4. Phoenix Contact PT 2x1VA-120AC-ST (2839185) with PT BE/FM (2839282) base for non-isolated wiring.
 - 5. Phoenix Contact PT-2 PE/S-120 AC-ST (2839334 with PT-BE/FM (2839282) base for isolated wiring.
- B. Standards: UL 497B or UL 1449.
- C. Design:
 - 1. General:
 - a. Mounted internally to control panels for point-of-use loads.
 - b. Multi-stage hybrid solid state high performance suppression system.
 - c. Designed for series connection.
 - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
 - e. Field connection: Provide unit with external terminal screws for each phase, neutral and ground that will accept #14 through #12 conductors.
 - f. Device monitoring: Long-life, solid state, externally visible indicators that monitors the on-line status of the units suppression filter system or power loss in any of the phases.
 - 2. Operating voltage: 120 VAC.
 - 3. Operating current: 3 A minimum.
 - 4. Operating frequency: 45 to 65 Hz.
 - 5. Modes of protection: L-N; when ground conductor is present L-G and N-G.
 - 6. Maximum continuous operating voltage: Less than 130 PCT of system peak voltage.
 - 7. Maximum surge current: 6000 A per phase, 3000A per mode minimum.
 - 8. Minimum repetitive surge current capacity:
 - a. The SPD shall meet one (1) of the following:
 - 1) 1000 occurrences of a 200A, 10x1000 microsecond waveform.
 - 2) 400 occurrences of a 500A, 10x1000 microsecond waveform.
 - 3) 100 occurrences of a 400A, 10x700 microsecond waveform.
 - 4) 100 occurrences of a 2000A, 8x20 microsecond waveform.
 - 9. Maximum clamping voltages, measured from the zero voltage reference:
 - a. The SPD shall meet one (1) of the following:
 - 1) 400A, 10x700 microsecond waveform: 200 PCT of system voltage.
 - 2) IEEE B3 combination wave: 250 PCT of system voltage.
 - 3) IEEE B3 ring wave: 200 PCT of system peak voltage.
 - 4) IEEE A3 ring wave: 200 PCT of system peak voltage.
 - 5) Mode N-G clamping voltage may be 175 PCT higher than the L-G levels.

2.3 TYPE IC5 SPD

- A. Approved Products:
 - 1. Eaton DHW2P036.
 - 2. EDCO DRS-036 or PC642C-036 with PCB1B base.
 - 3. MTL SD32 or SD32X.
 - 4. Phoenix Contact PT 2x2-24DC-ST (2838228) with PT 2x2-BE (2838208) or PT 2x2+F-BE (2839224) base.
- B. Standards: UL 497B.

- C. Design:
 - 1. General:
 - a. Mounted internally to control panels for protection of equipment connected to analog signal loops.
 - b. Multi-stage hybrid solid state high performance suppression system.
 - c. Designed for series connection.
 - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
 - e. Field connection: The unit shall have external terminal screws for line and ground conductors.
 - 2. Operating voltage: 24 VDC or as indicated on the Drawings.
 - 3. Modes of protection: All modes, L-L and L-G.
 - 4. Maximum continuous operating voltage: Less than 130 PCT of system peak voltage.
 - 5. Maximum surge current: 10,000 A.
 - 6. Minimum repetitive surge current capacity:
 - a. The SPD shall meet one (1) of the following:
 - 1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
 - 2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.
 - 3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
 - 4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
 - 5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.
 - 7. Maximum clamping voltages, L-L:
 - a. The SPD shall meet one (1) of the following:
 - 1) 400A, 10x700 microsecond waveform: 400 PCT of system voltage.
 - 2) 10,000A, 8x20 microsecond waveform: 400 PCT of system voltage.
 - 3) IEEE B3 combination wave: 225 PCT of system voltage.
 - 8. Maximum clamping voltages, L-G:
 - a. The SPD shall meet one (1) of the following:
 - 1) 400A, 10x700 microsecond waveform: 200 PCT of system voltage.
 - 2) 10,000A, 8x20 microsecond waveform: 200 PCT of system voltage.
 - 3) IEEE B3 combination wave: 300 PCT of system voltage.

2.4 TYPE IC7 SPD

- A. Approved Products:
 - 1. Eaton DDIN Series.
 - 2. EDCO DRS Series.
 - 3. MTL SD Series.
 - 4. Phoenix Contact: PT Series.
- B. Standards: UL 497B.
- C. Design:
 - 1. General:
 - a. Mounted internally to control panels for protection of equipment connected to a discrete signal.
 - b. Multi-stage hybrid solid state high performance suppression system.
 - c. Designed for series connection.
 - d. Enclosure: Metallic or plastic, flange or DIN rail mounting.
 - e. Field connection: Provide unit with external terminal screws for line and ground conductors.
 - 2. Operating voltage: 24 VDC or 24 VAC or 120 VAC or as indicated on the Drawings.
 - 3. Modes of protection: All modes:
 - a. AC applications: L-N, L-G, N-G.
 - b. DC applications: Pos-Neg, Pos-Gnd, Neg-Gnd.
 - 4. Maximum continuous operating voltage: Less than 130 PCT of system peak voltage.
 - 5. Maximum surge current: 10,000 A.

6. Minimum repetitive surge current capacity:
 - a. The SPD shall meet one (1) of the following:
 - 1) 1000 occurrences of a 200A, 10 x 1000 microsecond waveform.
 - 2) 400 occurrences of a 500A, 10 x 1000 microsecond waveform.
 - 3) 100 occurrences of a 400A, 10 x 700 microsecond waveform.
 - 4) 100 occurrences of a 2000A, 8 x 20 microsecond waveform.
 - 5) 10 occurrences of a 10,000A, 8 x 20 microsecond waveform.
7. Maximum clamping voltages, L-L (Pos-Neg):
 - a. The SPD shall meet one (1) of the following:
 - 1) 400A, 10x700 microsecond waveform: 400 PCT of system voltage.
 - 2) 10,000A, 8x20 microsecond waveform: 400 PCT of system voltage.
 - 3) IEEE B3 combination wave: 250 PCT of system voltage.
8. Maximum clamping voltages, L-G:
 - a. The SPD shall meet one (1) of the following:
 - 1) 400A, 10x700 microsecond waveform: 200 PCT of system voltage.
 - 2) 10,000A, 8x20 microsecond waveform: 200 PCT of system voltage.
 - 3) IEEE B3 combination wave: 300 PCT of system voltage.

2.5 SOURCE QUALITY CONTROL

- A. Performance tests to be performed or independently verified by a certified testing laboratory.
- B. The SPD are to be tested as a complete SPD system including: Integral unit level and/or component level fusing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Type IC3 SPD:
 1. Provide on the following applications:
 - a. 120 V discrete RTU signals into a control panel from float switches, position switches, etc., where both the device and control panel are mounted outdoors and the control conductors are routed above grade or underground.
 2. Connected in series with the equipment.
 3. Provide fuse protection as recommended by manufacturer.
 4. Flange mount or DIN rail mount in control panel.
 5. Connect all SPDs in the panel to the same grounding point.
- C. Type IC5 SPD:
 1. Provide on the following applications:
 - a. Incoming 4-20mA signals into a control panel from transmitters (flow, level, etc.) where both the transmitter and control panel are mounted outdoors and the signal conductors are routed above grade or underground.
 2. Connect in series with the equipment.
 3. Flange mount or DIN rail mount in control panel.
 4. Connect all SPDs in the control panel to the same grounding point.
 5. Verify SPDs series resistance and capacitance does not interfere with the transmitters signal.
- D. Type IC7 SPD:
 1. Provide on the following applications:
 - a. Low voltage (e.g., 24 VAC, 24 VDC) discrete RTU signals into a control panel from float switches, position switches, etc., where both the device and control panel are mounted outdoors and the control conductors are routed above grade or underground.

2. Connect in series with the equipment.
3. Flange mount or DIN rail mount in control panel.
4. Connect all SPDs in the control panel to the same grounding point.

END OF SECTION

SECTION 13450

FLOW INSTRUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flow Transmitters: Magnetic Flow Meters (Inline).
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 13440 - Instrumentation for Process Control: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Gas Association (AGA):
 - a. Gas Measurement Committee Report #3.
 - 2. American Society of Mechanical Engineers (ASME):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. B16.5, Pipe Flanges and Flanged Fittings.
 - c. B626, Standard Specification for Welded Nickel and Nickel-Cobalt Alloy Tube.
 - d. PTC 19.5, Application of Fluid Meters, Part 2.
 - 3. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 4. American Water Works Association (AWWA).
 - 5. National Sanitation Foundation (NSF).
 - 6. US Department of Interior Bureau of Reclamation (USDIBR):
 - a. Water Measurement Manual.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification Section 13440.
- B. Operation and Maintenance Manuals:
 - 1. See Division 01 Specification for requirements:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

1.4 SYSTEM DESCRIPTION

- A. The instruments specified in this Specification Section are the primary element components for the control loops shown on the Drawings.
- B. These instruments are integrated with other control system components specified under Specification Section 13440 series to produce the functional control defined in the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

2.2 FLOW TRANSMITTERS

- A. Magnetic Flow Meters (Inline):
 - 1. Acceptable manufacturers:
 - a. ABB (WaterMaster).
 - b. Endress + Hauser (ProMag).
 - c. Krohne (OPTIFLUX).
 - d. Rosemount (8700 Series).
 - e. Siemens (SITRANS F M).
 - 2. Accessories:
 - 3. Design and fabrication:
 - a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
 - b. High input impedance pre-amplifiers.
 - 1) Minimum impedance: 10^{10} ohms.
 - c. Provide meters 30 IN and larger shall be AWWA mechanical coupling end connections rated for piping system operating and test conditions. Meter body shall be rated to same pressure as the flanges.
 - d. Grounding requirements:
 - 1) Nonmetallic or lined pipe:
 - a) Inlet and outlet grounding rings of same material as electrode or as recommended by manufacturer to meet process requirements.
 - 2) Conductive piping:
 - a) Conductive path between the meter and the piping flanges.
 - e. Provide cable between magnetic flow meter and transmitter.
 - 1) Cable shall be potted and fitted by manufacturer at the factory.
 - f. Pulsed DC magnetic field excitation.
 - g. Automatic zero.
 - h. Adjustable low flow cutoff.
 - i. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
 - j. Inaccuracy: ± 0.4 PCT of rate.
 - k. 4-20 mA DC HART isolated output into maximum 800 ohms.
 - l. Power supply: 117 V ± 10 PCT, 60 Hz.
 - m. Indication of flow rate and totalized flow at transmitter.
 - n. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
 - o. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.
 - p. All meters for drinking water service shall be NSF 61 certified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

3.2 TRAINING

- A. Provide on-site training in accordance with Specifications.

END OF SECTION

SECTION 13500

PROGRAMMABLE LOGIC CONTROLLER (PLC) CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Programmable logic controller (PLC) control system(s), including Hardware, software, programming, documentation, and training.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 10400 - Identification Devices.
 - 4. Section 16120 - Wire and Cable - 600 Volt and Below.
 - 5. Section 13502 - Computer Network and Human Machine Interface (HMI) Hardware.
 - 6. Section 13448 - Control System Equipment Panels and Racks.
 - 7. Section 13440 - Instrumentation for Process Control - Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C37.90.2, Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
 - b. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. ICS 1, Industrial Control and Systems General Requirements.
- B. Qualifications:
 - 1. Installation supervisor shall have had experience in overseeing installation and startup of at least three (3) similar installations within the last 5 years.
 - 2. Programmer(s) shall have had experience in programming PLCs for at least two (2) projects of similar size and complexity.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Annotated copies of complete PLC software programs.
 - 1) Provide one PDF-format file with fully annotated PLC code that can be read without the native configuration and programming environment on electronic media (DVD or USB drive).
 - 2) Provide written descriptions completely defining all function blocks used in program.
 - 3) Provide list of all addresses referenced in logic diagram with description of data associated with each address (Tag database).
 - b. Results of factory testing or simulation procedures.
 - c. Drawings containing the following information to be submitted as part of Specification Section 13448 (control panels) submittals:
 - 1) Arrangement Drawings for PLC system components.
 - 2) Panel and enclosure Plans, Sections and details.

- 3) Access opening locations and required clearances for each panel and enclosure.
 - 4) Enclosure internal wiring and terminal blocks.
 - d. DIP Switch and Jumper Settings, if applicable.
 - e. I/O Rack and I/O Module Layout.
 - f. Wiring and Interconnection diagrams.
 - 1) Power Supplies.
 - 2) I/O Points.
 - 3) Communications.
 - g. Catalog cut sheets containing information on PLC components to be submitted as part of these Specification Section submittals.
 - 3. Certifications:
 - a. Qualifications of installation supervisor.
 - b. Qualifications of programmer(s).
 - 4. Software Licenses:
 - a. Documentation proving all software package licenses are assigned to owner.
- B. Operation and Maintenance Data:
- 1. See Division 01 Specifications for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.
 - 2. Program Documentation.
 - a. Program Overview.
 - b. Program Listing.
 - c. I/O Listing.
 - d. Memory Map.
 - e. I/O Cross Reference.
 - 3. Submit maintenance procedures available to Owner.
 - a. Include the location and phone numbers of service centers (including 24 HR "hot lines").
 - b. Provide specific information including operation and maintenance requirements, programming assistance, troubleshooting guide, parts ordering, field service personnel requests, and service contracts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rockwell Automation: Allen-Bradley – Controllogix.
 - 2. Schneider Electric: Modicon – Unity.
 - 3. Siemens: SIMATIC – S7-1500.
 - 4. Emerson: ControlWave – Micro.
- B. Products nearing their "End of Life" shall not be used. "Used" hardware shall also not be used.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The PLC system shall accomplish the control requirements of the Loop Descriptions, Drawings, and Specifications.
- B. PLC programming shall be documented and factory tested.
- C. The PLC system shall operate in ambient conditions of 32 to 140 DEGF temperatures and 5 to 95 PCT relative humidity without the need for purging or air conditioning.
- D. Environmental Controls:
 - 1. Furnish circulation fans in solid state control system enclosures.

2. Over-temperature switches shall be utilized to provide special cooling if required to maintain operating temperatures within the manufacturer's specified range.
 3. Air conditioning applications shall include means of preventing moisture condensation.
- E. Where the PLC is utilized to control multiple trains of equipment and where the equipment in each train operates as a unit relatively independent of other equipment trains (e.g., facility with multiple boiler units or filter trains), the PLC components (I/O modules, power supplies, etc.) shall be assigned so that the failure of any one (1) component does not affect equipment on all trains.
1. I/O modules shall be segregated on a train basis unless required otherwise for safety reasons.
 2. Where several equipment units operate in parallel, but are not considered assigned to a particular equipment train (e.g., multiple raw water pumps or chemical feed pumps all discharging into a common system), the PLC I/O modules associated with each equipment unit shall be assigned so that the failure of any one (1) I/O module does not affect all of the parallel operating equipment units.

2.3 HARDWARE

- A. Processor shall include diagnostic indicators for power, mode, low battery, communications ports, and memory and I/O errors.
- B. I/O modules shall be capable of being replaced while under power.
- C. All I/O modules shall report to the CPU should a terminal block fail or be removed.
- D. Analog output modules shall have a resolution of at least 12 bits.
- E. Provide electric isolation between logic and field device.
- F. Field wiring shall not be disturbed when removing or replacing an I/O module.
- G. Power Supply Units:
 1. Electrical service to PLC system is 105 to 125 V, 60 Hz, +/- 10 PCT, 1 PH power.
- H. All PLC control system components shall be capable of meeting or exceeding electromagnetic interference tests per IEEE C37.90.2.
- I. Incorporate the following minimum safety measures:
 1. Watchdog function to monitor:
 - a. Internal processor clock failure.
 - b. Processor memory failure.
 - c. Loss of communication between processor and I/O modules.
 - d. Processor ceases to execute logic program.
 2. Safety function wiring: Emergency shutdown switches shall not be wired into the controller.
 3. Safe wiring:
 - a. Unless otherwise specified, activation of alarms and stopping of equipment shall result from the de-energization of control circuits, rather than the energization of control circuits.
 - b. Low voltage control signal wires:
 - 1) Place in conduit segregated for that purpose only.
 - 2) Twisted shielded wire pair.
 - 3) Not located in the same conduit or bundle with power wiring.
 4. Initial safety conditions:
 - a. Utilize program module to dictate output states in a known and safe manner prior to running of control program.
 - b. Utilize program each time PLC is re-initiated and the control program activated.

5. Monitoring of internal faults and display:
 - a. Internal PLC system status and faults shall be monitored and displayed.
 - 1) Monitored items shall include:
 - a) Memory ok/loss of memory.
 - b) Processor ok/processor fault.
 - c) Scan time overrun.
6. Control of programs: Protect access to PLC program loading with password protection or with locked, key operated selector switches.
 - a. Provide passwords and/or keys to owner at Substantial Completion.
7. Design PLC system with high noise immunity to prevent occurrence of false logic signals resulting from switching transients, relay and circuit breaker noise or conducted and radiated radio frequency interference.
8. Operator intervention:
 - a. Logic system failure shall not preclude proper operator intervention.
 - b. Safety shutdown of equipment or a system shall require manual operator intervention before the equipment or system operation may be reestablished.

2.4 SOFTWARE

- A. All software will be furnished and licensed to Owner.
 1. Once project is accepted as complete, transfer all licenses and media to Owner.
 2. All software must be latest edition and licensed to the Owner.
- B. Programming.
 1. Languages supported: All application programming in IEC 61131-3 compliant language.
 2. Program PLC utilizing ladder diagram, function block, or structured text format.
 3. Protect program via removable key switch or password to prevent unauthorized changes. Provide password and/or programming keys to owner.
 4. Capable of on-line and off-line programming.
- C. PLC program Structure.
 1. Clear, concise, well-annotated logic.
 2. Implement a modular design to allow specific functions to be replicated to ensure consistency.
 3. Program shall align with the control strategies. Include comments reflecting alignment with control strategies.
 4. Include named variables that reflect the actual use of the variable.
 5. Annotate program listing to include the following (using the features of the appropriate PLC programming software):
 - a. Clearly identified variables, I/O points, contacts, and analog values.
 - b. Written description of each functional area.
 - c. Written description of each rung's function.
 - d. Reference to control loop number for each rung where applicable.
 - e. Reference to instrumentation tag number of I/O devices for each rung where applicable.

2.5 COMPONENTS

- A. PLC System Central Processor Unit (CPU):
 1. CPU shall provide communications with other control systems and man-machine interfaces as specified.
 2. CPU shall include capability to modify logic via an Ethernet port without taking processor off line.
 3. Memory:
 - a. Battery-backed RAM.
 - b. Non-volatile program storage via flash EEPROM:
 - 1) Automatically download to RAM in the event RAM is corrupted.
 4. Memory battery backup shall be capable of 180 days memory retention with fresh battery.
 - a. Provide visual indication of battery status and alarm low battery voltage.

- b. Memory battery backup shall be capable of 28 days memory retention after the "Battery Low" indicating LED is on.
 - 5. Plug-in card designed to allow quick field replacement of faulty devices.
 - a. Provide unit designed for field replacement and expansion of memory without requiring rewiring or use of special tools.
 - 6. 20 PCT minimum spare useable memory capacity after all required programming is in place and operating.
 - 7. Capable of executing all control functions required by the Specifications and Drawings.
 - 8. Built-in three-mode (proportional-integral-derivative) control capabilities.
 - a. As directly selectable algorithms requiring no user knowledge of programming languages.
 - 9. Lighted status indicators for "RUN" and "FAILURE".
 - 10. Capable of manual or automatic control mode transfer from the operating console stations or from within the control strategy.
 - a. Transfer shall be bumpless and balanceless.
 - 11. Processor shall provide backup data storage via a USB connected device.
- B. Input/output (I/O) Modules:
- 1. Provide plug-in modular-type I/O racks with cables to connect to all other required PLC system components.
 - 2. Provide I/O system with:
 - a. I/O solid state boards with status lights indicating I/O status.
 - b. Electric isolation between logic and field device.
 - c. Capability of withstanding low energy common mode transient to 1000 V without failure.
 - d. Incorporate noise suppression design.
 - e. Capable of meeting or exceeding electrical noise tests, NEMA ICS 1-109.60-109.66.
 - f. Capable of being removed and inserted into the I/O rack under power, without affecting any other I/O modules in the rack.
 - g. Install 20 PCT spare I/O points for each type.
 - 3. Input/output connection requirements:
 - a. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the I/O enclosure.
 - b. Prewire I/O modules to terminal blocks.
 - c. Provide terminal blocks with continuous marking strip.
 - d. Size terminals to accommodate all active data base points and spares.
 - e. Provide terminals for individual termination of each signal shield.
 - f. Field wiring shall not be disturbed when removing or replacing an I/O module.
 - 4. Discrete I/O modules:
 - a. Interface to ON/OFF devices.
 - b. I/O status indicator on module front.
 - c. Voltage rating to match circuit voltage.
 - d. Output module current rating:
 - 1) Match maximum circuit current draw.
 - 2) Minimum 1.0 continuous A/point for 120 VAC applications.
 - e. Isolated modules for applications where one (1) module interfaces with devices utilizing different sources of power.
 - 5. Discrete outputs shall be fused:
 - a. Provide one (1) fuse per common or per isolated output.
 - b. Provide blown fuse indication.
 - c. External fusing shall be provided if output module does not possess internal fusing.
 - d. Fuses provided external to output model shall:
 - 1) Be in accordance with module manufacturer's specifications.
 - 2) Be installed at terminal block.
 - 6. Provide surge suppressors directly across the coils of all inductive devices which are energized by PLC outputs.

7. Analog I/O modules:
 - a. Input modules to accept signals indicated on Drawings or Specifications.
 - b. Minimum 12 bit resolution.
 - c. I/O chassis supplied power for powering connected field devices.
 - d. Differential inputs and outputs.
 - e. User configurable for desired fault-response state.
 - f. Provide output signals as indicated on Drawings and Specifications.
 - g. Individual D/A converter for each output module.
 - h. Individual A/D converter for each input module.
- C. Power Supply Units:
 1. Provide regulated power units:
 - a. Designed to operate with PLC system and shall provide power to:
 - 1) All components of PLC system.
 - 2) All two-wire field instruments.
 - 3) Other devices as indicated on Drawings or Specifications.
 - b. Capable of supplying PLC system when all of the specified spare capacity is utilized.
 - c. Each power supply shall be sized such that it will carry no more than 75 PCT of capacity under normal loads.
 2. Electrical service to PLC system is 105 to 125 V, 60 Hz, +1 PCT, 1 PH power.
 3. Separate AC circuit breakers shall be provided for each power supply.
 4. If the PLC system is field expandable beyond the specified spare capacity, and if such expansion requires power supply modification, note such requirements in the submittals and allow room for power supply modification in the PLC system enclosure.
 5. Capable of meeting or exceeding electrical noise tests, NEMA ICS 1-109.60-109.66.
 6. Power distribution:
 - a. Immune to transients and surges resultant from noisy environment.
 - b. Shall provide constant voltage level DC distribution to all devices.
- D. PLC System Enclosure:
 1. In accordance with Specification Section 13448 – Control Panels.
 2. Component placement:
 - a. Mount all controller components vertically within the enclosure to allow maximum convection cooling.
 - b. Either install power supplies above all other equipment with at least 10 IN of clearance between the power supply and the enclosure top, or adjacent to other components, but with sufficient spacing for circulation of cooling air.
 - c. Do not place I/O racks directly above the CPU or power supply.
 - d. Locate incoming line devices (isolation or constant voltage transformers, local power disconnects, surge suppressors, etc.) so as to keep power wire runs within an enclosure as short as possible.
 - e. If items such as magnetic starters, contactors, relays, and other electromagnetic devices must be located within the same enclosure as the PLC system components, place a barrier with at least 6 IN of separation between the magnetic area and the control area.
 - f. Place circulating fans close to major heat generating devices.
 - g. Segregate input/output modules into groups of identical type.
 3. Wiring and grounding to be in accordance with Specification Section 13448.
 4. Termination requirements:
 - a. In accordance with Specification Section 13448.
 - b. Make connections to I/O subsystem by terminating all field wiring on terminal blocks within the enclosure.
 - c. Prewire I/O modules to terminal blocks.
 - d. Size terminals to accommodate all active database points and spares.
 - e. Provide terminals for individual termination of each signal shield.
 - f. Field wiring shall not be disturbed when removing or replacing an I/O module.

- E. PLC System Software and Programming:
 - 1. Provide all hardware and programming required to provide communication between the PLC and the human-machine interface.
 - 2. Coordinate with HMI programmer to allow modification of all setpoint through the HMI utilizing appropriate security considerations.
 - 3. Provide programming to accomplish all control and monitoring requirements of the Drawings and Specifications.
 - 4. Full documentation capability.
 - 5. Online and offline programming.
 - 6. Offline simulation prior to download.
 - 7. Program over network capability.
 - 8. Two-step commands requiring PLC programmer verification prior to modification of any programming.

2.6 ACCESSORIES

- A. Provide all accessories required to install and test a complete PLC control system to accomplish the requirements of the Drawings and Specifications.
- B. Provide all programming cables required to configure the PLC logic.

2.7 SOURCE QUALITY CONTROL

- A. Provide a performance test after factory completion and prior to shipment.
 - 1. Conduct a test where the system is operated continuously and checked for correct operation including loop controls, displays, printing, keyboard functions, alarm responses, and on/off sequencing control.
 - 2. Conduct testing with simulated I/O to verify each control loop operation.
 - 3. Allow for Owner and Engineer representatives to witness program testing.
 - a. Provide minimum of 15 days notice prior to testing.
 - 4. Do not ship prior to successful completion of this testing program.

2.8 MAINTENANCE MATERIALS

- A. Furnish Owner with the following extra materials:
 - 1. One (1) spare I/O card of each card type for every 10 cards or fraction thereof installed.
 - 2. One (1) spare power supply.
- B. Include a complete bill of materials indicating detailed part model number.
- C. Include a complete set of all special tools required to install, maintain and test the PLCs.

PART 3 - EXECUTION

3.1 FUNCTIONALITY

- A. Complete System.
 - 1. Provide all programming, configuration, coordination, integration, and testing required for furnishing a fully functioning system.

3.2 FACTORY TESTING

- A. After assembly, wiring, configuration, and programming, and prior to shipment of the control system to the project site, verify system functionality by applying test signals to all input points and observing system response at output points.
- B. Submit a factory test report indicating how the system was tested and which items were tested.
- C. After Owner has had sufficient time to review the factory test report, provide an opportunity for Owner and Owner's technical representative to witness a factory acceptance test.
- D. Retain the system in test configuration until approval of the factory acceptance test.

3.3 INSTALLATION

- A. Install PLC control system in accordance with manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Employ and pay for services of equipment manufacturer's field service representative(s) to:
 - 1. Inspect equipment covered by these Specifications.
 - 2. Supervise adjustments and installation checks.
 - 3. Maintain and submit an accurate daily or weekly log of all commissioning functions.
 - a. All commissioning functions may be witnessed by the Engineer.
 - b. All reports shall be cosigned by the Contractor and the Engineer if witnessed.
 - 4. Conduct startup of equipment and perform operational checks.
 - 5. Provide Owner with a written statement that manufacturer's equipment has been installed properly, started up, and is ready for operation by Owner's personnel.

3.5 TRAINING

- A. Employee of the manufacturer or certified representative to provide up to 4 hours of operation and maintenance training at the Project site after the system has successfully undergone all field testing and acceptance procedures.
- B. As a minimum, training shall cover:
 - 1. Hardware overview.
 - 2. Software overview.
 - 3. Documentation.
 - 4. Maintenance.
 - 5. Trouble shooting.
 - 6. Operation, e.g., changing set points, passwords, etc.

3.6 DOCUMENTATION

- A. Update O&M manuals to reflect as-built conditions.

3.7 SUPPORT

- A. Provide on-call technical support for a period of one (1) year after substantial completion. Include a minimum of two site visits to work with Owner on any final modifications to the logic.

END OF SECTION

SECTION 13502

COMPUTER NETWORK AND HUMAN MACHINE INTERFACE (HMI) HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Computer network and HMI hardware requirements, which include, but are not necessarily limited to:
 - a. Panel Mounted OIT (Operator Interface Terminals).
 - b. Software.
- B. Related Specification Sections include, but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 13440 - Instrumentation for Process Control: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 802.3, Information Technology - Local and Metropolitan Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
 - 1) 802.3u: IEEE Standards for Local and Metropolitan Area Networks: Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation, Type 100BASE-T.
 - 2) 802.3x: IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex Operation.

1.3 DEFINITIONS

- A. HMI: Human Machine Interface.
- B. LCD: Liquid Crystal Display.
- C. OIT: Operator Interface Terminal.
- D. OPC: "OLE for Process Control", a software standard utilizing a client/server model that makes interoperability possible between automation/control applications and field systems/devices.
- E. PC: Personal Computer.
- F. RAID: Redundant Array of Independent Disks, a method of storing the same data in different places on multiple hard disks.
- G. RAM: Random Access Memory.
- H. SCSI: Short for Small Computer System Interface, a parallel interface standard used for attaching peripheral devices to computers.
- I. SDRAM: Synchronous Dynamic RAM.
- J. SNMP: Simple Network Management Protocol, a set of protocols for managing complex networks.
- K. TFT: Thin-Film Transistor, a technology for building LCD screens.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification Section 13440.
 - 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Division 01 Specifications for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 PANEL MOUNTED OPERATOR INTERFACE PANELS (OIT)

- A. Acceptable Manufacturers:
 - 1. Allen-Bradley Panel View Plus6.
 - 2. GE QuickPanel.
 - 3. Automation Direct C-More.
 - 4. Siemens.
- B. Provide Panel Mounted Operator Interface Panels (OITs) as shown on the Drawings and the Schedule herein.
- C. Design and Fabrication:
 - 1. Display: Color graphics.
 - 2. Touch screen.
 - 3. Size: Minimum 9".
 - 4. 120 VAC or 24 VDC power supply.
 - 5. Real time battery-backed clock, time stamp data.
 - 6. USB port for external data logging.
 - 7. Provide password protection to prevent unauthorized entries for a minimum of two (2) levels:
 - a. Authorization to operate.
 - b. Authorization to adjust setpoints.
 - 8. Operating temperature: 32 DEGF to 131 DEGF.
 - 9. Humidity: 10 to 90 PCT RH non-condensing.
 - 10. Configuration software:
 - a. Provide latest version of configuration software licensed to Owner.

2.2 SOFTWARE

- A. Provide all software and associated programming/configuration required to meet performance requirements of the Contract Documents.
 - 1. At substantial completion of the Project:
 - a. Turn current licenses for all software over to the Owner in the Owner's name and install the latest version, upgrade or service pack for all software.
 - b. Provide the respective software supplier's Comprehensive Support Contract for all software covering a full one (1) year warranty period following substantial completion which shall provide no cost software upgrades, service packs and tech support from the software supplier.
- B. HMI Software:
 - 1. Subject to compliance with the Contract Documents, the following HMI software packages are acceptable:
 - a. Wonderware System Platform.
 - b. Rockwell Automation Factory Talk View Site Edition.

- c. Rockwell Automation Factory Talk View Machine Edition.
 - d. Siemens Simatic WinCC.
 - e. GE Proficy HMI/SCADA iFIX.
 - 2. Development software:
 - a. Install development software on engineering workstation.
 - 3. Data Historian software:
 - a. Provide data historian software compatible with HMI software package.
 - 4. I/O capacity requirements:
 - a. As required to meet performance requirements of the Contract Documents.
 - b. Capable of handling an additional 20 PCT more points (future expansion) without impacting the license.
- C. All software must be latest edition and licensed to the Owner.

PART 3 - EXECUTION

3.1 DEMONSTRATION

- A. Demonstrate system in accordance with Specifications.

3.2 INSTALLATION AND CHECKOUT

- A. Provide installation and checkout in accordance with Specification Section 13440.

END OF SECTION



DIVISION 15

MECHANICAL



SECTION 15060
PIPE AND PIPE FITTINGS - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Utility piping systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
 - 4. Section 15060 - Pipe And Pipe Fittings: Basic Requirements.
 - 5. Section 15062 - Pipe – Ductile.
 - 6. Section 15064 - Pipe – Plastic.
 - 7. Section 15103 – Butterfly Valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
 - b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
 - c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
 - d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
 - 2. American Iron and Steel Institute (AISI).
 - 3. ASTM International (ASTM):
 - a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
 - c. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - d. A536, Standard Specification for Ductile Iron Castings.
 - e. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
 - f. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - g. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - h. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - i. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - j. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.
 - k. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - l. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 - 4. American Water Works Association (AWWA):
 - a. C200, Standard for Steel Water Pipe - 6 IN and Larger.

5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - d. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
6. Cast Iron Soil Pipe Institute (CISPI):
 - a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
 - c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
 - 1) Attach technical product data on gaskets, pipe, fittings, and other components.
- B. Contract Closeout Information:
 1. Operation and Maintenance Data:
 - a. See Specification Section 01300 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe coating during handling using methods recommended by manufacturer.
 1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit.
 1. Repair abrasions, scars, and blemishes.
 2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 PIPING SPECIFICATION SCHEDULES

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping Specification Schedules located at the end of PART 3 of this Specification Section.
- B. Valves:
 1. See schematics and details for definition of manual valves used in each system under 4 IN in size.
 - a. See Drawing Schedule for valve types 4 IN and above and for automatic valves used in each system.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

- A. Enter and exit through structure walls, floors, and ceilings by using penetrations as shown on Drawings.

- B. Laying Pipe-In-Trench:
 - 1. Excavate and backfill trench in accordance with Specification Section 02200.
 - 2. Clean each pipe length thoroughly and inspect for compliance to Specifications.
 - 3. Thoroughly cleaned and examined.
 - 4. Lay pipe in only suitable weather with good trench conditions.
 - a. Never lay pipe in water except where approved by Engineer.
 - 5. Seal open end of line with watertight plug if pipe laying stopped.
 - 6. Remove water in trench before removal of plug.
- C. Lining Up Push-On Joint Piping:
 - 1. Lay piping on route lines shown on Drawings.
 - 2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
 - 3. Observe maximum deflection values stated in manufacturer's written literature.
 - 4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
 - 5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

3.2 PIPING INSTALLATION

- A. Install piping in vertical and horizontal alignment as shown on Drawings.
- B. Enter and exit through structure walls, floor and ceilings using penetrations and seals as shown on the Drawings.
- C. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.
- D. Locate and size sleeves and castings required for piping system.
- E. Unions:
 - 1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
 - 2. Mechanical type couplings may serve as unions.
 - 3. Additional flange unions are not required at flanged connections.
- F. Install expansion devices as necessary to allow expansion/contraction movement.
- G. Provide full face gaskets on all Systems.
- H. Anchorage and Blocking:
 - 1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.
- I. Equipment Pipe Connections:
 - 1. Equipment - General:
 - a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
 - b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
 - c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
 - 1) Provide tightening torque in accordance with manufacturer's recommendations.
 - d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
 - e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
 - f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.

- g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
- h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
 - 1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
 - 2) Realign as necessary, install flange bolts and make equipment connection.
- i. Provide utility connections to equipment shown on Drawings, scheduled or specified.

3.3 FIELD QUALITY CONTROL

- A. Pipe Testing – in accordance with Section 02512:
 - 1. Bear the cost of all testing and inspecting, locating and remedying of failed tests and any necessary retesting and re-examination.
- B. Pressure Testing:
 - 1. Testing medium: Unless otherwise specified in the PIPING SPECIFICATION SCHEDULES, utilize the following test media.
 - a. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
All sizes	Pumped/Pressurized	50 PSIG or less	Water

- 2. Allowable leakage rates:
 - 1) Acceptable test head leakage rate for heads greater than 3 FT: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to the 1/2 power).

3.4 LOCATION OF BURIED OBSTACLES

- A. Furnish exact location and description of buried utilities encountered.
- B. Reference items to project stationing and offset.
- C. Include such information as location, elevation, coverage, supports and additional pertinent information.
- D. Incorporate information on "As-Recorded" Drawings.

END OF SECTION

SECTION 15062

PIPE - DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Ductile iron piping, fittings, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 15064 - Pipe – Plastic.
 - 5. Section 15103 – Butterfly Valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 2. ASTM International (ASTM):
 - a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - 3. American Water Works Association (AWWA):
 - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - b. C606, Standard for Grooved and Shouldered Joints.
 - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
 - c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - e. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
 - f. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - 5. Society of Automotive Engineers (SAE):
 - a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification Section 15060.
 - 3. Certification of factory hydrostatic testing.
 - 4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Flanged adaptors:
 - a. Rockwell Style 912 (cast).
 - b. Dresser Style 127 (cast).
 2. Compression sleeve coupling:
 - a. Rockwell Style 431 (cast).
 - b. Dresser Style 153 (cast).
 3. Mechanical coupling:
 - a. Victaulic (Style 31).
 - b. Tyler.
 4. Glass lining:
 - a. Ceramic Coating (Non-Stick Glass Lining).
 - b. Permutit (SG-14 Glass Lining).
 5. Insulating couplings:
 - a. Rockwell (Style 416).
 - b. Dresser (Style 39).
 6. Reducing couplings:
 - a. Rockwell (Style 415).
 - b. Dresser (Style 62).
 7. Transition coupling:
 - a. Rockwell (Style 413).
 - b. Dresser (Style 62).
 8. Polyethylene encasement tape:
 - a. Chase (Chasekote 750).
 - b. Kendall (Polyken 900).
 - c. 3 M (Scotchrap 50).
 9. Restrained joints:
 - a. American (Lock Fast) - 12 IN and below.
 - b. U.S. Pipe (TR-Flex) - 4 IN to 54 IN.
 - c. American (Lock Fast) - Above 12 IN.

2.2 MATERIALS

- A. Ductile Iron Pipe:
1. AWWA/ANSI C115/A21.15.
 2. AWWA/ANSI C150/A21.50.
 3. AWWA/ANSI C151/A21.51.
- B. Fittings and Flanges:
1. AWWA/ANSI C110/A21.10.
 2. AWWA/ANSI C115/A21.15.
 3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 PSI applications.
- C. Nuts and Bolts:
1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for buried application.
 2. Exposed: Mechanical galvanized ASTM B695, Class 40.
 3. Heads and dimensions per ASME B1.1.
 4. Threaded per ASME B1.1.
 5. Project ends 1/4 to 1/2 IN beyond nuts.
- D. Gaskets: See individual piping system requirements in Section 15060.

- E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.
- F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.
- G. See Piping Schedules in Section 15060.

2.3 MANUFACTURED UNITS

- A. Couplings:
 - 1. Flanged adaptors:
 - a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
 - 2. Compression sleeve coupling:
 - a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
 - b. Provide units specified in the MANUFACTURERS Article.
 - c. Supply flanges meeting standards of adjoining flanges.
 - d. The working pressure rating of the entire assembly shall be greater than or equal to the test pressure specified on piping schedule for each respective piping application.
 - e. Provide field coating for buried couplings per AWWA C203.
 - 3. Mechanical couplings:
 - a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 15060.
 - b. Utilize units defined in the MANUFACTURERS Article.

2.4 FABRICATION

- A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.
- B. Furnish cast parts with lacquer finish compatible with finish coat.
- C. Glass Lining:
 - 1. Minimum two-coat process.
 - a. Base coat heated to solidly fuse glass to pipe surface.
 - b. Subsequent coat(s) heated to form integral bond with preceding coat.
 - 2. Final finish parameters:
 - a. Thickness: 8-12 MILS.
 - b. Hardness: Above 5 on MOHS scale.
 - c. Density: 2.5-3.0 grams per cubic centimeter.
 - d. Metal to lining bonding: Capable of withstanding strain of 0.0001 IN/IN without damage to lining.
 - 3. Complete compatibility between fittings and piping.

2.5 LININGS AND COATINGS

- A. Where specified in piping schedule, provide linings to a minimum thickness of 40 MILS.

2.6 SOURCE QUALITY CONTROL

- A. Factory Test:
 - 1. Subject pipe to hydrostatic test of not less than 500 PSI with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Joining Method - Push-On Mechanical (Gland-Type) Joints:
 - 1. Install in accordance with AWWA/ANSI C111/A21.11.
 - 2. Assemble mechanical joints carefully according to manufacturer's recommendations.
 - 3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
 - 4. Do not overstress bolts.
 - 5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.
- B. Joining Method - Push-On Joints:
 - 1. Install in accordance with AWWA/ANSI C151/A21.51.
 - 2. Assemble push-on joints in accordance with manufacturer's directions.
 - 3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
 - 4. Assure the gasket groove is thoroughly clean.
 - 5. For cold weather installation, warm gasket prior to placement in bell.
 - 6. Taper of bevel shall be approximately 30 DEG with centerline of pipe and approximately 1/4 IN back.
- C. Joining Method - Flanged Joints:
 - 1. Install in accordance with AWWA/ANSI C115/A21.15.
 - 2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
 - 3. Make flange faces flat and perpendicular to pipe centerline.
 - 4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
 - 5. Allow one (1) flange free movement in any direction while bolts are being tightened.
 - 6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
 - 7. Gradually tighten flange bolts uniformly to permit even gasket compression.
- D. Joining Method - Mechanical Coupling Joint:
 - 1. Arrange piping so that pipe ends are in full contact.
 - 2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
 - 3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.
- E. Flange Adaptors 12 IN and Less:
 - 1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
 - 2. Drill holes not more than 1/8 IN larger than diameter of stud projection.
- F. Cutting:
 - 1. Do not damage interior lining material during cutting.
 - 2. Use abrasive wheel cutters or saws.
 - 3. Make square cuts.
 - 4. Bevel and free cut ends of sharp edges after cutting.
- G. Support exposed pipe in accordance with Section 15060.
- H. Install buried piping in accordance with Section 15060.
- I. Install restrained joint systems where specified in Section 15060 under specific piping system.

3.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 15060.

END OF SECTION

SECTION 15064

PIPE - PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Plastic pipe.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 15062 - Pipe – Ductile.
 - 5. Section 15103 – Butterfly Valves.

1.2 QUALITY ASSURANCE

- A. See Specification Section 15060.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. PVC (polyvinyl chloride) materials:
 - 1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2) D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.
 - 3) D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 6) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 7) F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 8) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 9) F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - 10) F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.
 - b. Installation:
 - 1) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 2. American Water Works Association (AWWA):
 - a. PVC (polyvinyl chloride) materials:
 - 1) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN through 48 IN, for Water Transmission and Distribution.
 - b. Polyethylene (PE) materials:
 - 1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.
 - 3. NSF International (NSF).

1.3 SUBMITTALS

- A. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
- B. See Specification Section 15060.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPING (EXPOSED)

- A. General:
 - 1. Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.
 - 2. Furnish materials in full compliance to following material specifications:
 - a. Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.
 - b. Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.
- B. Pipe:
 - 1. Furnish pipe meeting requirements of ASTM D1785.
 - 2. Pipe 2 IN and less to be solvent welded.
 - 3. Pipe larger than 2 IN may be either flanged or solvent welded unless shown otherwise on Drawings.
- C. Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.
- D. Flanges/Unions:
 - 1. Furnish flanges and unions at locations shown on Drawings.
 - 2. Provide either flanges or unions at valves, penetrations through structures and equipment connections.
 - 3. For pipe larger than 2 IN, provide 150 LB socket type PVC flange.
 - 4. For pipe 2 IN and less, provide socket type PVC union with Buna O-rings.
 - 5. Use flat, full faced natural rubber gaskets at flanged connections.
 - a. Furnish heavy hex head bolts, each with one (1) heavy hex nut, ASTM F593 Type 316 stainless steel.
 - 6. Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.
- E. Installation:
 - 1. Field threading PVC will not be permitted.
 - a. Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.
 - b. Female adapters are not acceptable.
 - 2. Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.
 - a. Continuously support PVC piping at liquid operating temperatures in excess of 100 DEGF.
 - b. For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.
 - c. Support riser clamps on spring hangers.
 - d. Do not clamp PVC tightly or restrict movement for expansion and contraction.

2.2 PRESSURE PIPING (UNDERGROUND)

- A. Materials: Furnish materials in full compliance with following requirements:
 - 1. 1/2-3 IN: AWWA C901 PE with Pressure Class of 100 PSI.

2. 4-20 IN: AWWA C900 PVC with Pressure Class of 100 PSI.
3. 24-60 IN: AWWA C900 PVC -DR-51 80 PSI.
4. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.
5. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than pipe pressure rating meeting performance requirements of ASTM D3139.

B. Installation:

1. Field threading of PVC pipe will not be permitted.
2. Perform installation procedures, handling, thrust blocking, connections, bell restraints and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

2.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

A. Materials:

1. Furnish materials in full compliance to the following material specification.
2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C as described in specification ASTM D1784.
3. The requirements of this Specification are intended to provide for pipe and fittings suitable for non-pressure drainage of wastewater and surface water.
4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of ASTM D3212.
5. Supply to the Engineer all information and sample of joining method for his evaluation.
 - a. Only jointing methods acceptable to the Engineer will be permitted.
6. Provide pipe and fittings meeting or exceeding the following requirements:
 - a. 4-27 IN DIA: ASTM D3034 and ASTM F679, SDR 35.
 - b. 8-30 IN DIA: ASTM F794.
 - c. 4-18 IN DIA: ASTM F949.
7. Ensure impact strengths and pipe stiffnesses in full compliance to these Specifications.

B. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.

1. Provide for a maximum deflection of not more than 3 PCT.

2.4 PVC TUBING

A. General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.

B. Materials:

1. Furnish clear outer braided tubing with braid outside the walls.
2. Have tubing manufactured of nylon with working temperatures from 5 to 180 DEGF.
3. Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.
4. Provide tubing with working pressure of 75 PSI at 180 DEGF.
5. Ensure that tubing is self-extinguishing and fire resistant.

C. Fittings:

1. Install tubing with nylon fittings and connectors.
2. Use barbed type adapters with stainless steel clamps.
3. Provide fittings capable of withstanding temperatures from a -70 to 250 DEGF.
4. Ensure fittings have the same pressure and temperature rating as the tubing.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.

1. Include manufacturer's name and trademark.

2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding Performance Specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING (UNDERGROUND)

- A. Installation:
1. Field threading of PVC pipe will not be permitted.
 2. Perform installation procedures, handling, thrust blocking, connections, restraint systems and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PVC DRAINAGE, SEWER PIPING AND UNDERGROUND AIR DUCTS

- A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.
1. Provide for a maximum deflection of not more than 3 PCT.
- B. Infiltration and Exfiltration:
1. The maximum allowable infiltration measured by test shall not exceed 100 GAL/IN of pipe diameter per mile per 24 HRS.
 2. For exfiltration, all the pipe and fittings shall exceed performance requirements by the test procedure as specified in Section 15060.
 3. Observe full instructions of the Engineer for carrying of testing procedures.
 - a. Perform tests only during presence of the Engineer or his authorized representative.
 4. Should any test on any section of pipe line disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.
- C. Deflection:
1. After backfilling, each section of pipe shall be checked for deflection by pulling a mandrel through the pipe.
 2. Pipe with deflection exceeding 5 PCT of the inside diameter shall have backfill removed and replaced to provide a deflection of less than 5 PCT.
 3. Any repaired pipe shall be retested.

3.4 PVC TUBING

- A. Fittings:
1. Install tubing with nylon fittings and connectors.
 2. Use barbed type adapters with stainless steel clamps.
 3. Provide fittings capable of withstanding temperatures from a -70 to 250 DEGF.
 4. Ensure fittings have the same pressure and temperature rating as the tubing.
- B. Trays:
1. Flat smoothed bottom tray for supporting flexible hoses when there is a chance that the hoses may pulse or move; specify a flat smoothed bottom tray.

END OF SECTION

SECTION 15103 BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Butterfly valves.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
 - 4. Section 15062 - Pipe – Ductile.
 - 5. Section 15064 - Pipe – Plastic.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.
 - 2. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. A276, Standard Specification for Stainless Steel Bars and Shapes.
 - d. A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
 - e. A436, Standard Specification for Austenitic Gray Iron Castings.
 - f. A536, Standard Specification for Ductile Iron Castings.
 - 3. American Water Works Association (AWWA):
 - a. C504, Standard for Rubber-Seated Butterfly Valves.
 - 4. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
 - a. SP-67, Butterfly Valves.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. For valves 8 IN and larger, furnish "Affidavit of Compliance" with Owner in accordance with AWWA C504.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Specification Section 01300 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. DeZurik.
 - 2. Clow.

3. Mueller/Linseal.
4. Pratt a Mueller Water Company.
5. Bray.
6. Pentair/Keystone.

2.2 HIGH PERFORMANCE BUTTERFLY VALVES:

- A. In locations where reliability is critical, for automated valves that modulate for flow control or actuate periodically in intervals less than 2 HRS, high performance butterfly valves with an offset disc design shall be used.
- B. Design Requirements:
 1. One-piece shaft.
 2. Separate shaft seal.
 3. Minimum shaft diameter to conform to AWWA C504, Class 150B.
- C. Materials of construction:
 1. Disc: 316 stainless steel.
 2. Shaft and pins: 17-4PH stainless steel or 316 stainless steel.
 3. Seals:
 - a. Water: PTFE.
 - b. Process air and high temperature: Graphite rings.
 4. Backing ring: Stainless steel.
 5. Bushings/Bearings: TFE/Glass liner with a 316 Stainless steel shell.
 6. Seat:
 - a. Two part with encapsulated RTFE or PTFE.
 - b. Seat Retainer: Stainless Steel.
 - c. Or Stainless Steel.
 7. End connection: Lugged valves may be used.

2.3 GENERAL USE BUTTERFLY VALVES

- A. For use in all location, except where high performance butterfly valves are required.
- B. Comply only with AWWA C504, as noted in this Specification Section.
- C. Materials:
 1. Valve bodies:
 - a. ASTM A126, Class B or ASTM A536 Grade 65-45-12 ductile iron.
 - b. Wafer valves may be constructed of ASTM A48, Class 40 cast iron.
 2. Valve shafts:
 - a. One-piece stainless steel, Type 304.
 - b. Pins: 304 stainless steel.
 - c. Bushings/Packing/O-rings: EPDM, RTFE or TFE.
 - d. Bearings: Reinforced TFE or equal.
 3. Valve discs:
 - a. Cast iron with welded nickel edge or 304 Stainless Steel disk.
 4. Valve seats:
 - a. Water: EPDM or Hycar.
 - b. Compressed air: Teflon, PTFE.
 - c. Process air: Viton, RTFE, rate for 300 DEGF minimum or higher if required by service.
 5. Shaft bearing: Bronze, TFE-coated stainless steel or reinforced TFE.
 6. Shaft seal in addition to any sealing provided by seat: Suitable synthetic rubber rings or PTFE V-ring suitable for operating conditions.
- D. Design Requirements:
 1. Seat type: Resilient.
 2. Body type:
 - a. Wafer Lug (laying length may vary from AWWA C504).

- b. Equip wafer type with fully tapped anchor lugs drilled per ASME B16.5.
- 3. Direct buried valves:
 - a. All valves: Working pressure rated for 150 PSI (Class 150B per AWWA C504).
- 4. Shaft diameter: One-piece constant diameter.

2.4 ACCESSORIES

- A. Refer to Drawings and/or valve schedule for type of actuators.
 - 1. Furnish actuator integral with valve.
- B. Valve Flange Seal Rings:
 - 1. If Steel Slip-on flanges are being used on the process piping, flange seals will be required for proper installation of valves.

PART 3 - EXECUTION (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 15115

FLAP GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Flap gates.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 318, Code Requirements for Structural Concrete.
 - 2. ASTM International (ASTM):
 - a. A240/A-276, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - b. D2000, Standard Classification System for Rubber Products in Automotive Applications.
 - c. D4020,
 - d. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - e. F594, Standard Specification for Stainless Steel Nuts.
 - 3. ICC Evaluation Service (ICC-ES):
 - a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 - b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- B. Anchor Designer and Installer Qualifications:
 - 1. Anchor designer shall be a Professional Structural Engineer licensed in the State of Nebraska.
 - 2. Installer shall be trained by the manufacturer or certified by a training program approved by Engineer.
 - 3. Installer for adhesive anchors installed in horizontal, upward incline, or overhead applications shall be certified by ACI-CRSI Adhesive Anchor Installation Certification Program.
- C. Post-Installed Anchors and Related Materials Shall be listed by the Following Agencies:
 - 1. ICC-ES.
- D. Field verify existing gate anchorage pattern, spacing and all other required information for application.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product Data:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Submittal for Gates:
 - 1) Manufacturer's installation instructions.
 - 2) Scaled or dimensions fabrication and/or layout Drawings.
 - 3) Gate weight.

- 4) Details of frame anchorage requirements.
- c. Submittal for Anchors:
 - 1) Manufacturer's installation instructions.
 - 2) Manufacturer material data sheet.
 - 3) Current ICC-ES AC308 report indicating the following:
 - a) Performance data showing the anchor is approved for use in cracked concrete.
- d. Anchorage layout Drawings and details:
 - 1) Indicate anchor diameter, embedment, length, anchor type, material and finish.
 - 2) Scaled or dimensioned drawings showing location, configuration, spacing and edge distance.
- e. Contractor Designed Post-Installed Anchors:
 - 1) Show diameter and embedded depth of each anchor.
 - 2) Indicate compliance with ACI 318 Appendix D.
 - 3) Design tension and shear loads used for anchor design.
 - 4) Engineering design calculations:
 - a) Indicate design load to each anchor.
 - b) Include calculations to develop anchor forces based on Design Criteria listed herein.
 - c) Sealed and signed by Contractor's Professional Structural Engineer.
3. Written documentation that existing frame anchorage locations have been field verified and that new frame anchorage locations have been designed to miss existing anchorage left imbedded in the wall.
- B. Informational Submittals:
 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 2. Documentation of final gate closure adjustment on manufacturer's letterhead.
 3. Documentation defining training program related to post-installed anchor installation.
 4. Certification of qualifications for each installer of post-installed anchors.
 - a. Indicate successful completion or certification of each type of approved post-installed anchor.
 - b. Provide one of the following for each type of anchor:
 - 1) Letter from manufacturer documenting successful training completion.
 - 2) Certificate of completion for Engineer approved program.
- C. Operation and Maintenance Manuals:
 - a. See Section 01300 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.4 EXISTING CONDITIONS

- A. Existing flap gate weight is approximately 5,000 LBS each.
- B. A Drawing of the existing flap gates taken from the original Contract Drawings titled Phase III South Interceptor Sewer No. 2182 is included as Appendix A to this Specification Section. This Drawing is provided for general information purposes only.
- C. This work involves replacement of existing flap gates. Existing headwall will be maintained and new flap gates will be installed to replace existing units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Flap Gates:
 - a. Fontaine-Aquanox (Series 70).
 - b. Waterman (Model SSF-43).

- c. No substitutions or “or approved equals.”
- 2. Post-installed adhesive anchors:
 - a. HILTI.
 - 1) HIT RE 500 V3 (ICC ESR-3814).
 - 2) No substitutions or “or equal”.
- 3. Non-Shrink Grout:
 - a. BASF Admixtures, Inc. “Masterflow,” 713 IN.
 - b. Euclid Chemical “NS Grout.”
 - c. Sika Corporation “Sika Grout,” 212 IN.
 - d. Sauereisen, Inc. “F-100 Level Fill Grout.”
 - e. Or approved equal.
- 4. Epoxy Grout:
 - a. BASF “Masterflow,” 648 IN.
 - b. Five Start Products, Inc. “DP Five Start Epoxy Grout.”
 - c. Euclid Chemical “E3-G.”
 - d. Sika “Sikadur Hi-Mod.”
 - e. Or approved equal.

2.2 DESIGN CRITERIA

- A. Flap Gates-General:
 - 1. Each gate shall be sized to fit the inside opening of one side of the Leavenworth Outfall Dual Box Sewer discharge location: Approximate 10 FT (120 IN) vertical x 8 FT–4 IN (100 IN) horizontal.
 - a. See the Drawing referenced in Section 1.4.B above.
 - 2. Non-floating design with single cover plate reinforced to withstand the specified seating head without distortion.
 - 3. Minimum design seating head above the bottom of the gate cover: 30 FT.
 - 4. Body: Structural members or formed plate welded to for a rigid one-piece frame.
 - 5. Frame: Flange back design suitable for mounting on an existing concrete wall.
 - 6. Cover: Structural members or formed plate adequately reinforced to withstand the minimum specified design seating head without distortion.
 - 7. Hinge Linkage: Adjustable double pivot joints per linkage to permit full seating and full opening with adjustment in the lower pivot to limit rotation to prevent cover from getting wedged in the open position and an upper adjustment to adjust the gate sensitivity to the unseating head.
 - 8. Designed to close and seal when head in river exceeds conduit water level.
 - 9. Designed to open when head in conduit exceeds river level.
- B. Post Installed Concrete Anchors:
 - 1. Provide anchors with design capacity to resist the calculated load based on requirements given in the Building Code, ACI 318, Appendix D and current ICC-ES report, for the anchor to be used.
 - 2. Design assuming cracked concrete.

2.3 MATERIALS

- A. Flap Gates:
 - 1. Fontaine-Aquanox:
 - a. Frame and cover: 304L stainless steel, ASTM A240.
 - b. Hinge arm: 304L stainless steel, ASTM A240.
 - c. Hinges: 304L stainless steel, ASTM A240.
 - d. Hinge pin: 304L stainless steel, ASTM A240/A-276.
 - e. Hinge bushing: UHMWPE, ASTM D4020.
 - f. Frame seal: EPDM, ASTM D2000.
 - g. Assembly and mounting hardware including post installed adhesive anchor rods and nuts: 316 stainless steel, ASTM F593 and ASTM F594.

2. Waterman:
 - a. Frame and cover: 304L stainless steel, ASTM A240 A-276.
 - b. Hinge link: 304L stainless steel, ASTM A240/A-276.
 - c. Hinge pin: 304L stainless steel, ASTM A240/A-276.
 - d. Hinge bushing: Bronze.
 - e. Frame seal: Neoprene, ASTM D2000.
 - f. Assembly and mounting hardware including post installed adhesive anchor rods and nuts: 316 stainless steel, ASTM F593 and ASTM F594.
- B. Non-Shrink Grout:
 1. Non-shrink, nonmetallic, noncorrosive, and non-staining.
 - a. Conform to ASTM C1107.
 2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
 3. Grout to produce a positive but controlled expansion.
 - a. Mass expansion shall not be created by gas liberation or by other means.
 4. Minimum 28 day compressive strength: 7,000 PSI.
- C. Epoxy Grout:
 1. Three-component epoxy resin system:
 - a. Two (2) liquid epoxy components.
 - b. One (1) inert aggregate filler component.
 2. Aggregate manufacturer shall be the same as the adhesive manufacturer.
 3. The aggregate shall be compatible with the adhesive.
 4. Each component furnished in separate package for mixing at jobsite.

2.4 FLAP GATE FRAME FABRICATION

- A. Fabricate frame with anchorage pattern arrangement that is coordinated with existing frame anchorage pattern such that new anchors do not conflict with existing anchors that have been cut off and remain embedded in the wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation, inspect and verify areas and conditions into which concrete anchorage is to be installed.
 1. Notify Engineer of conditions detrimental to proper and timely completion of work.
 2. Do not proceed with work until satisfactory conditions have been corrected in a matter acceptable to the Engineer.
- B. Special Inspection is required in accordance with the Building Code for all concrete anchorage.
 1. Notify Owner's Service Provider that an inspection is required prior to post-installed anchorage installation.
- C. Take all necessary precautions to protect the adjacent facilities and structures from damage.
- D. Saw cut and remove ends of all existing anchorage.
- E. Remove by drilling the exposed anchor heads to a depth of 1 1/2 IN from the face of the concrete wall and patch holes with epoxy grout.
- F. Prepare surface of existing concrete wall to a tolerance of 1/8 IN to provide a full seal of flap gate frame against concrete.
 1. Prepare by either grinding concrete (maximum 1/4 IN) or adding layers of non-shrink grout to maximum thickness of 1 1/2 IN.

3.2 INSTALLATION

- A. See Specification Section 01060 – Special Conditions for scheduling of work.

- B. Anchor manufacturer's certified field representative shall demonstrate the proper installation procedures for anchor installation and shall observe the Contractor's installation of a minimum of four anchors.
- C. Extend threaded anchorage a maximum of 3/4 IN and a minimum of 1/2 IN above the top of the fully engaged nut.
 - 1. If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.
- D. After nuts are snug-tightened down:
 - 1. Install in accordance with manufacturer's printed installation instructions and manufacturer's installation procedures.
 - 2. Upset threads of anchorage to prevent nuts from backing off.
 - a. Provide double nut or lock nut in lieu of upset threads for items that may require removal in the future.
 - 3. If two (2) nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two (2) nuts together.
- E. Comply with the manufacturer's printed installation instructions on the hole diameter and depth required to fully develop the tensile strength of the anchor.
 - 1. Use hammer drills to create holes.
 - 2. Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Owner's Testing Agency.
- F. Provide washers for all anchorage.

3.3 FIELD QUALITY CONTROL

- A. Owner's Service Provider shall inspect and document installation of gate anchorage in accordance with ACI-CRSI Adhesive Anchor Installation Certificate Program.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Certified Manufacturer's Representative shall visit the site for final adjustment of gate closure.

END OF SECTION



DIVISION 16

ELECTRICAL



SECTION 16010

ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Basic requirements for electrical systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16120 - Wire and Cable - 600 Volt and Below.
 - 4. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM, Aluminum Design Manual.
 - 2. American Institute of Steel Construction (AISC):
 - a. Steel Construction Manual.
 - 3. American National Standards Institute (ANSI).
 - 4. ASTM International (ASTM):
 - a. A36/A36M, Standard Specification for Carbon Structural Steel.
 - b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C2, National Electrical Safety Code (NESC).
 - 6. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 7. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 8. Underwriters Laboratories, Inc. (UL).
- B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.
 - 1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
 - 2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
 - 1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
 - 2. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of submittal process.
 - 2. General requirements:
 - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
 - b. Include data sheets that include manufacturer's name and product model number.
 - 1) Clearly identify all optional accessories.
 - c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
 - d. Manufacturer's delivery, storage, handling and installation instructions.
 - e. Product installation details.
 - f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
 - g. See individual Specification Sections for any additional requirements.
- B. Operation and Maintenance Manuals:
 - 1. See Specification Section 01300 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content process of Operation and Maintenance Manuals.
- C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Division 01 Specifications and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. See Division 01 Specifications.
- B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
 - 1. Outdoor areas: Wet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.
- B. Submit request for substitution in accordance with Division 01 Specifications.
- C. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

- A. Electrical Equipment Support Pedestals and/or Racks:
 - 1. Manufacturers:
 - a. Modular strut:
 - 1) Unistrut Building Systems.
 - 2) B-Line by Eaton.
 - 3) Globe Strut.
 - 4) Superstrut by Thomas & Betts.
 - 2. Material requirements:
 - a. Modular strut:
 - 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.

- 2) Stainless steel: AISI Type 316.
 - b. Structural members (e.g., I beams, L and C channels):
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - c. Mounting plates:
 - 1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
 - d. Mounting hardware:
 - 1) Galvanized steel.
 - 2) Stainless steel.
- B. Field touch-up of galvanized surfaces.
- 1. Zinc-rich primer.
 - a. One coat, 3.0 MILS, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.
- B. Install equipment in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. IEEE C2.
 - 3. The manufacturer's instructions.
- C. In general, conduit routing is not shown on the Drawings.
 - 1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
 - 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- D. When complete branch circuiting is not shown on the Drawings:
 - 1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
 - 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
 - 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
 - 4. See Specification Section 16120 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- F. Install equipment plumb, square and true with construction features and securely fastened.
- G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.

- I. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
 - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 IN in equipment location with the Engineer's approval.
 - a. Changes in equipment location exceeding those defined above require the Engineer's approval.
- J. Provide electrical equipment support system per the following area designations:
 - 1. Wet areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
- K. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
 - 1. Do not cut, or weld to, building structural members.
 - 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- L. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.
- M. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- N. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
- O. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- P. Identify electrical equipment and components.
- Q. Provide field markings and/or documentation of available short-circuit current (available fault current) and related information for equipment as required by the NFPA 70 and other applicable codes.
- R. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - 1. Determine the SCCR rating by one of the following methods:
 - a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
 - b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
 - 2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
 - 3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

- A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
- B. Replace equipment and systems found inoperative or defective and re-test.

- C. Cleaning: See Division 01 Specifications.
- D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
 - 1. Repair galvanized components utilizing a zinc rich paint.
 - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 3. Repair surfaces which will be inaccessible after installation prior to installation.
 - 4. See Specification Section 16130 for requirements for conduits and associated accessories.
- E. Replace nameplates damaged during installation.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for grounding and bonding system(s).
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical - Basic Requirements.
 - 4. Section 16120 - Wire and Cable - 600 Volt and Below.
 - 5. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 467, Grounding and Bonding Equipment.
- B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 01 Specifications for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data.
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Grounding clamps, terminals and connectors.
 - 2) Exothermic welding system.
 - b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Ground rods and bars and grounding clamps, connectors and terminals:
 - a. ERICO by Pentair.
 - b. Harger Lightning & Grounding.
 - c. Heary Bros. Lightning Protection Co. Inc.
 - d. Burndy by Hubbell.
 - e. Robbins Lightning, Inc.

- f. Blackburn by Thomas & Betts.
- g. Thompson Lightning Protection, Inc.
- 2. Exothermic weld connections:
 - a. ERICO by Pentair - Cadweld.
 - b. Harger Lightning & Grounding - Ultraweld.
 - c. Burndy by Hubbell - Thermoweld.
 - d. FurseWELD by Thomas & Betts.

2.2 COMPONENTS

- A. Wire and Cable:
 - 1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
 - 2. Insulated conductors: Color coded green, per Specification Section 16120.
- B. Conduit: As specified in Specification Section 16130.
- C. Ground Rods:
 - 1. 3/4 IN x 10 FT.
 - 2. Copper-clad:
 - a. 10 MIL minimum uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bond between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.
- D. Grounding Clamps, Connectors and Terminals:
 - 1. Mechanical type:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - 2. Compression type for interior locations:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Terminals for connection to bus bars shall have two bolt holes.
 - 3. Compression type suitable for direct burial in earth or concrete:
 - a. Standards: UL 467, IEEE 837.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Factory filled with oxide inhibiting compound.
- E. Exothermic Weld Connections:
 - 1. Copper oxide reduction by aluminum process.
 - 2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install products in accordance with manufacturer's instructions.
 - 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
 - 3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. After connection, apply manufacturers approved touch-up paint to protect metallic surface from corrosion.
 - 4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves.
 - a. Seal the sleeve interior to stop water penetration.
 - 5. Do not splice grounding electrode conductors except at ground rods.

6. Install ground rods and grounding electrode conductors in undisturbed, firm soil.
 - a. Provide excavation required for installation of ground rods and conductors.
 - b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
 - c. Unless otherwise specified, connect conductors to ground rods with compression type connectors or exothermic weld.
 - d. Provide sufficient slack in conductor to prevent conductor breakage during backfill or due to ground movement.
 - e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
 7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.
- B. Grounding Electrode System:
1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
 - a. All grounding electrode conductors terminate on a main ground bar located adjacent to the service entrance equipment.
 2. Grounding electrode conductor terminations:
 - a. Piping systems: Use mechanical type connections.
 - b. Ground rod: Compression type or exothermic weld, unless otherwise specified.
 3. Single ground rod grounding system:
 - a. Single ground rod system consists of a single ground rod.
 - b. Place ground rod a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
 - c. Grounding conductor: Bare conductor, sized as indicated on the Drawings.
- C. Supplemental Grounding Electrode:
1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
 - a. See Grounding Electrode System paragraph for conductor termination requirements.
 2. Equipment support rack and pedestals mounted outdoors:
 - a. Connect metallic structure to a ground rod.
 - b. Grounding conductor: #6 AWG minimum.
- D. Raceway Bonding/Grounding:
1. Install all metallic raceway so that it is electrically continuous.
 2. Provide an equipment grounding conductor in all raceways with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
 3. NFPA 70 required grounding bushings shall be of the insulating type.
 4. Provide double locknuts at all panels.
 5. Bond all conduits, at entrance and exit of equipment, to the equipment ground bus or lug.
 6. Provide bonding jumpers if conduits are installed in concentric knockouts.
 7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- E. Equipment Grounding:
1. Ground all utilization equipment with an equipment grounding conductor.

3.2 FIELD QUALITY CONTROL

- A. Leave grounding system uncovered until observed by Owner.

END OF SECTION

SECTION 16120
WIRE AND CABLE - 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Building wire.
 - b. Instrumentation cable.
 - c. Wire connectors.
 - d. Insulating tape.
 - e. Pulling lubricant.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Insulated Cable Engineers Association (ICEA):
 - a. S-58-679, Standard for Control Cable Conductor Identification.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. ICS 4, Industrial Control and Systems: Terminal Blocks.
 - 3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - a. WC 57/S-73-532, Standard for Control Cables.
 - b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
 - 5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
 - a. 568, Commercial Building Telecommunications Cabling Standard.
 - 6. Underwriters Laboratories, Inc. (UL):
 - a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
 - b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - c. 467, Standard for Safety Grounding and Bonding Equipment.
 - d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
 - e. 486C, Standard for Safety Splicing Wire Connections.
 - f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
 - h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
 - i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

- A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- B. Instrumentation Cable:
 - 1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
 - 2. The following are specific types of instrumentation cables:
 - a. Analog signal cable:
 - 1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 VDC) signals, using No. 16 AWG and smaller conductors.
 - 2) Commonly used types are defined in the following:
 - a) TSP: Twisted shielded pair.
 - b) TST: Twisted shielded triad.
 - b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.
- C. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 01 Specifications for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Wire connectors.
 - 2) Insulating tape.
 - 3) Cable lubricant.
 - b. See Specification Section 16010 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 16010.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Building wire:
 - a. Aetna Insulated Wire.
 - b. Alphawire.
 - c. Cerrowire.
 - d. Encore Wire Corporation.
 - e. General Cable.
 - f. Okonite Company.
 - g. Southwire Company.
 - 2. Instrumentation cable:
 - a. Analog cable:
 - 1) Alphawire.
 - 2) Belden Inc.
 - 3) General Cable.
 - 3. Wire connectors:
 - a. Burndy Corporation.
 - b. Buchanan.
 - c. Ideal.

- d. IlSCO.
- e. 3M Co.
- f. Teledyne Penn Union.
- g. Thomas and Betts.
- h. Phoenix Contact.
- 4. Insulating and color coding tape:
 - a. 3M Co.
 - b. Plymouth Bishop Tapes.
 - c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

- A. Building Wire:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
 - 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 - 4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- B. Electrical Equipment Control Wire:
 - 1. Conductor shall be copper with 600 V rated insulation.
 - 2. Conductors shall be stranded.
 - 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 - 4. Conform to UL 44 for Type SIS insulation.
 - 5. Conform to UL 83 for Type MTW insulation.
- C. Instrumentation Cable:
 - 1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
 - 2. Analog cable:
 - a. Tinned copper conductors.
 - b. 300 V or 600 V PVC insulation with PVC jacket.
 - c. Twisted with 100 PCT foil shield coverage with drain wire.
 - d. Six (6) twists per foot minimum.
 - e. Individual conductor color coding: ICEA S-58-679, Method 1, Table E-2.
 - f. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
- D. Wire Connectors:
 - 1. Twist/screw on type:
 - a. Insulated pressure or spring type solderless connector.
 - b. 600 V rated.
 - c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
 - d. Phase and neutral conductors: Conform to UL 486C.
 - 2. Compression and mechanical screw type:
 - a. 600 V rated.
 - b. Ground conductors: Conform to UL 467.
 - c. Phase and neutral conductors: Conform to UL 486A.
 - 3. Terminal block type:
 - a. High density, screw-post barrier-type with white center marker strip.
 - b. 600 V and ampere rating as required, for power circuits.
 - c. 600 V, 20 ampere rated for control circuits.
 - d. 300 V, 15 ampere rated for instrumentation circuits.
 - e. Conform to NEMA ICS 4 and UL 486A.

- E. Insulating and Color Coding Tape:
 - 1. Pressure sensitive vinyl.
 - 2. Premium grade.
 - 3. Heat, cold, moisture, and sunlight resistant.
 - 4. Thickness, depending on use conditions: 7, 8.5, or 10 MIL.
 - 5. For cold weather or outdoor location, tape must also be all-weather.
 - 6. Color:
 - a. Insulating tape: Black.
 - b. Color coding tape: Fade-resistant color as specified herein.
 - 7. Comply with UL 510.
- F. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Permitted Usage of Insulation Types:
 - 1. Type XHHW-2:
 - a. Building wire in conduit in outdoor areas and below grade.
 - 2. Type SIS and MTW:
 - a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.
- B. Conductor Size Limitations:
 - 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
 - 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
 - 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.
- C. Color Code All Wiring as Follows:
 - 1. Building wire:

	240/120 V
Phase 1	Black
Phase 2	Red *
Phase 3	Blue
Neutral	White
Ground	Green

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
- b. Conductors larger than No. 6 AWG:
 - 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
 - a) Continuous colored outer finish along its entire length.
 - b) 3 IN of colored tape applied at the termination.
 - 2) Insulated grounding conductor shall be identified by one (1) of the following methods:
 - a) Continuous green outer finish along its entire length.
 - b) Stripping the insulation from the entire exposed length.

- c) Using green tape to cover the entire exposed length.
 - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
- D. Install all wiring in raceway unless otherwise indicated on the Drawings.
- E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
 - 1. Where specifically indicated on the Drawings.
 - 2. Where field conditions dictate and written permission is obtained from the Engineer.
 - 3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
 - a. The combinations shall comply with the following:
 - 1) 12 VDC, 24 VDC and 48 VDC may be combined.
 - 2) 125 VDC shall be isolated from all other AC and DC circuits.
 - 3) AC control circuits shall be isolated from all DC circuits.
 - 4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
 - a. The combinations shall comply with the following:
 - 1) Analog signal circuits may be combined.
- F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
 - 1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).
- G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
 - 1. Feeder and branch power circuits:
 - a. Device outlet boxes:
 - 1) Twist/screw on type connectors.
 - b. Junction and pull boxes and wireways:
 - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
 - 2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
 - c. Motor terminal boxes:
 - 1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
 - 2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
 - d. Below grade enclosures:
 - 1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
 - 2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
 - 2. Control circuits:
 - a. Junction and pull boxes: Terminal block type connector.
 - b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
 - c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
 - 3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
 - a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
 - b. Junction and pull boxes: Terminal block type connector.
 - c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.
 - 4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

- H. Insulating Tape Usage:
 - 1. For insulating connections of No. 8 AWG wire and smaller: 7 MIL vinyl tape.
 - 2. For insulating splices and taps of No. 6 AWG wire or larger: 10 MIL vinyl tape.
 - 3. For insulating connections made in cold weather or in outdoor locations: 8.5 MIL, all weather vinyl tape.
- I. Color Coding Tape Usage: For color coding of conductors.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Conduits.
 - b. Conduit fittings.
 - c. Conduit supports.
 - d. Wireways.
 - e. Outlet boxes.
 - f. Pull and junction boxes.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical - Basic Requirements.
 - 4. Section 16135 - Electrical - Exterior Underground.
 - 5. Section 16140 - Wiring Devices.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Iron and Steel Institute (AISI).
 - 2. ASTM International (ASTM):
 - a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - 4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
 - a. C80.1, Electric Rigid Steel Conduit (ERSC).
 - b. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 6. Underwriters Laboratories, Inc. (UL):
 - a. 1, Standard for Flexible Metal Conduit.
 - b. 6, Electrical Rigid Metal Conduit - Steel.
 - c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - d. 360, Standard for Liquid-Tight Flexible Metal Conduit.
 - e. 467, Grounding and Bonding Equipment.
 - f. 514A, Metallic Outlet Boxes.
 - g. 514B, Conduit, Tubing, and Cable Fittings.
 - h. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

- i. 797, Electrical Metallic Tubing - Steel.
- j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
- k. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- l. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 01 Specifications for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Specification Section 16010 for additional requirements.
 - 3. Fabrication and/or Layout Drawings:
 - a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 16010.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rigid metal conduits:
 - a. Allied Tube and Conduit.
 - b. Western Tube and Conduit Corporation.
 - c. Wheatland Tube.
 - 2. PVC coated rigid metal conduits:
 - a. Ocal by Thomas & Betts.
 - b. Robroy Industries.
 - 3. Rigid nonmetallic conduit:
 - a. Prime Conduit.
 - b. Cantex, Inc.
 - c. Osburn Associates, Inc.
 - 4. Flexible conduit:
 - a. AFC Cable Systems.
 - b. Anamet, Inc.
 - c. Electri-Flex Company.
 - d. International Metal Hose Company.
 - e. Southwire Company, LLC.
 - 5. Conduit fittings and accessories:
 - a. Appleton by Emerson Electric Co.
 - b. Carlon by Thomas & Betts.
 - c. Cantex, Inc.
 - d. Crouse-Hinds by Eaton.
 - e. Killark by Hubbell.
 - f. Osburn Associates, Inc.
 - g. O-Z/Gedney by Emerson Electric Co.
 - h. Racor by Hubbell.
 - i. Steel City by Thomas & Betts.
 - j. Thomas & Betts.

6. Support systems:
 - a. Unistrut by Atkore International, Inc.
 - b. B-Line by Eaton.
 - c. Kindorf by Thomas & Betts.
 - d. Minerallac Company.
 - e. CADDY by Pentair.
 - f. Superstrut by Thomas & Betts.
7. Outlet, pull and junction boxes:
 - a. Appleton by Emerson Electric Co.
 - b. Crouse-Hinds by Eaton.
 - c. Killark by Hubbell.
 - d. O-Z/Gedney by Emerson Electric Co.
 - e. Steel City by Thomas & Betts.
 - f. Racor by Hubbell
 - g. Bell by Hubbell.
 - h. Hoffman Engineering.
 - i. Wiegmann by Hubbell.
 - j. B-Line by Eaton.
 - k. Adalet.
 - l. RITTAL North America LLC.
 - m. Stahlin by Robroy Enclosures.

B. Submit request for substitution in accordance with Division 01 Specifications.

2.2 RIGID METAL CONDUITS

- A. Rigid Galvanized Steel Conduit (RGS):
 1. Mild steel with continuous welded seam.
 2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
 3. Threads galvanized after cutting.
 4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
 5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.
- B. PVC-Coated Rigid Steel Conduit (PVC-RGS):
 1. Nominal 40 MIL Polyvinyl Chloride Exterior Coating:
 - a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
 - b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
 2. Nominal 2 mil, minimum, urethane interior coating.
 3. Urethane coating on threads.
 4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
 5. Female Ends:
 - a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN, whichever is less beyond the opening.
 - b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
 6. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6, NEMA RN 1.

2.3 RIGID NONMETALLIC CONDUIT

- A. Schedules 40 (PVC-40) and 80 (PVC-80):
 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
 2. Rated for direct sunlight exposure.
 3. Fire retardant and low smoke emission.
 4. Shall be suitable for use with 90 DEGC wire and shall be marked "maximum 90 DEGC".
 5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

- A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
 - 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
 - 2. Extruded PVC outer jacket positively locked to the steel core.
 - 3. Liquid and vaportight.
 - 4. Standard: NFPA 70 Type LFMC, UL 360.

2.5 CONDUIT FITTINGS AND ACCESSORIES

- A. Fittings for Use with RGS:
 - 1. Locknuts:
 - a. Threaded steel or malleable iron.
 - b. Gasketed or non-gasketed.
 - c. Grounding or non-grounding type.
 - 2. Bushings:
 - a. Threaded, insulated metallic.
 - b. Grounding or non-grounding type.
 - 3. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
 - 4. Couplings:
 - a. Threaded straight type: Same material and finish as the conduit with which they are used on.
 - b. Threadless type: Gland compression or self-threading type, concrete tight.
 - 5. Unions: Threaded galvanized steel or zinc plated malleable iron.
 - 6. Conduit bodies (ells and tees):
 - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
 - b. Standard and mogul size.
 - c. Cover:
 - 1) Clip-on type with stainless steel screws.
 - 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
 - 7. Expansion/deflection couplings:
 - a. 3/4 IN nominal straight-line conduit movement in either direction.
 - b. 30-degree nominal deflection from the normal in all directions.
 - c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
 - d. Internally or externally grounded.
 - e. Watertight, raintight and concrete tight.
 - 8. Standards: UL 467, UL 514B, UL 1203.
- B. Fittings for Use with PVC-RGS:
 - 1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS" and coated as defined under paragraph "PVC Coated Rigid Steel Conduit (PVC-RGS)."
- C. Fittings for Use with FLEX-LT:
 - 1. Connector:
 - a. Straight or angle type.
 - b. Metal construction, insulated and gasketed.
 - c. Composed of locknut, grounding ferrule and gland compression nut.
 - d. Liquid tight.
 - 2. Standards: UL 467, UL 514B.
- D. Fittings for Use with Rigid Nonmetallic PVC Conduit:
 - 1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.

- c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
 - 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
 - 3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.
- E. Weather and Corrosion Protection Tape:
- 1. PVC based tape, 10 mils thick.
 - 2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
 - 3. Used with appropriate pipe primer.

2.6 ALL RACEWAY AND FITTINGS

- A. Mark Products:
- 1. Identify the nominal trade size on the product.
 - 2. Stamp with the name or trademark of the manufacturer.

2.7 OUTLET BOXES

- A. Cast Outlet Boxes:
- 1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
 - 2. Threaded hubs and grounding screw.
 - 3. Styles:
 - a. "FS" or "FD".
 - b. "Bell".
 - c. Single or multiple gang and tandem.
 - d. "EDS" or "EFS" for hazardous locations.
 - 4. Accessories: 40 MIL PVC exterior coating and 2 MIL urethane interior coating.
 - 5. Standards: UL 514A, UL 1203.
- B. See Specification Section 16140 for wiring devices, wallplates and coverplates.

2.8 PULL AND JUNCTION BOXES

- A. NEMA 4 Rated:
- 1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - 2. Seams continuously welded and ground smooth.
 - 3. No knockouts.
 - 4. External mounting flanges.
 - 5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
 - 6. Cover with oil resistant gasket.
- B. Miscellaneous Accessories:
- 1. Rigid handles for covers larger than 9 SQFT or heavier than 25 LBS.
 - 2. Split covers when heavier than 25 LBS.
 - 3. Weldnuts for mounting optional panels and terminal kits.
 - 4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- C. Standards: NEMA 250, UL 50.

2.9 SUPPORT SYSTEMS

- A. Single Conduit and Outlet Box Support Fasteners:
- 1. Material requirements:
 - a. Zinc plated steel.
 - b. Stainless steel.

2.10 OPENINGS AND PENETRATIONS IN WALLS AND FLOORS

- A. Sleeves, smoke and fire stop fitting through walls and floors:

- B. Sleeves Through Walls and Floors: Galvanized steel:

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

- A. Shall be in accordance with the requirements of:
 - 1. NFPA 70.
 - 2. Manufacturer instructions.
- B. Size of Raceways:
 - 1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
 - 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
 - a. Conduit: 3/4 IN.
- C. Field Bending and Cutting of Conduits:
 - 1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
 - 2. Do not reduce the internal diameter of the conduit when making conduit bends.
 - 3. Prepare tools and equipment to prevent damage to the PVC coating.
 - 4. Degrease threads after threading and apply a zinc rich paint.
 - 5. Debur interior and exterior after cutting.
- D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
- E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
 - 1. Repair galvanized components utilizing a zinc rich paint.
 - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
 - a. Total nominal thickness: 40 MIL.
 - 4. Repair surfaces which will be inaccessible after installation prior to installation.
- F. Remove moisture and debris from conduit before wire is pulled into place.
 - 1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
 - 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 - 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.
- I. Fill openings in walls, floors, and ceilings and finish flush with surface.
 - 1. The same materials of construction shall be used for non-fire-rated walls.
 - 2. Use the following to seal fire-rated walls:
 - a. For single conduit penetrations:
 - 1) Flanged and segmented to install around in-place conduits.

3.2 RACEWAY ROUTING

- A. Raceways shall be routed in the field unless otherwise indicated.
 - 1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
 - 2. Run in straight lines parallel to or at right angles to building lines.
 - 3. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.
 - 4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
 - 5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 DEG of bends in the conduit run or in long straight runs to limit pulling tensions.
- B. All conduits within a structure shall be installed exposed except as follows:
 - 1. As indicated on the Drawings.
- C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following:
 - 1. Between instrumentation and 125 V, 48 V and 24 VDC, 2 IN.
 - 2. Between instrumentation and 600 V and less AC power or control: 6 IN.
 - 3. Between 125 V, 48 V and 24 VDC and 600 V and less AC power or control: 2 IN.
 - 4. Between process, gas, air and water pipes: 6 IN.
- D. Conduits shall be installed to eliminate moisture pockets.
 - 1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.
- E. Provide all required openings in walls, floors, and ceilings for conduit penetration.
 - 1. New construction:
 - a. Sleeves and blockouts:
 - 1) Set in concrete walls and floors during forming.
 - b. Sleeves not considered to structurally replace the displaced concrete.

3.3 RACEWAY APPLICATIONS

- A. Permitted Raceway Types per Wire or Cable Types:
 - 1. Power wire or cables: All raceway types.
 - 2. Control wire or cables: All raceway types.
 - 3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
- B. Permitted Raceway Types per Area Designations:
 - 1. Wet areas:
 - a. RGS.
- C. Permitted Raceway Types per Routing Locations:
 - 1. Embedded in poured concrete walls and floors:
 - a. PVC-40.
 - b. PVC-RGS when emerging from concrete into areas designated as wet.
 - 2. Direct buried conduits and ductbanks:
 - a. PVC-40.
 - b. PVC-80.
 - c. 90 DEG elbows for transitions to above grade:
 - 1) PVC-RGS.
 - d. Long sweeping bends greater than 15 DEG:
 - 1) PVC-RGS.

- D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
 - 1. The maximum length shall not exceed:
 - a. 6 FT to light fixtures.
 - b. 3 FT to motors.
 - c. 2 FT to all other equipment.
- E. Underground Conduit: See Specification Section 16135.

3.4 CONDUIT FITTINGS AND ACCESSORIES

- A. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
 - 1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.
- B. Install Expansion/Deflection Fittings:
 - 1. Where conduits enter a structure.
 - 2. Elsewhere as identified on the Drawings.
- C. Threaded connections shall be made wrench-tight.
- D. Conduit joints shall be watertight:
 - 1. Where subjected to possible submersion.
 - 2. In areas classified as wet.
 - 3. Underground.
- E. Terminate Conduits:
 - 1. In metallic outlet boxes:
 - a. RGS:
 - 1) Conduit hub and locknut.
 - 2) Insulated bushing and two locknuts.
 - 3) Use grounding type locknut or bushing when required by NFPA 70.
 - 2. In NEMA 4 rated enclosures:
 - a. Watertight, insulated and gasketed hub and locknut.
 - 3. When stubbed up through the floor into floor mount equipment:
 - a. With an insulated grounding bushing on metallic conduits.
 - b. With end bells on nonmetallic conduits.
- F. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

- A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
 - 1. Wet areas:
 - a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
 - 2. Conduit type shall be compatible with the support system material.
 - a. Galvanized steel system may be used with RGS.
 - b. Stainless steel system may be used with RGS.
 - c. PVC coated galvanized steel system may be used with PVC-RGS.
- B. Permitted single conduit support fasteners per area designations and conduit types:
 - 1. Wet areas:
 - a. Material: Zinc plated steel, stainless steel and malleable iron.
 - b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.

2. Conduit type shall be compatible with the support fastener material.
 - a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS.
 - b. Stainless steel system may be used with RGS.
 - c. PVC coated fasteners may be used with PVC-RGS.
 - d. Nonmetallic fasteners may be used with PVC-40 and PVC-80.
- C. Conduit Support General Requirements:
 1. Maximum spacing between conduit supports per NFPA 70.
 2. Support conduit from the building structure.
 3. Do not support conduit from process, gas, air or water piping; or from other conduits.
 4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
 - a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
 - b. Conduit hangers:
 - 1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
 - c. Do not use suspended ceiling support systems to support raceways.
 - d. Hangers in metal roof decks:
 - 1) Utilize fender washers.
 - 2) Not extend above top of ribs.
 - 3) Not interfere with vapor barrier, insulation, or roofing.
 5. Conduit support system fasteners:
 - a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
 - b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

- A. General:
 1. Install products in accordance with manufacturer's instructions.
 2. See Specification Section 16010 and the Drawings for area classifications.
 3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
 4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.
- B. Outlet Boxes:
 1. Permitted uses of cast outlet boxes:
 - a. Housing of wiring devices surface mounted in wet areas.
 - b. Pull and junction box surface mounted in wet areas.
 2. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 16010.
 3. Set device outlet boxes plumb and vertical to the floor.
 4. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.
- C. Pull and Junction Boxes:
 1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
 - a. Make covers of boxes accessible.
 2. Permitted uses of NEMA 4 enclosure:
 - a. Pull or junction box surface mounted in areas designated as wet.

END OF SECTION

SECTION 16135
ELECTRICAL - EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Handhole.
 - b. Underground conduits and ductbanks.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16060 - Grounding.
 - 4. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB-17, Standard Specifications for Highway Bridges.
 - 2. ASTM International (ASTM):
 - a. A536, Standard Specification for Ductile Iron Castings.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Society of Cable Telecommunications Engineers (SCTE):
 - a. 77, Specifications for Underground Enclosure Integrity.

1.3 DEFINITIONS

- A. Direct-Buried Conduit(s):
 - 1. Individual (single) underground conduit.
 - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Division 01 Specifications for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - 3. Fabrication and/or Layout Drawings:
 - a. Provide Dimensional Drawings of each manhole indicating all specified accessories and conduit entry locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Prefabricated composite handholes:
 - a. Armorcast Products Company.
 - b. Quazite by Hubbell.

- c. Synertech by Oldcastle Enclosure Solutions.
- 2. Handhole and ductbank accessories:
 - a. Cantex, Inc.
 - b. Condux International, Inc.
 - c. Neenah Enterprises, Inc.
 - d. Prime Conduit.
 - e. Thomas and Betts.
 - f. Underground Devices, Inc.
 - g. Unistrut by Atkore International, Inc.

2.2 HANDHOLES

- A. Prefabricated Composite Material Handholes:
 - 1. Handhole body and cover: Fiberglass reinforced polymer concrete conforming to all test provisions of SCTE 77.
 - 2. Minimum load ratings: SCTE 77 Tier 15.
 - 3. Open bottom.
 - 4. Stackable design as required for specified depth.
 - 5. Cover:
 - a. Engraved legend of "ELECTRIC" or "COMMUNICATIONS".
 - b. Non-gasketed bolt down with stainless steel penta head bolts.
 - c. Lay-in non-bolt down, when cover is over 100 LBS.
 - d. One or multiple sections so the maximum weight of a section is 125 LBS.
 - 6. Cover lifting hook: 24 IN minimum in length.

2.3 UNDERGROUND CONDUIT AND ACCESSORIES

- A. Conduit: See Specification Section 16130.
- B. Duct Spacers/Supports:
 - 1. High density polyethylene or high impact polystyrene.
 - 2. Interlocking web or mesh design.
 - 3. Provide 2 IN minimum spacing between conduits.
 - 4. Accessories, as required:
 - a. Hold down bars.
 - b. Ductbank strapping.
- C. Underground Warning Tape:
 - 1. Materials: Polyethylene.
 - 2. Size:
 - a. 6 IN wide (minimum).
 - b. Thickness: 3.5 MILS.
 - 3. Fabrication:
 - a. Legend: Preprinted and permanently imbedded.
 - b. Message continuous printed.
 - c. Tensile strength: 1750 PSI.
 - 4. Color: As specified.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings indicate the intended location of handholes and routing of ductbanks and direct buried conduit.
 - 1. Field conditions may affect actual routing.
- B. Handhole Locations:
 - 1. As required for pulling distances.
 - 2. As required to keep pulling tensions under allowable cable tensions.

3. As required for number of bends in ductbank routing.
 4. Shall not be installed in a swale or ditch.
 5. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
 6. Locations are to be approved by the Engineer prior to excavation and placement or construction of manholes and handholes.
- C. Install products in accordance with manufacturer's instructions.
- D. Install handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.
- E. Comply with Specification Section 02221 for Trenching, Backfilling and Compacting.

3.2 HANDHOLES

- A. Prefabricated Composite Material Handholes:
1. For use in areas subjected to occasional non-deliberate vehicular traffic.
 2. Place handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than handholes footprint on all sides.
 3. Provide concrete encasement ring around handhole per manufacturers installation instructions (minimum of 10 IN wide x 12 IN deep).
 4. Install so that the surrounding grade is 1 IN lower than the top of the handhole.
 5. Size: As indicated on the Drawings or as required for the number and size of conduits.
 6. Provide cable rails and pulling eyes as needed.

3.3 UNDERGROUND CONDUITS

- A. General Installation Requirements:
1. Ductbank types per location:
 - a. Direct-buried conduit(s):
 - 1) All locations.
 2. Do not place concrete or soil until conduits have been observed by the Engineer.
 3. Ductbanks shall be sloped a minimum of 4 IN per 100 FT or as detailed on the Drawings.
 - a. Low points shall be at handholes.
 4. During construction and after conduit installation is complete, plug the ends of all conduits.
 5. Provide conduit supports and spacers.
 - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 IN and less: 3 FT.
 - 2) 1-1/4 to 3 IN: 5 FT.
 - 3) 3-1/2 to 6 IN: 7 FT.
 - b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 IN and less: 10 FT.
 - 2) 1-1/4 to 2-1/2 IN: 14 FT.
 - 3) 3 IN and larger: 20 FT.
 - c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
 6. Stagger conduit joints at intervals of 6 IN vertically.
 7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
 8. Accomplish changes in direction of runs exceeding a total of 15 DEG by long sweep bends having a minimum radius of 25 FT.
 - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
 9. Furnish manufactured bends at end of runs.
 - a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.

10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
 11. After the conduit run has been completed:
 - a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
 - 1) Test mandrel:
 - a) Length: Not less than 12 IN.
 - b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.
 - b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
 12. Pneumatic rodding may be used to draw in lead wire.
 - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
 - b. Extend cord 3 FT beyond ends of conduit.
 13. Transition from rigid nonmetallic conduit to rigid metallic conduit, per Specification Section 16130, prior to entering a structure or going above ground.
 - a. Except rigid nonmetallic conduit may be extended directly to handholes.
 - b. Terminate rigid PVC conduits with end bells.
 - c. Terminate steel conduits with insulated bushings.
 14. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable..
 15. Placement of conduits stubbing into handholes shall be located to allow for proper bending radiuses of the cables.
- B. Direct-Buried Conduit(s):
1. Install so that the top of the uppermost conduit, at any point:
 - a. Is not less than 36 IN below grade, unless indicated otherwise on Drawings.
 2. Provide a uniform minimum clearance of 2 IN between conduits or as required in Specification Section 16130 for different cabling types.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Wall switches.
 - b. Receptacles.
 - c. Device wallplates and coverplates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.
 - 4. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. WD 1, General Color Requirements for Wiring Devices.
 - c. WD 6, Wiring Devices - Dimensional Requirements.
 - 2. Underwriters Laboratories, Inc. (UL):
 - a. 20, General-Use Snap Switches.
 - b. 498, Standard for Attachment Plugs and Receptacles.
 - c. 514A, Metallic Outlet Boxes.
 - d. 943, Ground-Fault Circuit-Interrupters.
 - e. 1310, Standard for Class 2 Power Units.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Wall switches and receptacles:
 - a. Bryant Electric.
 - b. Cooper Wiring Devices by Eaton.
 - c. Hubbell Incorporated Wiring Device-Kellems.
 - d. Leviton Manufacturing Company.
 - e. Legrand/Pass & Seymour.
 - f. Eaton Crouse-Hinds.

- g. Appleton Electric Co.
- h. Hubbell Killark.

2.2 WALL SWITCHES

- A. Basic requirements unless modified in specific requirements paragraph of switches per designated areas or types:
 - 1. Industrial Specification Grade.
 - 2. Quiet action, snap switch.
 - 3. Self-grounding with grounding terminal.
 - 4. Back and side wired.
 - 5. Solid silver cadmium oxide contacts.
 - 6. Rugged thermoplastic and/or nylon housing and one-piece switch arm.
 - 7. Ratings: 20 A, 120/277 VAC.
 - 8. Switch handle type: Toggle.
 - 9. Switch handle color: Gray.
 - 10. Types as indicated on the Drawings:
 - a. Single-pole.
 - 11. Standards: UL 20, UL 514A, NEMA WD 1, NEMA WD 6.
- B. Wet or Damp or Exterior Area Specific Requirements:
 - 1. Coverplate:
 - a. Cast aluminum, gasketed, stainless steel hardware, natural, lacquer, or factory painted finish.
 - b. Operator type:
 - 1) Side mounted rocker type handle to operate snap switch.
 - 2) Front mounted lever type handle to operate snap switch.
 - 3) Push/pull operator to operate snap switch.
 - 4) Spring type door to cover snap switch.
 - c. Wet location rated.
 - d. Single or multiple gang as required.

2.3 RECEPTACLES

- A. Basic requirements unless modified in specific requirements paragraph of receptacles and per designated areas:
 - 1. Industrial Specification Grade.
 - 2. Straight blade.
 - 3. Brass triple wipe line contacts.
 - 4. One-piece grounding system with double wipe brass grounding contacts and self-grounding strap with grounding terminal.
 - 5. Back and side wired.
 - 6. Rating: 20 A, 125 VAC.
 - 7. High impact nylon body.
 - 8. Receptacle body color:
 - a. Normal power: Gray.
 - 9. Duplex or simplex as indicated on the Drawings.
 - 10. Configuration: NEMA 5-20R.
 - 11. Standards: UL 498, UL 514A, NEMA WD 1, NEMA WD 6.
- B. Receptacle Type Specific Requirements:
 - 1. Basic receptacles:
 - a. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
 - 1) Identification: Letters "WR" on face of receptacle.
 - 2. Ground Fault Circuit Interrupter (GFCI):
 - a. Specification Grade.
 - b. Class A protection.

- c. Feed through type.
 - d. Test and reset buttons.
 - e. Self-testing.
 - f. Visual indicator light.
 - g. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
 - 1) Identification: Letters “WR” on face of receptacle.
 - h. Additional standards: UL 943.
- C. Wet Non-architecturally Finished Areas Specific Requirements:
- 1. Coverplate:
 - a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 IN minimum cover depth for #12 AWG cords.
- D. Exterior Locations Specific Requirements:
- 1. Coverplate:
 - a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 IN minimum cover depth for #12 AWG cord.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 16010.
- C. See Specification Section 16130 for device outlet box requirements.

END OF SECTION

SECTION 16441

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Lighting and appliance panelboards.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical - Basic Requirements.
 - 4. Section 16490 - Overcurrent and Short Circuit Protective Devices.
 - 5. Section 16491 - Low Voltage Surge Protective Devices (SPD).

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. PB 1, Panelboards.
 - 2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 3. Underwriters Laboratories, Inc. (UL):
 - a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - b. 67, Standard for Panelboards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data.
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 16010 for additional requirements.
 - 3. Fabrication and/or Layout Drawings:
 - a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Division 01 Specifications for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 - 2. Panelboard schedules with as-built conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Eaton.
 - 2. General Electric.
 - 3. Square D by Schneider Electric.

- 4. Siemens Corporation.
- B. Submit request for substitution in accordance with Division 01 Specifications.

2.2 MANUFACTURED UNITS

- A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.
- B. Ratings:
 - 1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
 - 2. Panelboards rated 240 VAC or less: 10,000 AMP minimum short circuit rating or as indicated in the schedule.
 - 3. Service Entrance Equipment rated when indicated on the Drawings.
- C. Construction:
 - 1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
 - 2. Multi-section panelboards: Feed-through or sub-feed lugs.
 - 3. Main lugs: Solderless type approved for copper and aluminum wire.
- D. Bus Bars:
 - 1. Main bus bars:
 - a. Plated aluminum or copper sized to limit temperature rise to a maximum of 65 DEGC above an ambient of 40 DEGC.
 - b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
 - 2. Ground bus and isolated ground bus, when indicated on the Drawings: Solderless mechanical type connectors.
 - 3. Neutral bus bars: Insulated 100 PCT rated or 200 PCT rated, when indicated on the Drawings and with solderless mechanical type connectors.
- E. Enclosure:
 - 1. Boxes: Code gage galvanized steel, furnish without knockouts.
 - 2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
 - 3. Lighting and appliance panelboard:
 - a. Trims supplied with hinged door over all circuit breaker handles.
 - b. Trims for surface mounted panelboards, same size as box.
 - c. Trims for flush mounted panelboards, overlap the box by 3/4 IN on all sides.
 - d. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
 - e. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NFPA 70.
 - f. Clear plastic cover for directory card mounted on the inside of each door.
 - g. NEMA 3R: Door gasketed.
- F. Overcurrent and Short Circuit Protective Devices:
 - 1. Main overcurrent protective device:
 - a. Molded case circuit breaker.
 - 2. Branch overcurrent protective devices:
 - a. Mounted molded case circuit breaker.
 - 3. See Section 16490 for overcurrent and short circuit protective device requirements.
 - 4. Factory installed.
- G. Integral surge protective device: See Specification Section 16491.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install as indicated on the Drawings, in accordance with the NFPA 70, and in accordance with manufacturer's instructions.

- B. Support panelboard enclosures from wall studs or modular channels support structure, per Specification Section 16010.
- C. Provide NEMA 3R rated enclosure as indicated on the Drawings.
- D. Provide each panelboard with a typed directory:
 - 1. Identify all circuit locations in each panelboard with the load type and location served.
 - 2. Mechanical equipment shall be identified by Owner-furnished designation if different than designation indicated on the Drawings.
 - 3. Room names and numbers shall be final building room names and numbers as identified by the Owner if different than designation indicated on the Drawings.

END OF SECTION

SECTION 16490

OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Low voltage circuit breakers.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.
 - 3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C37.13, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
 - b. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations.
 - c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
 - 2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 3. Underwriters Laboratories, Inc. (UL):
 - a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - b. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
 - c. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. See Specification Section 16010 for additional requirements.
- B. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See Division 01 Specifications for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Circuit breakers:
 - a. Eaton.
 - b. General Electric Company.

- c. Square D Company.
- d. Siemens.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:

1. General:
 - a. Standards: UL 489.
 - b. Unit construction.
 - c. Over-center, toggle handle operated.
 - d. Quick-make, quick-break, independent of toggle handle operation.
 - e. Manual and automatic operation.
 - f. All poles open and close simultaneously.
 - g. Three (3) position handle: On, off and tripped.
 - h. Molded-in ON and OFF markings on breaker cover.
 - i. One-, two- or three-pole as indicated on the Drawings.
 - j. Current and interrupting ratings as indicated on the Drawings.
 - k. Bolt on type.
2. Thermal magnetic type:
 - a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
 - b. Frame size 150 amp and below:
 - 1) Non-interchangeable, non-adjustable thermal magnetic trip units.
 - c. Ground Fault Circuit Interrupter (GFCI) Listed:
 - 1) Standard: UL 943.
 - 2) One- or two-pole as indicated on the Drawings.
 - 3) Class A ground fault circuit.
 - 4) Trip on 5 mA ground fault (4-6 mA range).

2.3 FUSES

A. UL Class RK-1 Fuses:

1. Standard: UL 248-1 and UL 248-12.
2. Single-element fast-acting and current limiting rejection type.
3. Dual-element time-delay and current limiting rejection type.
4. Ratings: 250 and 600 V, 1/10-600 amps and 200,000 RMS AIC symmetrical.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Current and interrupting ratings as indicated on the Drawings.
- B. Series rated systems not acceptable.
- C. Devices shall be ambient temperature compensated.
- D. Circuit Breakers:
 1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
 - a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.
- E. Fuses:
 1. UL Class RK-1 (dual element): Use for motor feeder and branch circuit devices.

END OF SECTION

SECTION 16491

LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Type 3 SPD - Medium exposure locations (switchboard, panelboard and motor control center), integrally mounted.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 00 - Procurement and Contracting Requirements.
 - 2. Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
 - c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
 - d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
 - 2. Military Standard:
 - a. MIL-STD-220B, Method of Insertion Loss Measurement.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 4. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 5. Underwriters Laboratories, Inc. (UL):
 - a. 1283, Standard for Electromagnetic Interference Filters.
 - b. 1449, Standard for Surge Protective Devices.
- B. Qualifications:
 - 1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
 - a. Upon request, suppliers or manufacturers shall provide a list of not less than three customer references showing satisfactory operation.

1.3 DEFINITIONS

- A. Clamping Voltage:
 - 1. The applied surge shall be induced at the 90 DEG phase angle of the applied system frequency voltage.
 - 2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.
- B. Let-Through Voltage:
 - 1. The applied surge shall be induced at the 90 DEG phase angle of the applied system frequency voltage.

2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge.
- C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.
- D. Maximum Surge Current:
 1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 PCT deviation of clamping voltage at a specified surge current.
 2. Listed by mode, since number and type of components in any SPD may vary by mode.
- E. MCC: Motor Control Center.
- F. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).
- G. Surge Current per Phase:
 1. The per phase rating is the total surge current capacity connected to a given phase conductor.
 - a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
 - b. The N-G mode is not included in the per phase calculation.
- H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

- A. Shop Drawings:
 1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
 2. Product technical data including:
 - a. Manufacturer's qualifications.
 - b. Standard catalog cut sheet.
 - c. Electrical and Mechanical Drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
 - d. Testing procedures and testing equipment data.
 - e. Create a Product Data Sheet for each different model number of SPD provided (i.e., Model XYZ with disconnect and Model XYZ without disconnect, each require a Product Data Sheet).
 - 1) Data in the Product Data Sheet heading:
 - a) SPD Type Number per PART 2 of the Specification.
 - b) Manufacturer's Name.
 - c) Product model number.
 - 2) Data in the Product Data Sheet body:
 - a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
 - b) Column two: Manufacturer's certified value confirming the product meets the specified value/feature.
 - c) Name of the nationally recognized testing laboratory that preformed the tests.
 - d) Warranty information.
 - 3) Data in the Product Data Sheet closing:
 - a) Signature of the manufacturer's official (printed and signed).
 - b) Title of the official.
 - 4) Date of signature.

- B. Operation and Maintenance Manuals:
 - 1. See Division 01 Specifications for requirements for:
 - a. The mechanics and administration of submittal process.
 - b. The content of the Operation and Maintenance Manuals.
 - 2. Warranty.

1.5 WARRANTY

- A. Minimum of a five year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE 3 SPD

- A. Product:
 - 1. Integrally mounted in a panelboard.
 - 2. Hybrid solid state high performance suppression system.
 - a. Do not use gas tubes, spark gaps or other components in suppression system which might short or crowbar the line resulting in interruption of normal power flow to connected loads.
 - 3. Do not connect multiple SPD modules in series to achieve the specified performance.
 - 4. Designed for parallel connection.
 - 5. Field connection: Use mechanical or compression lugs for each phase, neutral and ground that will accept bus bar or #10 through #1/0 conductors.
 - 6. Device monitor:
 - a. Long-life, solid state, externally visible indicators and Form C contact(s) that monitor the on-line status of each mode of the units suppression filter system or power loss in any of the phases.
 - b. A fuse status only monitor system is not acceptable.
- B. Operating Voltage: The nominal unit operating voltage and configuration as indicated on the Drawings.
- C. Modes of Protection: All modes.
 - 1. Three phase (delta): L-L, L-G.
 - 2. Three phase (wye): L-N, L-L, L-G and N-G.
 - 3. Single phase (2 pole): L-L, L-N, L-G and N-G.
 - 4. Single phase: L-N, L-G and N-G.
- D. Maximum Continuous Operating Voltage: Less than 130 PCT of system peak voltage.
- E. Operating Frequency: 45 to 65 Hz.
- F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.
- G. Maximum Surge Current: 160,000 A per phase, 80,000 A per mode minimum.
- H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High or B combination waveform impulses with no degradation of more than 10 PCT deviation of the clamping voltage.
- I. SPD Protection:
 - 1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.
 - 2. An IEEE B combination wave shall not cause the fuse to open and render the SPD inoperable.

- J. Maximum Clamping Voltages: Dynamic test at the 90 DEG phase angle including 6 IN lead length and measured from the zero voltage reference:

System Voltage	Test Mode	IEEE C62.41		UL 1449
		B Comb. Wave	B3 Ring Wave	
L-L < 250 V L-N < 150 V	L-L	1000 V	700 V	800 V
	L-N	600 V	400 V	500 V
	L-G	800 V	550 V	600 V
	N-G	800 V	550 V	600 V
L-L > 250 V L-N > 150 V	L-L	2000 V	1400 V	1800 V
	L-N	1150 V	800 V	1000 V
	L-G	1550 V	1000 V	1200 V
	N-G	1550 V	1000 V	1200 V

- K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

- A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.
- B. The SPD are to be tested as a complete SPD system including:
1. Integral unit level and/or component level fusing.
 2. Neutral and ground shall not be bonded during testing.
 3. 6 IN lead lengths.
 4. Integral disconnect switch when provided.
- C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.
- D. Tests to be performed in accordance with IEEE C62.45:
1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
 2. Single pulse surge current capacity test.
 3. Repetitive surge current capacity testing.
 4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Type 3 SPD:
1. Connected in parallel to the equipment.
 2. Install in dedicated electrical equipment compartment, bucket or panelboard box at the factory before shipment.
 3. Provide leads that are as short and straight as possible.
 4. Maximum lead length: 12 IN.
 5. Minimum lead size: #2 stranded AWG or bus bar.

6. Connect leads to the equipment to be protected by one of the following means:
 - a. Through a circuit breaker or molded case switch mounted in the equipment.
 - b. Use manufacturer recommended circuit breaker size.
 - c. Circuit breaker or switch to be operable from the equipment exterior or from behind a hinged door.

END OF SECTION

