STATE OF COLORADO

Gagnon - DNR, Nikie <nikie.gagnon@state.co.us>

Re: Bromley Lakes TR11 adequacy review letter

1 message

Olsen, Scott <SOlsen@brightonco.gov> Mon, Jan 13, 2025 at 1:05 PM
To: "Gagnon - DNR, Nikie" <nikie.gagnon@state.co.us>
Cc: Kyle Regan <Kyler@civilresources.com>

Hi Nikie,

Please see below for a link to the stamped/signed design for the spillways and riprap at Ken Mitchell Cell #3. I have also included the specifications. As you will see from the attached plans, we have a design for riprap installation along the entirety of the banks. We are not entirely sure which banks will actually be stabilized with riprap and which will just be graded to 3:1 slopes. The location of the riprap shown on the TR is the area we will install it for sure. The TR shows the remainder of the banks as 3:1 slopes. If we determine that more will be installed, we would submit another TR at a later date.

Ken Mitchell Cell #3 Spillways and Riprap

As we discussed in the field, the cost of the improvements to the reservoir are extremely high. We do not currently have a schedule for construction of the work shown in the plans. In our financial model, the work is not shown until the years 2034-2036.

Thanks,

YOUR WATER
Brighton

Scott Olsen ***(he/him)***
Director of Utilities
City of Brighton
O. 303.655.2136
C. 720.641.3085
500 S 4th Ave., Brighton, CO 80601
solsen@brightonco.gov

From: Gagnon - DNR, Nikie <nikie.gagnon@state.co.us>
Sent: Monday, January 13, 2025 12:24 PM
To: Olsen, Scott <SOlsen@brightonco.gov>; Kyle Regan <Kyler@civilresources.com>
Subject: Bromley Lakes TR11 adequacy review letter

Hello.
Please see the attached adequacy review letter for the Bromley Lakes Technical Revision 11.

The decision date for this revision is January 16. If you need additional time to address the two comments, please submit an extension request before January 16 to allow more time to submit the requested information.

Please reach out to me if you have any questions on this.

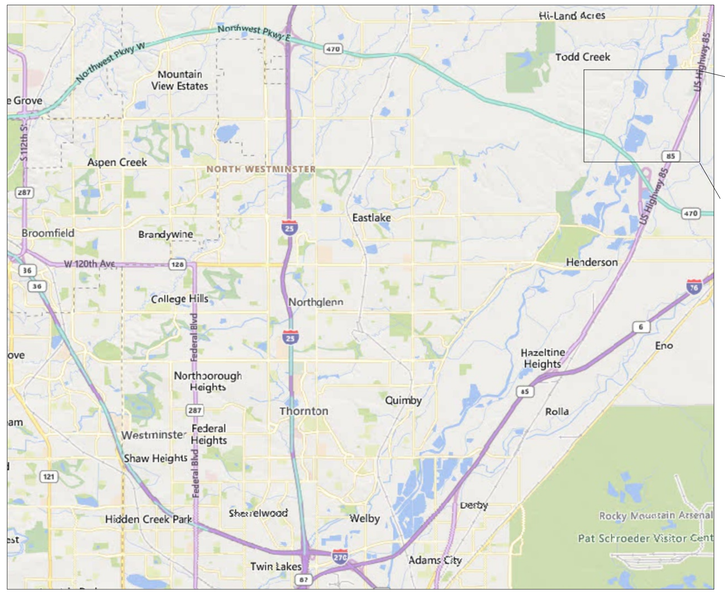
Kind regards,
--
Nikie Gagnon
Environmental Protection Specialist

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

Cell: 720.527.1640
Physical: 1313 Sherman Street, Room 215, Denver, CO 80203
Address for FedEx, UPS, or hand delivery:
DRMS Room 215, 1001 E 62nd Ave, Denver, CO 80216
nikie.gagnon@state.co.us |
https://www.drms.colorado.gov

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE PROTECTION PROJECT

100 PERCENT COMPLETE
CONSTRUCTION DRAWINGS
BRIGHTON, COLORADO



PROJECT VICINITY MAP
(NOT TO SCALE)

SITE LOCATION MAP
(NOT TO SCALE)

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12	BOAT RAMP PLAN AND SECTIONS
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14	MULTI-USE TRAIL PLAN AND PROFILE

GENERAL PROJECT INFORMATION

CITY OF BRIGHTON
OWNER

CONTRACTOR

RJH CONSULTANTS, INC., ENGLEWOOD, COLORADO
ENGINEER

CONSTRUCTION STARTED

CONSTRUCTION COMPLETED

PREPARED FOR:

CITY OF BRIGHTON

PREPARED BY:

RJH, CONSULTANTS, INC.
ENGLEWOOD • COLORADO
www.rjh-consultants.com

RJH ENGINEER APPROVAL

I HEREBY CERTIFY THAT THESE PLANS FOR THE KEN MITCHELL CELL NO. 3 SPILLWAY AND SLOPE PROTECTION PROJECT WERE PREPARED BY ME (OR UNDER MY DIRECT SUPERVISION) FOR THE OWNERS THEREOF.

ERIC M. HAHN, P.E. COLORADO P.E. #43260
REGISTERED ENGINEER
RJH CONSULTANTS, INC.

COLORADO LICENSED ERIC MATTHEW HAHN 43260 PROFESSIONAL ENGINEER 11/1/24

THESE PLANS REPRESENT THE AS-CONSTRUCTED CONDITIONS OF KEN MITCHELL CELL NO. 3 SPILLWAY AND SLOPE PROTECTION PROJECT TO THE BEST OF MY KNOWLEDGE AND JUDGMENT, BASED IN PART ON INFORMATION FURNISHED BY OTHERS, AS OF THE _____ DAY OF _____, _____.

(ENGINEER'S PRINTED NAME) (SIGNATURE)

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

COVER SHEET AND SHEET INDEX

SHEET ID
01
1 OF 14

P:\22143 - KEN MITCHELL CELL 3\CAD\DRAWINGS\PRELIMINARY DESIGN\90% DESIGN\22143_COVER.DWG 10/22/2024

100% DESIGN

GENERAL NOTES

1. CONSTRUCTION IS SUBJECT TO THE CITY OF BRIGHTON PUBLIC WORKS STANDARDS AND SPECIFICATIONS. SUBSTANTIVE CHANGES TO THE APPROVED DRAWINGS AND SPECIFICATIONS REQUIRE APPROVAL OF THE BRIGHTON AND RJH.
2. CONTRACTOR SHALL FIELD LOCATE ALL UTILITIES, WHETHER SHOWN ON THE DRAWINGS OR NOT, PRIOR TO EXCAVATION. CONTRACTOR SHALL PROTECT ALL UTILITIES IN PLACE UNLESS DESIGNATED FOR REMOVAL OR REPLACEMENT.
3. UNLESS SHOWN OR SPECIFIED OTHERWISE, PAYLINES FOR UNIT PRICE PAY ITEMS ARE BASED ON THE DESIGN LINES (NEAT LINES) SHOWN ON THE DRAWINGS.
4. ACTUAL SITE CONDITIONS MAY VARY FROM TOPOGRAPHY SHOWN. CONTRACTOR TO CONFIRM SITE TOPOGRAPHY PRIOR TO STARTING WORK.
5. HORIZONTAL CONTROL IS BASED ON THE 1983(11) NORTH AMERICAN DATUM (NAD83) COLORADO STATE PLANE COORDINATE SYSTEM, NORTH ZONE (CO83-NF), US SURVEY FEET. VERTICAL CONTROL IS BASED ON THE 1988 NORTH AMERICAN VERTICAL DATUM (NAVD88), GROUND ELEVATIONS DERIVED FROM GPS STATIC OBSERVATION AND SUPPLEMENTED WITH GEOID 2018.
6. THE SITE IS LOCATED WITHIN THE SOUTH PLATTE RIVER 100-YEAR FLOODPLAIN.

LEGEND

A / B-01 — DETAIL — DETAIL TITLE. THE LETTER "A" REFERS TO THE DETAIL DESIGNATION. THE NUMBER "B-01" REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS CALLED OUT.

1 / B-01 — SECTION — SECTION TITLE. THE NUMBER "1" REFERS TO THE SECTION DESIGNATION. THE NUMBER "B-01" REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS CALLED OUT.

1 / B-01 — SECTION LOCATION. THE NUMBER "1" REFERS TO THE SECTION DESIGNATION. THE NUMBER "B-01" REFERS TO THE DRAWING NUMBER WHERE THE SECTION IS SHOWN.

A / B-01 — DETAIL LOCATION. THE LETTER "A" REFERS TO THE DETAIL DESIGNATION. THE NUMBER "B-01" REFERS TO THE DRAWING NUMBER WHERE THE DETAIL IS SHOWN.

EXISTING MINOR TOPOGRAPHIC CONTOUR

EXISTING MAJOR TOPOGRAPHIC CONTOUR

WATERLINE

EARTH FILL SLOPE

EXCAVATION SLOPE

X — X — FENCE

CENTERLINE

LIMIT OF CONTRACTOR STAGING, STOCKPILE, AND ONSITE DISPOSAL AREAS

SOIL BENTONITE BARRIER WALL

PROPERTY BOUNDARY

? — ASSUMED FOUNDATION/EMBANKMENT CONTACT

UE — UNDERGROUND ELECTRIC

GAS — GAS LINE

CONSTRUCTION CONTROL POINT

SURVEY CONTROL POINT

JB — JUNCTION BOX

E — ELECTRICAL TRANSFORMER/BOX

RIPRAP OR GRAVEL SURFACING

CONCRETE

EARTH

GROUTED RIPRAP

ABBREVIATIONS

AB	= ANCHOR BOLT
ABT	= ABOUT
ADAS	= AUTOMATIC DATA ACQUISTION SYSTEM
ADDL	= ADDITIONAL
AL	= ALUMINUM
ALT	= ALTERNATE
APPROX	= APPROXIMATE
AS	= AUXILIARY SPILLWAY
ASCP	= AUXILIARY SPILLWAY CONTROL POINT
BF	= BOTTOM FACE
BLDG	= BUILDING
BM	= BENCHMARK
B.O.	= BOTTOM OF
B.O.B.	= BOTTOM OF BORING
BOC	= BOTTOM OF CONCRETE
BOH	= BOTTOM OF HOLE
BOT	= BOTTOM
BR	= BOTTOM ROW
BRG	= BEARING
BTWN	= BETWEEN
CCM	= CELLULAR CONCRETE MAT
CFS	= CUBIC FEET PER SECOND
CJ	= CONSTRUCTION JOINT
CL, ℄	= CENTERLINE
CLR	= CLEAR
CMP	= CORRUGATED METAL PIPE
CMU	= CONCRETE MASONRY UNIT
COL	= COLUMN
CONC	= CONCRETE
CONN	= CONNECTION
CONT	= CONTINUOUS
CP	= CONTROL POINT
CTJ	= CONTRACTION JOINT
CTR	= CENTER
DEMO	= DEMOLITION ITEM
DIA	= DIAMETER
DIAG	= DIAGONAL
D.I.P.	= DUCTILE IRON PIPE
DWG, DWGS	= DRAWING OR DRAWINGS
DWL	= DOWEL
DWLS	= DOWELS
E	= EAST OR EASTING
EA	= EACH
EC	= EACH CORNER
ECP	= EMBANKMENT CONTROL POINT
EF	= EACH FACE
EJ	= EXPANSION JOINT
EL, ELEV	= ELEVATION
EQ	= EQUAL
ER	= EACH ROW
ES	= EACH SIDE
EW	= EACH WAY
EXST	= EXISTING
EXT	= EXTENSION
EXP	= EXPANSION
F	= FAHRENHEIT
FB	= FLAT BAR
FD	= FLOOR DRAIN
FDN	= FOUNDATION
FF	= FAR FACE
FIN	= FINISH
FLG	= FLANGE
FO	= FACE OF
FR	= FAR ROW
FS	= FAR SIDE
FT	= FEET OR FOOT
FTG	= FOOTING
FES	= FLARED END SECTION
GALV	= GALVANIZED
GR	= GRADE
H	= HORIZONTAL
H.A.S.	= HEADED ANCHOR STUD
HDPE	= HIGH DENSITY POLYETHYLENE
HGT	= HEIGHT
HK	= HOOK
HORZ	= HORIZONTAL
HPU	= HYDRAULIC POWER UNIT
HR	= HANDRAIL
HS	= HIGH STRENGTH
HSS	= HOLLOW STRUCTURAL SECTION
HYD	= HYDRAULIC
ID	= INSIDE DIAMETER
IDF WSEL	= INFLOW DESIGN FLOOD WATER SURFACE ELEVATION
IE	= INVERT ELEVATION
I.F.	= INSIDE FACE
IR	= INSIDE ROW
IRR	= IRRIGATION
INV	= INVERT
JT	= JOINT
LG	= LONG
LP	= LOW POINT
LPBO	= LOW POINT BLOW-OFF
LT	= LEFT
MAX	= MAXIMUM
MFR	= MANUFACTURER
MIN	= MINIMUM
ML	= MIDDLE LAYER
MH	= MANHOLE
MR	= MIDDLE ROW
MJ	= MECHANICAL JOINT
MSE	= MECHANICALLY STABILIZED EARTH
NAVD	= NORTH AMERICAN VERTICAL DATUM
N	= NORTH OR NORTHING
NF	= NEAR FACE
NGS	= NATIONAL GEODETIC SURVEY
NGVD	= NATIONAL GEODETIC VERTICAL DATUM
NO.	= NUMBER
NR	= NEAR ROW
NS	= NEAR SIDE
NTS	= NOT TO SCALE
NWSEL	= NORMAL WATER SURFACE ELEVATION
OC	= ON CENTER
OD	= OUTSIDE DIAMETER
O.F.	= OUTSIDE FACE
OFF	= OFFSET
OH	= OVERHEAD
OPNG	= OPENING
OPP	= OPPOSITE
O.R.	= OUTSIDE ROW
OSE	= OFFICE OF THE STATE ENGINEER
OW	= OUTLET WORKS
OWC	= OUTLET WORKS CONDUIT
OWCP	= OUTLET WORKS CONTROL POINT
PC	= POINT OF CURVATURE
PD	= PLAIN DOWELS
PE	= POLYETHYLENE
PEN.	= PENETRATION
PI	= POINT OF INTERSECTION
PJF	= PREFORMED JOINT FILER
PL, ℙ	= PLATE
PMF	= PROBABLE MAXIMUM FLOOD
PT	= POINT OF TANGENCY
PVC	= POLYVINYL CHLORIDE
R	= RADIUS
RB	= ROOF BEAM
RCC	= ROLLER COMPACTED CONCRETE
RCP	= REINFORCED CONCRETE PIPE
REINF	= REINFORCEMENT
REQ'D	= REQUIRED
ROW	= RIGHTS OF WAY
RP	= RADIUS POINT
RT	= RIGHT
RW	= RAW WATER
S	= SLOPE
SC	= SOIL-CEMENT
SCH	= SCHEDULE
SIM	= SIMILAR
SLOT	= SLOTTED
SPC, SPCS	= SPACE OR SPACES
SPY	= SPILLWAY
SS	= STAINLESS STEEL
STA	= STATION
STD	= STANDARD
STL	= STEEL
SQ	= SQUARE
SYM	= SYMMETRICAL
T&B	= TOP & BOTTOM
TBD	= TO BE DETERMINED
TF	= TOP FACE
THK	= THICK
TL	= TOP LAYER
T.O.	= TOP OF
TOW	= TOP OF WALL
TR	= TOP ROW
TW	= TAILWATER
TYP	= TYPICAL
UCP	= UTILITY CARRIER PIPE
UDP	= UNDERDRAIN PIPE
UNC	= UNIFIED NATIONAL COARSE THREAD
UNO	= UNLESS NOTED OTHERWISE
USGS	= UNITED STATES GEOLOGICAL SURVEY
USFS	= UNITED STATES FOREST SERVICE
V, VERT	= VERTICAL
WS	= WATER SURFACE
WSA	= WATERSTOP
WWF	= WELDED WIRE FABRIC

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

COLORADO LICENSED — TIM MATTHEW HAN — 4/7/24 — 43260 — PROFESSIONAL ENGINEER

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DESIGNED BY:	RMW	
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CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

GENERAL NOTES AND ABBREVIATIONS

SHEET ID
02
2 OF 14

100% DESIGN

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STRUCTURAL NOTES

1) REINFORCEMENT SYMBOLS

BARS SHOWN THUS #8 @ 1'-0" OR #8 @ 1'-0"

INDICATE A GROUP OF IDENTICAL #8 BARS SPACED AT 1'-0" (12") CENTERS.

AN OPEN CIRCLE AT THE END OF A BAR INDICATES A BEND WITH THE BAR TURNED AWAY FROM THE OBSERVER.

A CLOSED CIRCLE AT THE END OF A BAR INDICATES A BEND WITH THE BAR TURNED TOWARDS THE OBSERVER.

INDICATES A DOWEL

SPLICES SHOWN THUS INDICATES A LAPPED SPLICE, NOT A BEND IN THE BAR.

2) DIMENSIONS

DIMENSIONS ARE TO THE CENTERLINES OF THE BARS UNLESS OTHERWISE SHOWN. CLEAR COVER DIMENSIONS ARE MARKED "CLR." ALL DIMENSIONS TO A JOINT ARE TO THE CENTERLINE OF THE JOINT. BEAMS, COLUMNS, AND WALLS ARE CENTERED ON REFERENCED LINES.

THICKNESS SHOWN FOR WALLS AND SLABS ADJACENT TO UNDISTURBED SOIL OR ROCK ARE MINIMUM DIMENSIONS.

3) COVER

UNLESS OTHERWISE INDICATED ON THE DRAWING, PLACE THE REINFORCEMENT SO THAT THE CLEAR DISTANCE BETWEEN THE FACE OF CONCRETE AND NEAREST REINFORCEMENT IS 3 INCHES FOR #4 BARS OR LARGER. FOR CONCRETE PLACED DIRECTLY AGAINST EARTH OR ROCK, MINIMUM CLEAR CONCRETE COVER OVER REINFORCEMENT SHALL BE 3 INCHES.

4) REINFORCEMENT DOWELS

DOWELS INDICATED ON THE DRAWING SUCH AS #8(D), SHALL HAVE A MINIMUM STRAIGHT EMBEDMENT AND PROJECTION EQUAL TO THAT REQUIRED FOR LAP SPLICING A BAR OF THE SAME DIAMETER.

5) PLAIN DOWELS

PLAIN DOWELS, INDICATED ON THE DRAWINGS SUCH AS 3/4" (PD), ACROSS CONTRACTION JOINTS SHALL BE PLAIN REINFORCING BARS OF THE BAR DIAMETER INDICATED. PLAIN DOWELS SHALL BE A MINIMUM OF 36 INCHES LONG, WITH EQUAL LENGTH EXTENDING ON EITHER SIDE OF THE CONTRACTION JOINT. IMMEDIATELY BEFORE THE SECOND CONCRETE PLACEMENT, THE PROJECTING HALF LENGTH OF DOWEL SHALL BE GREASED TO PREVENT BOND TO THE CONCRETE.

6) STANDARD HOOKS AND BENDS

HOOKS AND BENDS SHALL CONFORM TO ACI 318, SECTION 25.3.

7) PLACING REINFORCEMENT

PLACE REINFORCEMENT IN ACCORDANCE WITH APPROVED REINFORCEMENT SHOP DRAWINGS. IN THE EVENT OF A CONFLICT BETWEEN THESE DRAWINGS AND THE APPROVED SHOP DRAWINGS, THE APPROVED SHOP DRAWINGS SHALL GOVERN.

SEE ACI 318, SECTION 25.2 AND ACI 301, SECTION 5.3 FOR PLACING TOLERANCES.

REINFORCEMENT MAY BE ADJUSTED IN THE FIELD TO CLEAR FORM TIES AND ANCHOR BARS. IN SUCH CASES, RELOCATION OF THE EMBEDDED MATERIALS MUST BE CONSIDERED. IN NO CASE SHALL BARS BE BENT IN THE FIELD.

REINFORCEMENT SHALL BE PLACED TO MAINTAIN A CLEAR DISTANCE OF AT LEAST 1 INCH BETWEEN OTHER REINFORCEMENT, ANCHOR BOLTS, FORM TIES, OR OTHER EMBEDDED METALWORK.

REINFORCEMENT PARALLEL TO ANCHOR BOLTS OR OTHER EMBEDDED METALWORK SHALL BE PLACED TO MAINTAIN A CLEAR DISTANCE OF AT LEAST 1-1/3 TIMES THE MAXIMUM SIZE AGGREGATE TO BE USED.

8) SPACING

THE FIRST AND LAST BARS IN SLABS AND WALLS, STIRRUPS IN BEAMS, AND TIES IN COLUMNS ARE TO START AND END AT A MAXIMUM OF ONE HALF OF THE ADJACENT BAR SPACING. ALL REINFORCING TO BE EQUALLY SPACED UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

9) ACCESSORIES

BAR SUPPORTS, SPACERS, AND OTHER ACCESSORIES ARE NOT SHOWN ON THE DRAWINGS. THE RECOMMENDATIONS OF ACI 315 (DETAILING MANUAL) SHALL BE USED IN SELECTING ACCESSORIES.

10) DETAILING

UNLESS OTHERWISE SHOWN, FOLLOW THE RECOMMENDATIONS OF ACI 315. NO CHANGES SHALL BE MADE WITHOUT PRIOR APPROVAL.

11) CONCRETE PLACEMENT

BEFORE PLACING CONCRETE, CHECK ALL APPLICABLE DRAWINGS RELEASED AS SUITABLE FOR CONSTRUCTION INCLUDING MANUFACTURER'S DRAWINGS TO VERIFY THE PRESENCE OF ALL EMBEDDED MATERIAL REQUIRED IN THE PLACEMENT.

12) EMBEDMENT AND LAP SPLICE LENGTH REQUIREMENTS

EMBEDMENT LENGTHS AND LAP SPLICE LENGTHS ARE SHOWN IN THE TABLES BELOW.

BASIC EMBEDMENT LENGTHS ARE BASED ON ACI 318, SECTION 25.4 AND THE REQUIRED fc'.

ALL LAP SPLICE LENGTHS SHOWN ARE CLASS B SPLICES BASED ON ACI 318, SECTION 25.5.

UNLESS OTHERWISE SHOWN ON THE DRAWINGS, THE MINIMUM LENGTHS FOR EMBEDMENT AND LAP SPLICES FOR PARALLEL BARS SHALL BE AS GIVEN IN THE TABLE BELOW.

WHEN REINFORCING BARS OF DIFFERENT SIZE ARE TO BE SPLICED, THE LENGTH OF THE LAP SHALL BE GOVERNED BY THE SMALLER DIAMETER BAR.

SPLICES ARE TO BE MADE SO THAT THE GIVEN CLEAR DISTANCES TO THE FACE OF CONCRETE WILL BE MAINTAINED.

TABLE OF BASIC EMBEDMENT AND LAP SPLICE LENGTHS ACCORDING TO ACI 318
fc' = 4000 PSI

BAR SIZE NO.	EMBEDMENT (INCHES)		LAP SPLICE (INCHES)	
	ALL BARS EXCEPT TOP BARS	TOP BARS*	ALL BARS EXCEPT TOP BARS	TOP BARS*
3	1'-3"	1'-7"	1'-7"	2'-1"
4	1'-7"	2'-1"	2'-1"	2'-9"
5	2'-0"	2'-7"	2'-7"	3'-4"
6	2'-5"	3'-1"	3'-1"	4'-0"
7	3'-6"	4'-6"	4'-6"	5'-10"
8	4'-0"	5'-2"	5'-2"	6'-9"
9	4'-6"	5'-10"	5'-10"	7'-7"
10	5'-1"	6'-7"	6'-7"	8'-7"

* TOP BARS ARE HORIZONTAL BARS IN BEAMS AND SLABS PLACED SO THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR.

13) EMBEDDED ITEMS AND OPENINGS

BEFORE PLACING CONCRETE, CARE SHALL BE TAKEN THAT ALL EMBEDDED ITEMS ARE IN POSITION AND SECURELY FASTENED IN PLACE. ADD ADDITIONAL REINFORCING AROUND OPENINGS AS SHOWN ON DRAWINGS.

14) CHAMFER

UNLESS OTHERWISE INDICATED, CHAMFER EDGES OF ALL PERMANENTLY EXPOSED CONCRETE SURFACES WITH A 45 DEGREE BEVEL, 3/4 INCH X 3/4 INCH. CHAMFER STRIP MAY NOT BE SHOWN ON THE DESIGN DRAWINGS.

15) JOINTS

ALL CONSTRUCTION JOINTS, CONTRACTION JOINTS AND EXPANSION JOINTS SHALL BE PROVIDED WHERE SHOWN ON THE APPROVED SHOP DRAWINGS. NO OTHER JOINTS SHALL BE INTRODUCED UNLESS APPROVED BY THE ENGINEER.

16) STRUCTURAL STEEL

16a) GENERAL

FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO CURRENT AISC STEEL CONSTRUCTION MANUAL. ALL REINFORCEMENT SHALL BE GRADE 60.

16b) BOLTED CONNECTIONS

ANCHOR AND NON-STRUCTURAL BOLTS AND NUTS SHALL BE ASTM A 307, STRUCTURAL BOLTS AND NUTS SHALL BE ASTM A 325. ALL BOLTED STRUCTURAL CONNECTIONS SHALL CONFORM TO THE AISC SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS. ALL BOLTS, NUTS AND WASHERS SHALL BE HOT-DIP GALVANIZED. ALL STRUCTURAL BOLTED CONNECTIONS SHALL BE BEARING-TYPE CONNECTIONS. ALL BOLTS EXPOSED TO WATER OR SUBMERGED SHALL BE SS TYPE 316.

16c) WELDING

CONFORM TO AWS D1.1. WELDING ELECTRODES FOR PLAIN STRUCTURAL STEEL SHALL BE AWS SERIES E-70. WELDING ELECTRODES FOR GALVANIZED STEEL SHALL BE AWS SERIES E6010 OR E6011.

RJH CONSULTANTS, INC.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton

CITY OF BRIGHTON

COLORADO LICENSED PROFESSIONAL ENGINEER 43260 11/7/24

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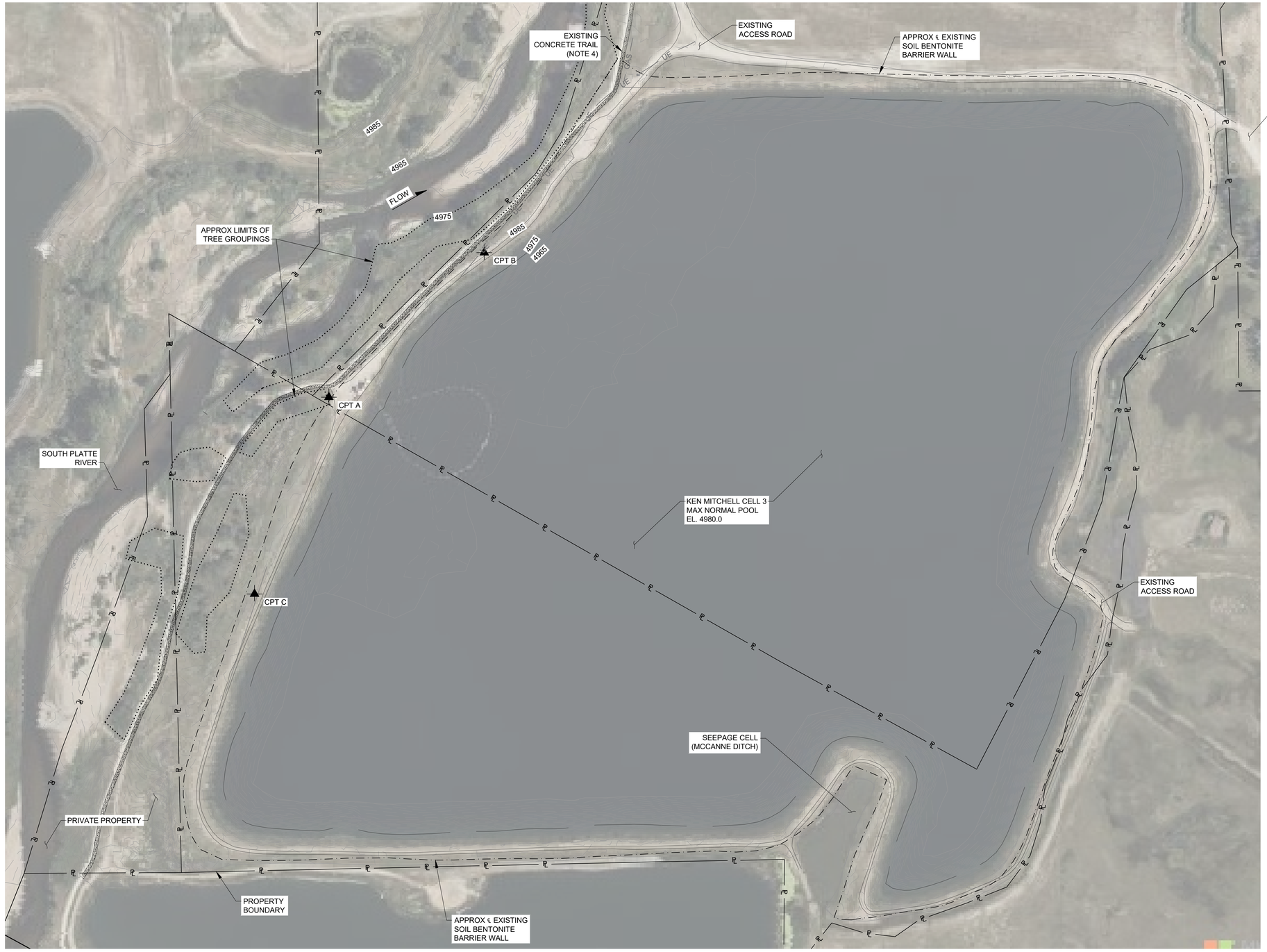
KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

STRUCTURAL NOTES

SHEET ID
03



NOTES:
1. CONTRACTOR TO VERIFY ACCURACY OF EXISTING CONTROL POINTS PRIOR TO CONSTRUCTION.
2. THE EXISTING TOPOGRAPHIC SITE SURVEY WAS COMPLETED BY ENCOMPASS ENERGY SERVICES, LLC, IN MARCH 2023.
3. SITE ENTRY FROM BRIGHTON ROAD.
4. ALSO REFERRED TO AS A MULTI-USE TRAIL.

SURVEY CONTROL POINTS (NOTE 1)

DESCRIPTION	NORTHING	EASTING	ELEVATION
CPT A	1229482.22	3181832.55	4985.22
CPT B	1229894.37	3182275.60	4985.24
CPT C	1228921.29	3181620.54	4984.09

0 75 150 300 450
SCALE IN FEET

N

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HAHN
11/7/24
43260
PROFESSIONAL ENGINEER

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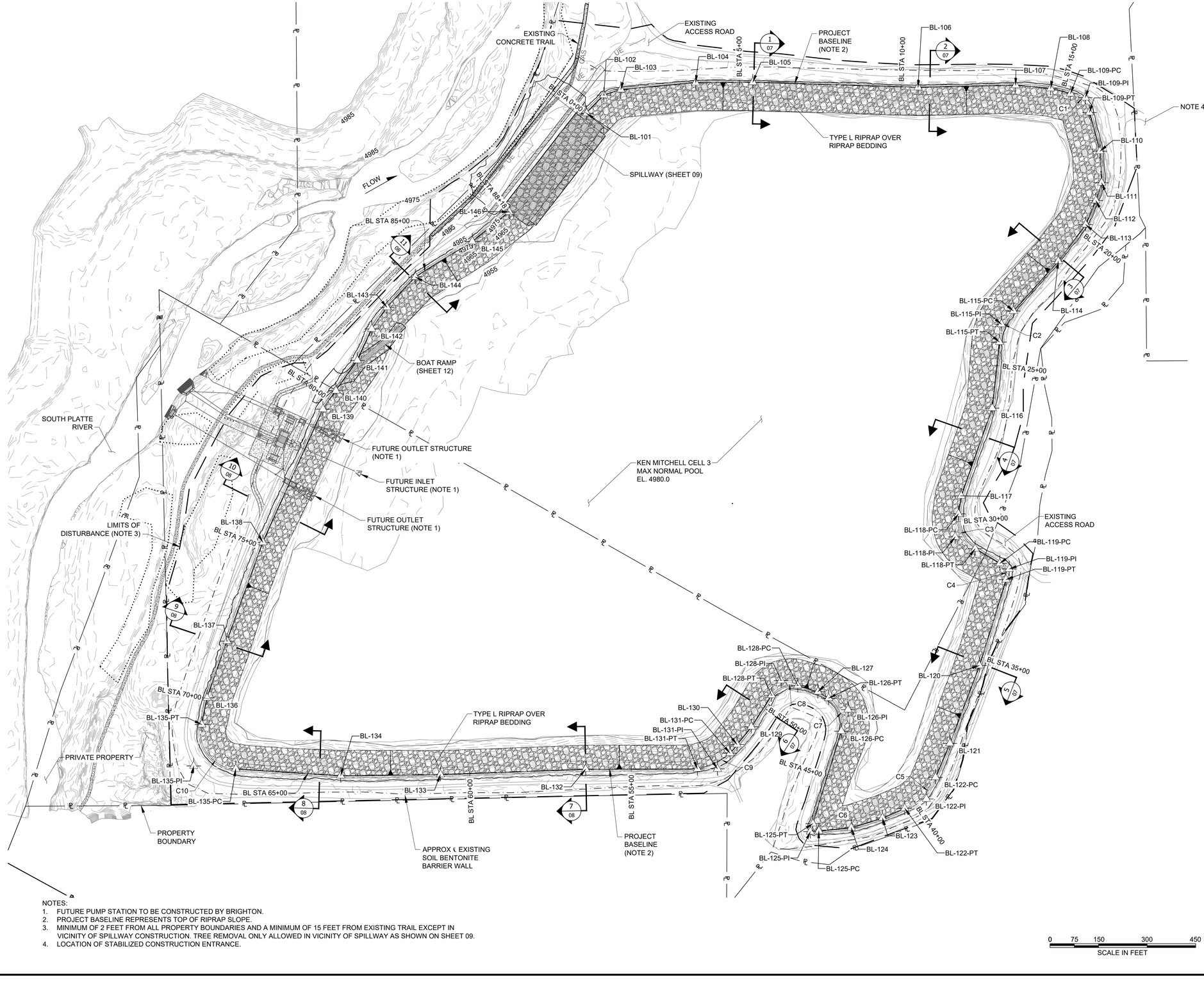
SPILLWAY AND SLOPE
PROTECTION PROJECT

EXISTING CONDITIONS AND SURVEY CONTROL PLAN

SHEET ID
04
4 OF 14

100% DESIGN

P:\22143 - KEN MITCHELL CELL 3\CAD\DRAWINGS\PRELIMINARY DESIGN\90% DESIGN\22143_EXISTING_CONDITIONS.DWG 10/22/2024



NOTES:
1. FUTURE PUMP STATION TO BE CONSTRUCTED BY BRIGHTON.
2. PROJECT BASELINE REPRESENTS TOP OF RIPRAP SLOPE.
3. MINIMUM OF 2 FEET FROM ALL PROPERTY BOUNDARIES AND A MINIMUM OF 15 FEET FROM EXISTING TRAIL EXCEPT IN VICINITY OF SPILLWAY CONSTRUCTION. TREE REMOVAL ONLY ALLOWED IN VICINITY OF SPILLWAY AS SHOWN ON SHEET 09.
4. LOCATION OF STABILIZED CONSTRUCTION ENTRANCE.

0 75 150 300 450
SCALE IN FEET

N

P:\22143 – KEN MITCHELL CELL 3\CAD\DRAWINGS\PRELIMINARY DESIGN\90% DESIGN\22143_PLAN_AND_SLOPE_SECTIONS.DWG 10/22/2024

RJH CONSULTANTS
CONSULTANTS, INC.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton℠

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HOLM
11/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

GENERAL PLAN OF MODIFICATIONS

SHEET ID
05
5 OF 14

100% DESIGN

PROJECT BASELINE POINT TABLE

POINT TABLE		
DESCRIPTION	NORTHING	EASTING
BL-101	1230264.44	3182697.03
BL-102	1230320.80	3182750.38
BL-103	1230337.64	3182802.84
BL-104	1230359.15	3183033.93
BL-105	1230360.47	3183210.61
BL-106	1230344.50	3183721.17
BL-107	1230351.11	3184022.64
BL-108	1230341.29	3184130.75
BL-109-PC	1230325.18	3184192.03
BL-109-PI	1230313.02	3184238.03
BL-109-PT	1230267.12	3184250.54
BL-110	1230147.59	3184283.13
BL-111	1230050.04	3184288.41
BL-112	1229995.33	3184270.59
BL-113	1229921.05	3184239.15
BL-114	1229807.97	3184154.32
BL-115-PC	1229654.15	3184015.83
BL-115-PI	1229613.12	3183978.89
BL-115-PT	1229558.24	3183972.81
BL-116	1229354.10	3183950.20
BL-117	1229083.23	3183854.46
BL-118-PC	1229027.56	3183846.10
BL-118-PI	1228956.58	3183835.87
BL-118-PT	1228919.90	3183897.50
BL-119-PC	1228874.59	3183973.63
BL-119-PI	1228857.18	3184002.90
BL-119-PT	1228824.65	3183992.82
BL-120	1228559.43	3183910.71
BL-121	1228318.85	3183819.40
BL-122-PC	1228214.19	3183775.02
BL-122-PI	1228147.31	3183746.67
BL-122-PT	1228118.43	3183680.01
BL-123	1228088.60	3183611.17
BL-124	1228058.36	3183514.77
BL-125-PC	1228048.76	3183414.53

POINT TABLE		
DESCRIPTION	NORTHING	EASTING
BL-125-PI	1228046.27	3183388.48
BL-125-PT	1228071.28	3183396.20
BL-126-PC	1228356.46	3183484.30
BL-126-PI	1228423.00	3183504.86
BL-126-PT	1228458.60	3183445.00
BL-127	1228478.38	3183411.72
BL-128-PC	1228497.34	3183349.67
BL-128-PI	1228513.15	3183297.92
BL-128-PT	1228467.65	3183268.63
BL-129	1228370.32	3183205.98
BL-130	1228315.36	3183161.80
BL-131-PC	1228288.56	3183140.37
BL-131-PI	1228240.12	3183101.50
BL-131-PT	1228240.02	3183039.39
BL-132	1228239.47	3182694.23
BL-133	1228222.86	3182245.67
BL-134	1228219.16	3181937.34
BL-135-PC	1228240.55	3181613.07
BL-135-PI	1228249.11	3181483.21
BL-135-PT	1228376.83	3181508.24
BL-136	1228459.45	3181524.44
BL-137	1228634.74	3181586.23
BL-138	1228939.77	3181697.05
BL-139	1229350.91	3181882.46
BL-140	1229407.91	3181922.63
BL-141	1229501.60	3181988.69
BL-142	1229598.75	3182033.46
BL-143	1229665.52	3182080.26
BL-144	1229759.04	3182167.94
BL-145	1229868.55	3182343.96
BL-146	1229959.92	3182458.27

PROJECT BASELINE CURVE TABLE

Curve Table		
Curve #	Radius	Length
C1	82.50	86.31
C2	171.56	106.83
C3	107.44	126.48
C4	43.24	57.69
C5	181.63	138.21
C6	17.44	34.29
C7	88.45	117.99
C8	71.53	92.66
C9	129.72	115.85
C10	114.50	194.48

MULTI-USE TRAIL POINT TABLE

POINT TABLE		
DESCRIPTION	NORTHING	EASTING
TR-101	1229887.92	3182217.52
TR-102	1229918.55	3182249.35
TR-103	1229958.38	3182292.99
TR-104-PC	1230006.18	3182343.23
TR-104-PI	1230010.05	3182347.29
TR-104-PT	1230014.48	3182350.74
TR-105-PC	1230403.02	3182652.81
TR-105-PI	1230416.81	3182663.52
TR-105-PT	1230433.90	3182667.06
TR-106	1230554.23	3182691.89
TR-107	1230597.92	3182697.21
TR-108	1230602.78	3182698.43

MULTI-USE TRAIL CURVE TABLE

Curve Table		
Curve #	Radius	Length
C11	75.00	11.20
C12	75.00	34.30

NOTES:
1. SEE SHEET 05 FOR PROJECT BASELINE POINT AND CURVES.
2. SEE SHEET 14 FOR MULTI-USE TRAIL POINT AND CURVES.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HOLT
11/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

PROJECT BASELINE INFORMATION

SHEET ID
06
6 OF 14

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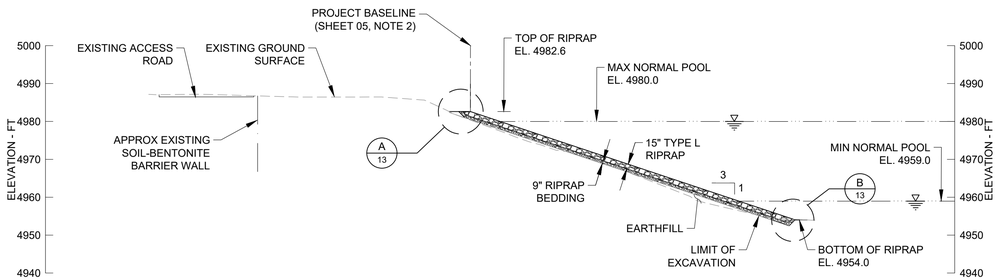
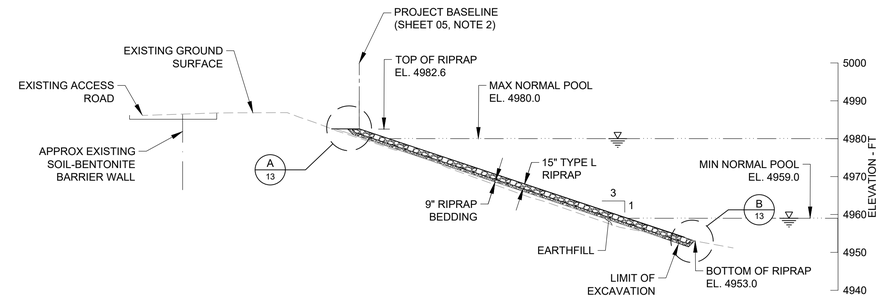


SECTION 1 / 05
BL STA 5+44

0 10 20 40 60
SCALE IN FEET



SECTION 2 / 05
BL STA 10+89

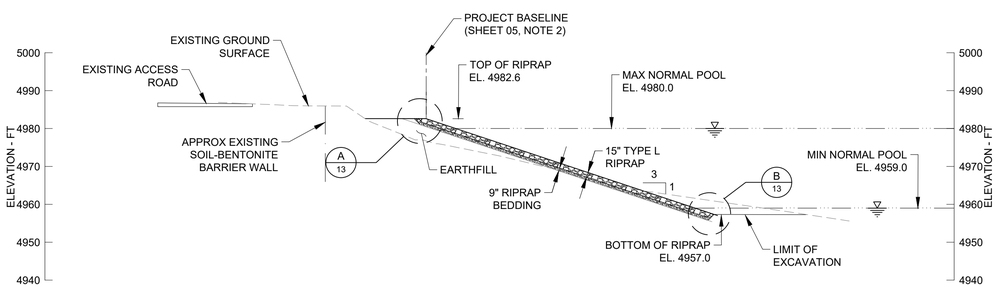
0 10 20 40 60
SCALE IN FEET

SECTION 3 / 05
BL STA 21+01

0 10 20 40 60
SCALE IN FEET

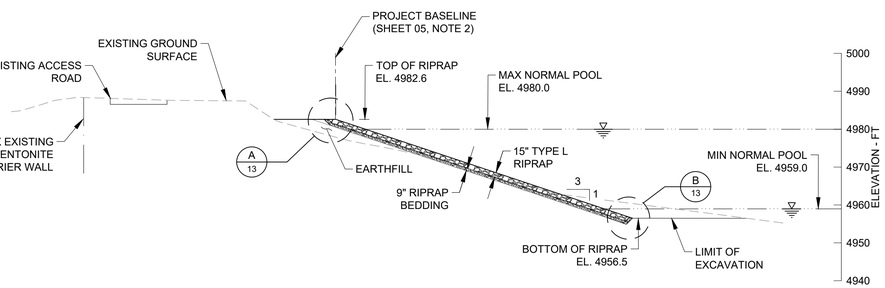
SECTION 4 / 05
BL STA 27+24

0 10 20 40 60
SCALE IN FEET



SECTION 5 / 05
BL STA 35+19

0 10 20 40 60
SCALE IN FEET



SECTION 6 / 05
BL STA 50+08

0 10 20 40 60
SCALE IN FEET

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9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton℠

CITY OF BRIGHTON

COLORADO LICENSED
TIMOTHY MATTHEW HAHN
11/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

SLOPE PROTECTION SECTIONS
(1 OF 2)

SHEET ID
07
7 OF 14

100% DESIGN

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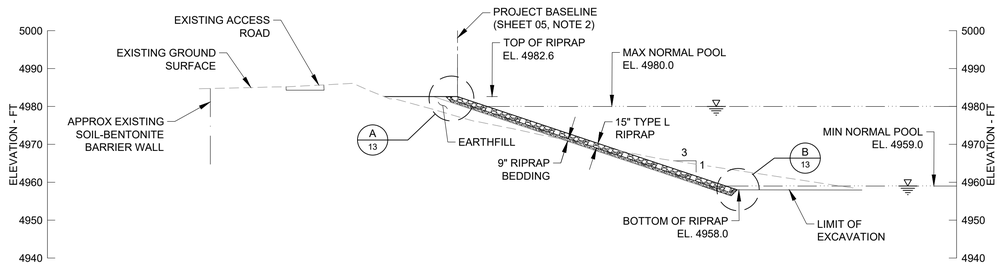
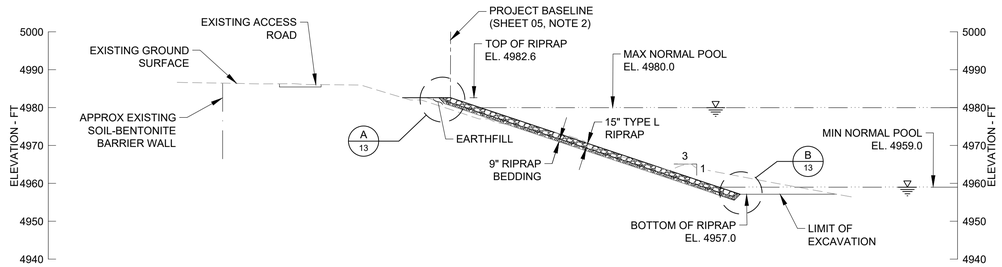


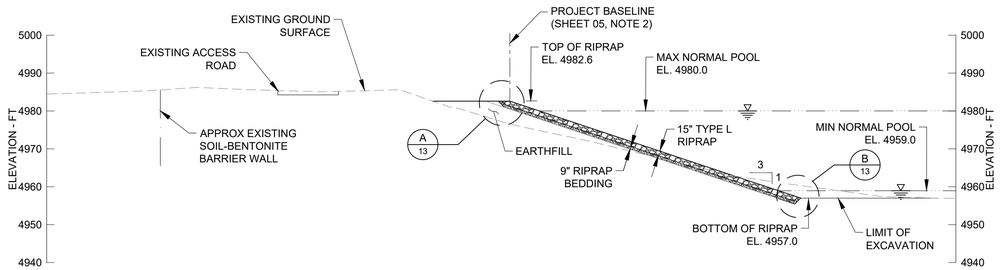
SECTION 7
BL STA 56+41 05

0 10 20 40 60
SCALE IN FEET



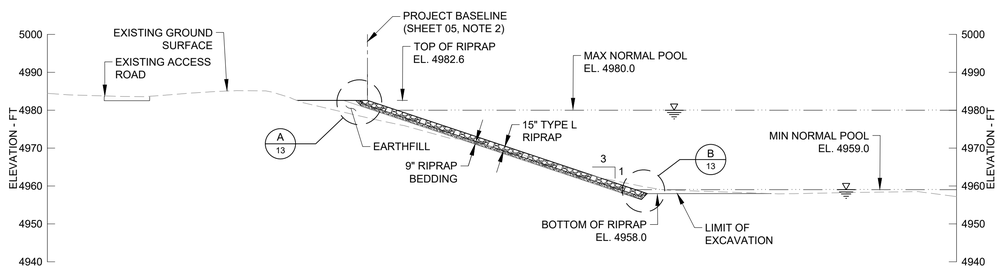
SECTION 8
BL STA 64+63 05

0 10 20 40 60
SCALE IN FEET



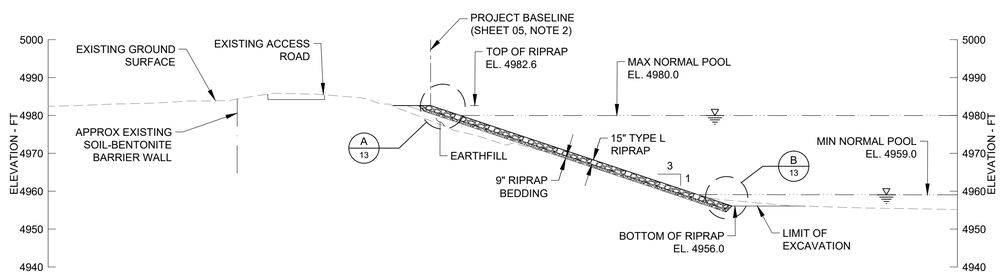
SECTION 9
BL STA 71+78 05

0 10 20 40 60
SCALE IN FEET



SECTION 10
BL STA 76+18 05

0 10 20 40 60
SCALE IN FEET



SECTION 11
BL STA 84+55 05

0 10 20 40 60
SCALE IN FEET

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9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton℠

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HEIL
11/7/24
33260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

SLOPE PROTECTION SECTIONS
(2 OF 2)

SHEET ID
08
8 OF 14

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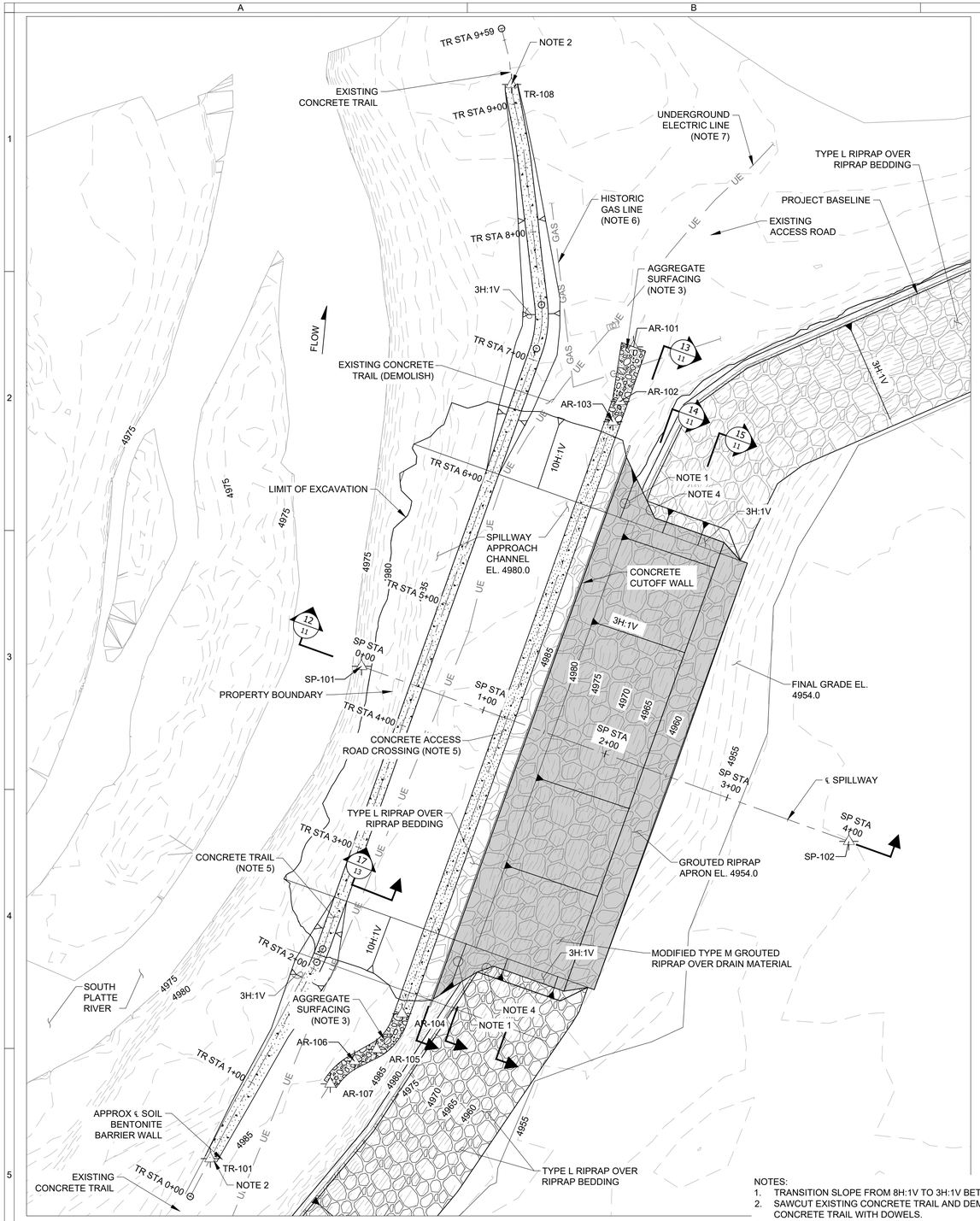
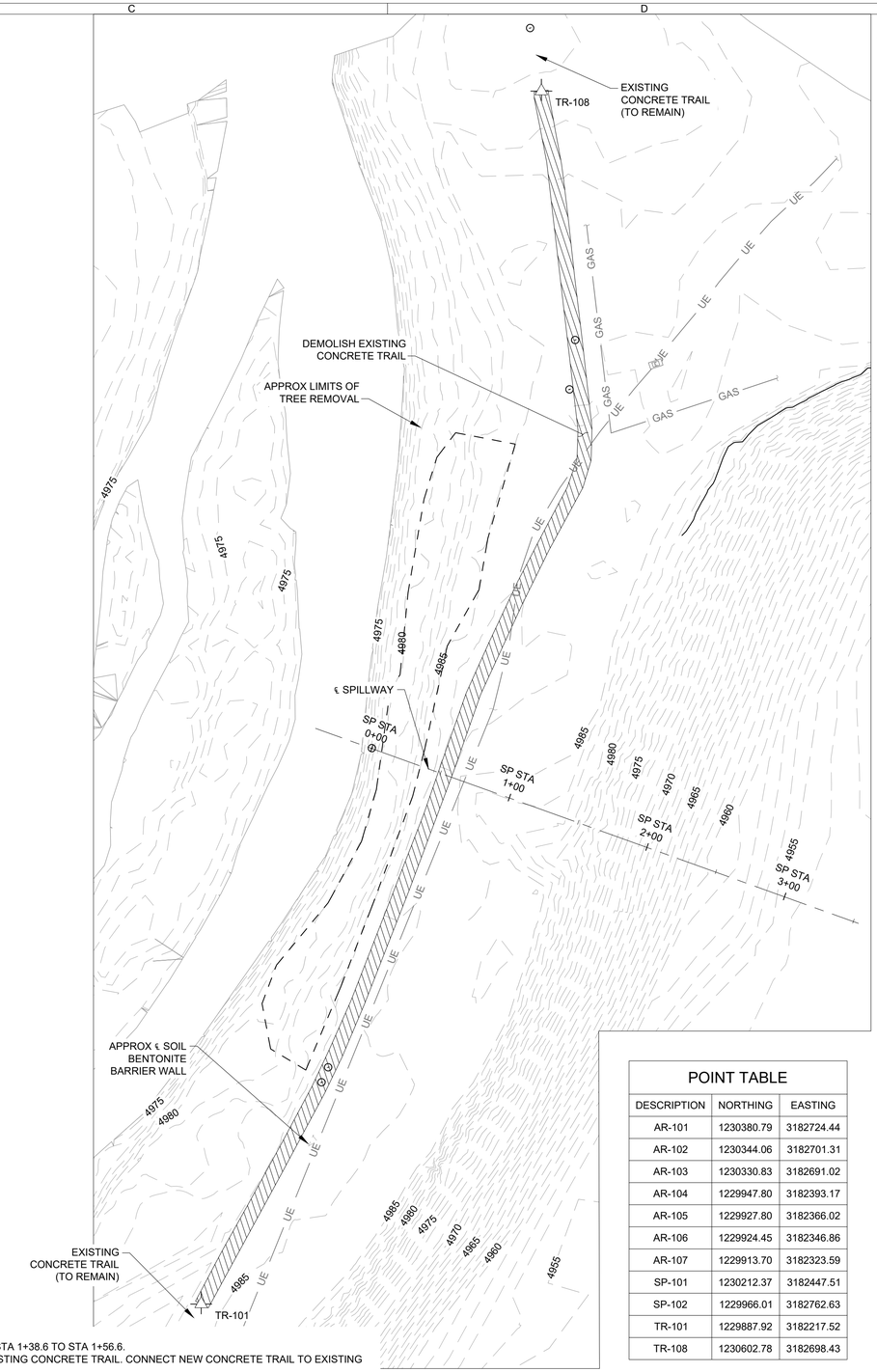


SPILLWAY PLAN

0 25 50 100 150
SCALE IN FEET



DEMOLITION PLAN

0 25 50 100 150
SCALE IN FEET

NOTES:
1. TRANSITION SLOPE FROM 8H:1V TO 3H:1V BETWEEN SP STA 1+38.6 TO STA 1+56.6.
2. SAWCUT EXISTING CONCRETE TRAIL AND DEMOLISH EXISTING CONCRETE TRAIL. CONNECT NEW CONCRETE TRAIL TO EXISTING CONCRETE TRAIL WITH DOWELS.
3. TRANSITION FROM NEW CONCRETE ACCESS ROAD CROSSING TO EXISTING ACCESS ROAD. PLACE 6-INCHES OF AGGREGATE SURFACING.
4. TRANSITION TOP OF GROUTED RIPRAP FROM THE TOP OF SLOPE TO 3 FEET ABOVE THE SPILLWAY INVERT.
5. PLACE TRANSVERSE TOOLED CONCRETE JOINTS EVERY 10 FEET. MINIMUM DEPTH OF JOINT SHALL BE 1.5 INCHES AND MAXIMUM DEPTH SHALL BE 2 INCHES. JOINTS MAY ALSO BE SAWCUT AFTER CURING.
6. GAS LINE SHOWN ON RECORDS PROVIDED BY PHILLIPS 66 BUT NOT FOUND DURING SUE SURVEY BY SURVWEST, LLC. THE GAS LINE HAS POTENTIALLY BEEN REMOVED OR ABANDONED.
7. UNITED POWER ELECTRIC LINE IDENTIFIED IN SUE SURVEY BY SURVWEST, LLC. COORDINATE RELOCATION WITH THE CITY AND UNITED POWER.

POINT TABLE

DESCRIPTION	NORTHING	EASTING
AR-101	1230380.79	3182724.44
AR-102	1230344.06	3182701.31
AR-103	1230330.83	3182691.02
AR-104	1229947.80	3182393.17
AR-105	1229927.80	3182366.02
AR-106	1229924.45	3182346.86
AR-107	1229913.70	3182323.59
SP-101	1230212.37	3182447.51
SP-102	1229966.01	3182762.63
TR-101	1229887.92	3182217.52
TR-108	1230602.78	3182698.43

RJH CONSULTANTS
CONSULTANTS, INC.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton℠

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HAHN
11/1/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

PLAN OF SPILLWAY AND DEMOLITION

SHEET ID
09
9 OF 14

100% DESIGN

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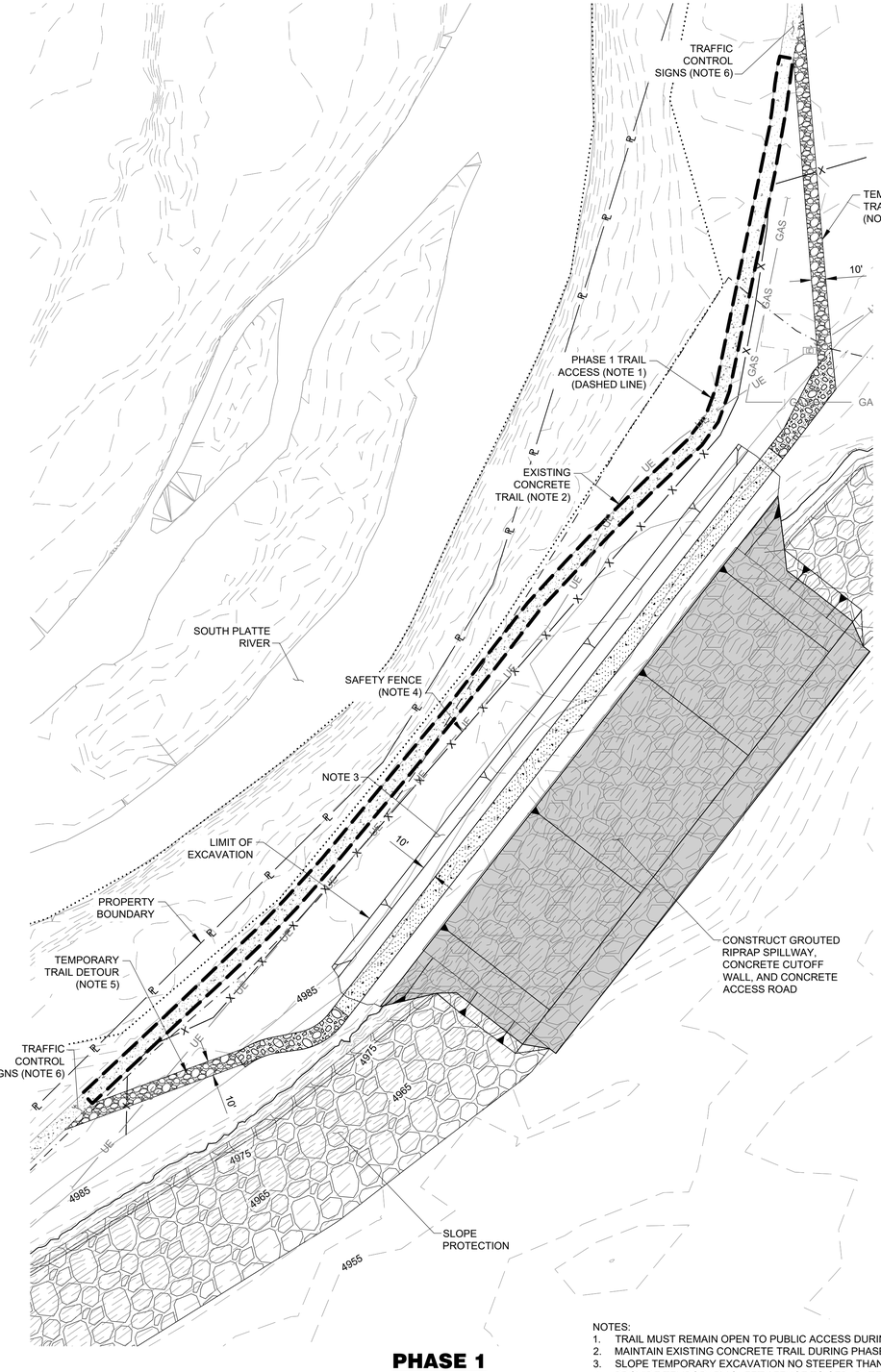
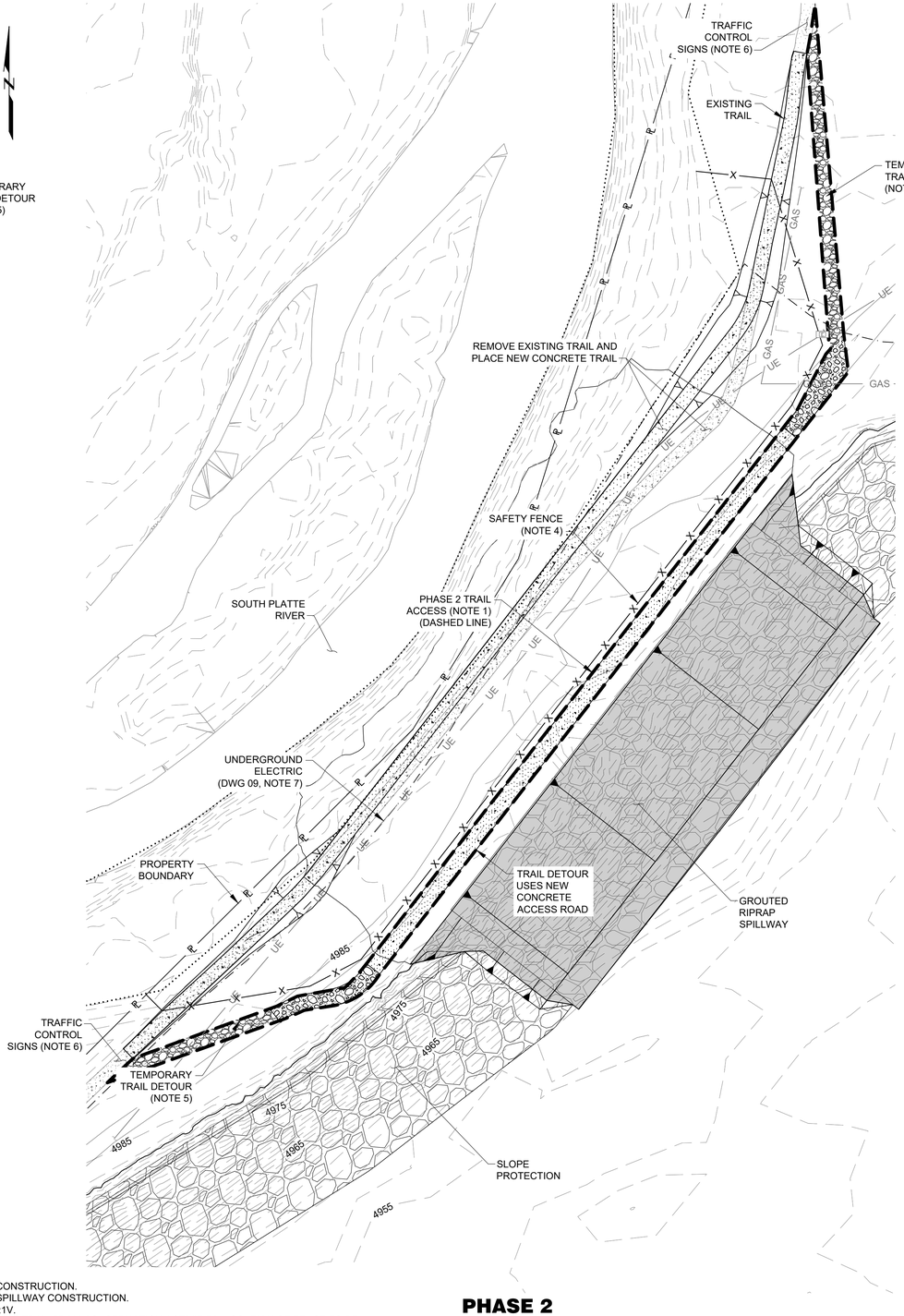


PHASE 1

0 25 50 100 150
SCALE IN FEET



PHASE 2

0 25 50 100 150
SCALE IN FEET

NOTES:
1. TRAIL MUST REMAIN OPEN TO PUBLIC ACCESS DURING CONSTRUCTION.
2. MAINTAIN EXISTING CONCRETE TRAIL DURING PHASE 1 SPILLWAY CONSTRUCTION.
3. SLOPE TEMPORARY EXCAVATION NO STEEPER THAN 2H:1V.
4. PROVIDE TEMPORARY SAFETY FENCE TO SEPARATE ACTIVE TRAIL FROM CONSTRUCTION ACTIVITIES. LOCATION OF FENCE TO BE APPROVED BY BRIGHTON AND WILL REQUIRE MODIFICATION DURING VARIOUS PHASES OF WORK.
5. PROVIDE TEMPORARY TRAIL DETOUR BETWEEN EXISTING CONCRETE TRAIL AND ACCESS ROAD DURING CONSTRUCTION OF NEW CONCRETE TRAIL. PLACE 6-INCH THICK LAYER OF AGGREGATE SURFACING. REMOVE TRAIL DETOUR WHEN CONSTRUCTION OF NEW TRAIL IS COMPLETE AND OPEN TO THE PUBLIC.
6. PROVIDE TEMPORARY TRAFFIC CONTROL SIGNS IN ACCORDANCE WITH APPROVED TRAFFIC CONTROL PLAN.

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PROFESSIONAL ENGINEER

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RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE PROTECTION PROJECT

SPILLWAY SEQUENCING PLAN

SHEET ID
10
10 OF 14

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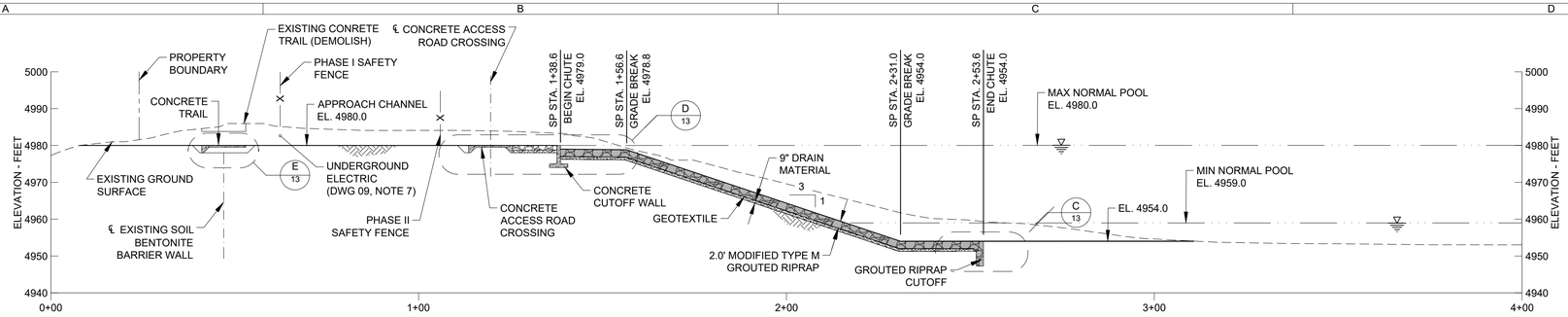
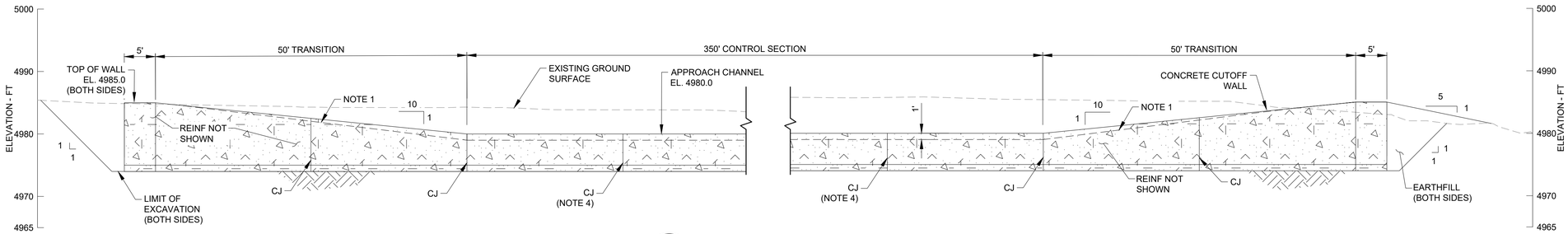


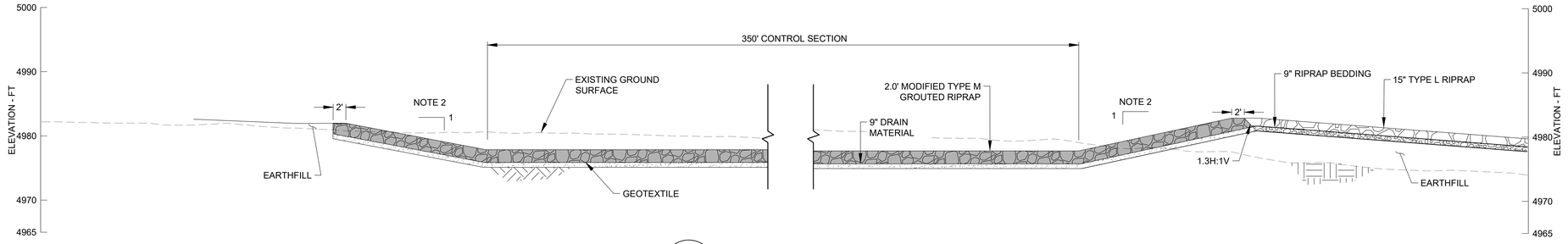
SECTION 12 / 09

0 10 20 40 60
SCALE IN FEET



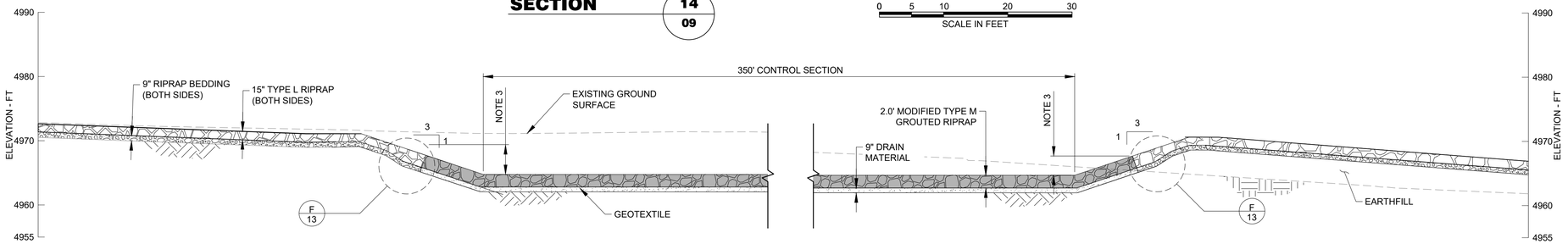
SECTION 13 / 09

0 5 10 20 30
SCALE IN FEET



SECTION 14 / 09

0 5 10 20 30
SCALE IN FEET



SECTION 15 / 09

0 5 10 20 30
SCALE IN FEET

NOTES:
1. TOP OF GROUTED RIPRAP ALONG DOWNSTREAM FACE. SLOPE IS 8H:1V.
2. SLOPE TRANSITIONS FROM 8H:1V TO 3H:1V.
3. PROVIDE MINIMUM DEPTH OF 3 FEET BETWEEN SP STA 1+56.6 TO 2+31.0.
4. PLACE CONSTRUCTION JOINTS WITHIN CONTROL SECTION AT EVENLY SPACED INTERVALS NO GREATER THAN 25 FEET.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

COLORADO LICENSED
ERIN M. MATTHEW HAIN
4/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

SPILLWAY SECTIONS

SHEET ID
11
11 OF 14

100% DESIGN

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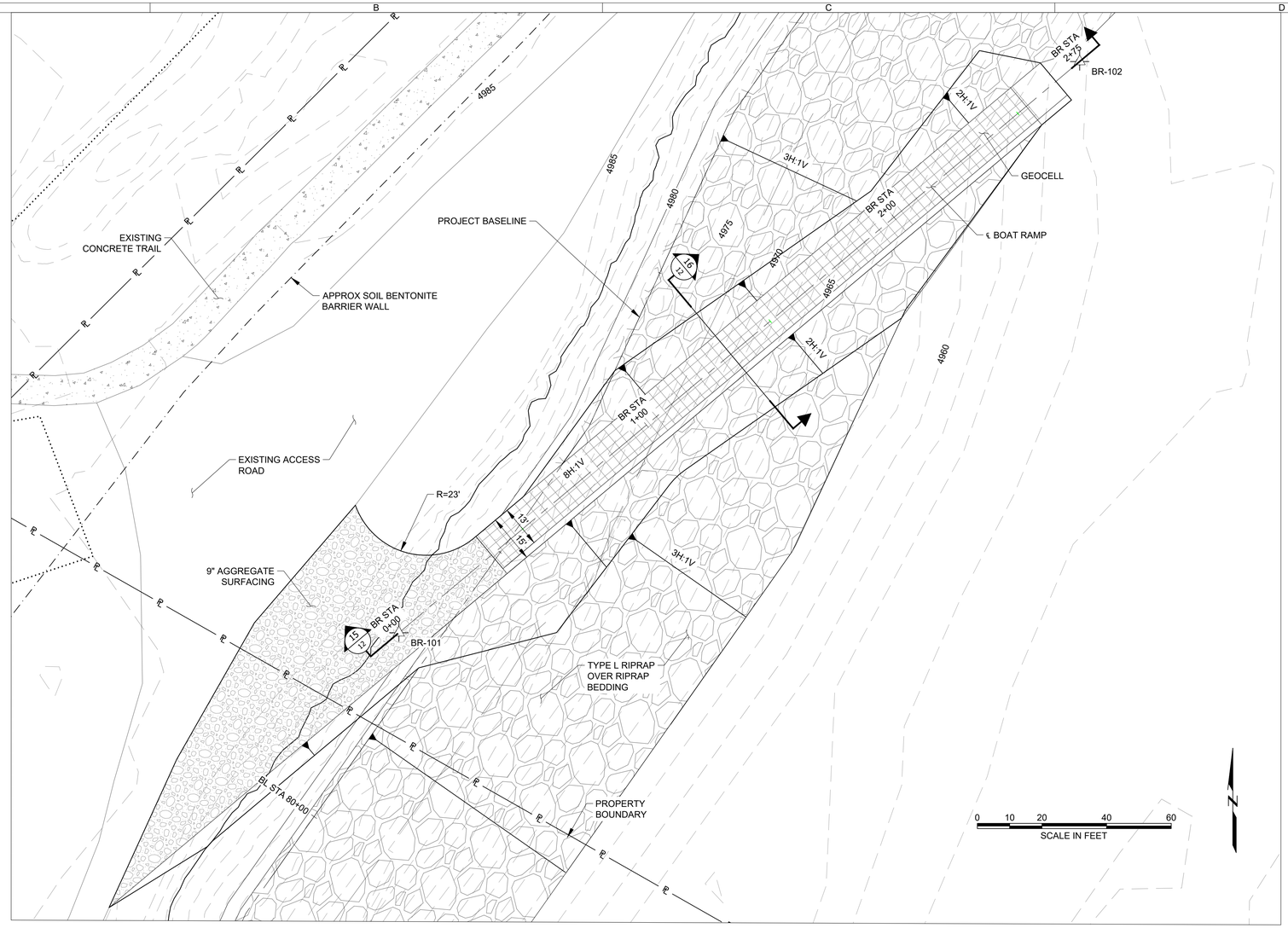
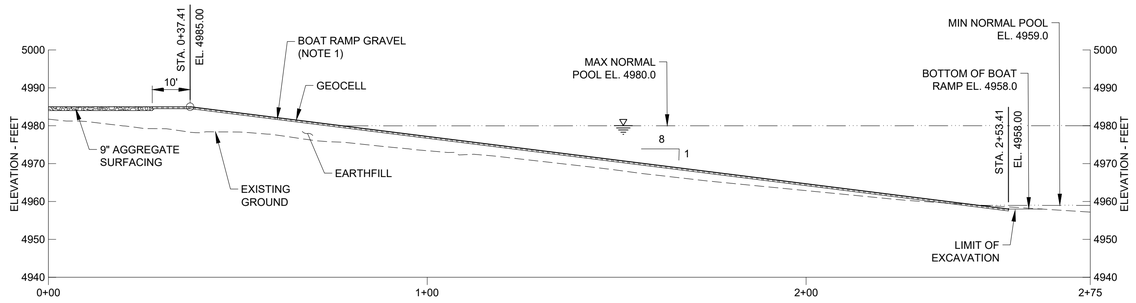
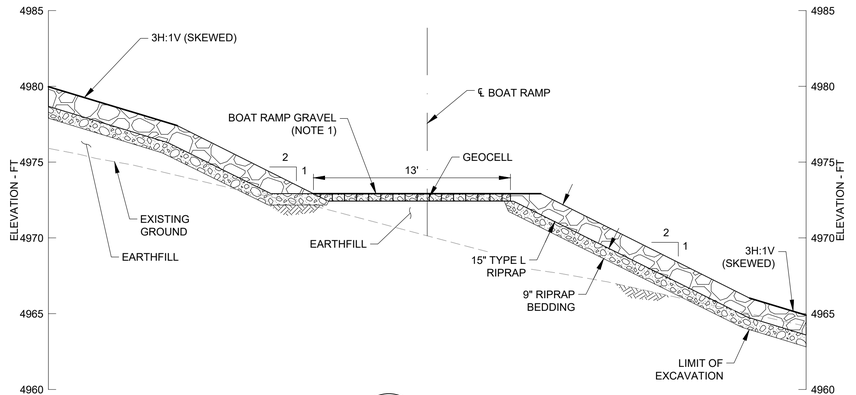


POINT TABLE		
DESCRIPTION	NORTHING	EASTING
BR-101	1229437.72	3181929.81
BR-102	1229614.47	3182140.49



SECTION 15 / 12

0 10 20 40 60
SCALE IN FEET



SECTION 16 / 12

0 2.5 5 10 15
SCALE IN FEET

NOTES:
1. PLACE BOAT RAMP GRAVEL IN GEOCELL CELLS.

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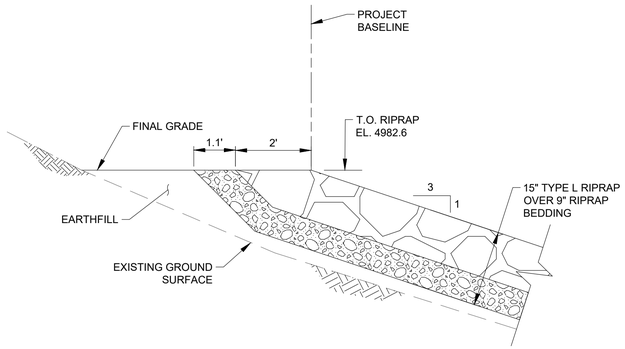
KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

BOAT RAMP PLAN AND SECTIONS

SHEET ID
12
12 OF 14

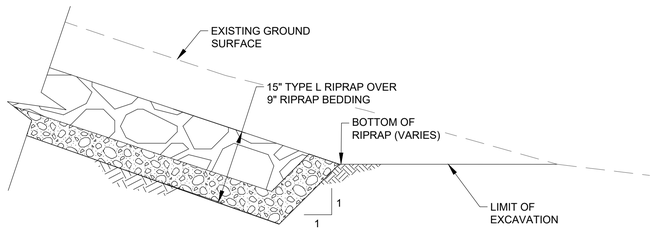
100% DESIGN

P:\22143 - KEN MITCHELL CELL 3\CAD\DRAWINGS\PRELIMINARY DESIGN\90% DESIGN\22143_BOAT_RAMP.DWG 10/22/2024



DETAIL A/07 A/08

0 1 2 4 6
SCALE IN FEET



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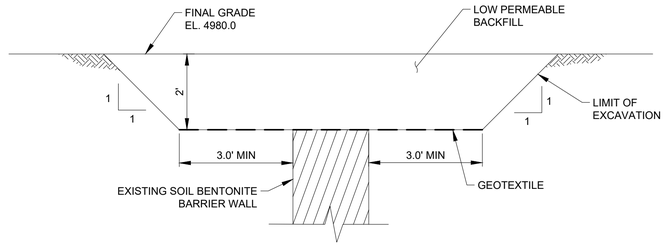

SECTION 17/09
(NOTE 4 AND 6)

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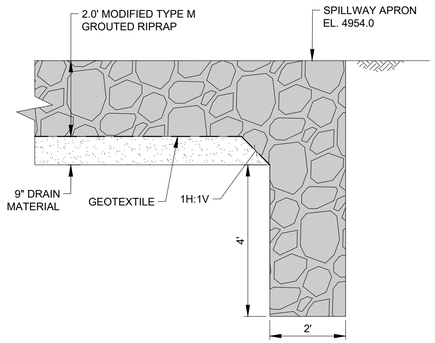
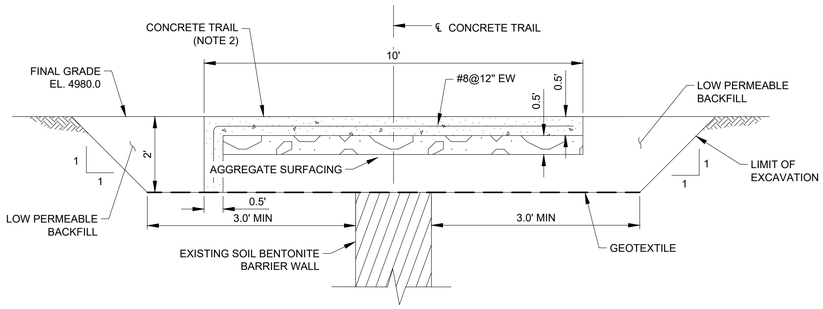


DETAIL C/11

0 1 2 4 6
SCALE IN FEET



DETAIL E/11
(NOTE 3 AND 6)

0 1 2 4 6
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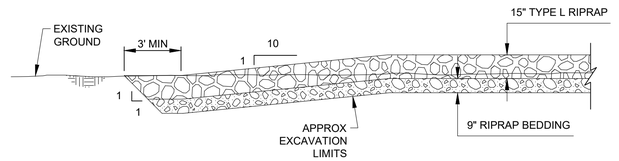
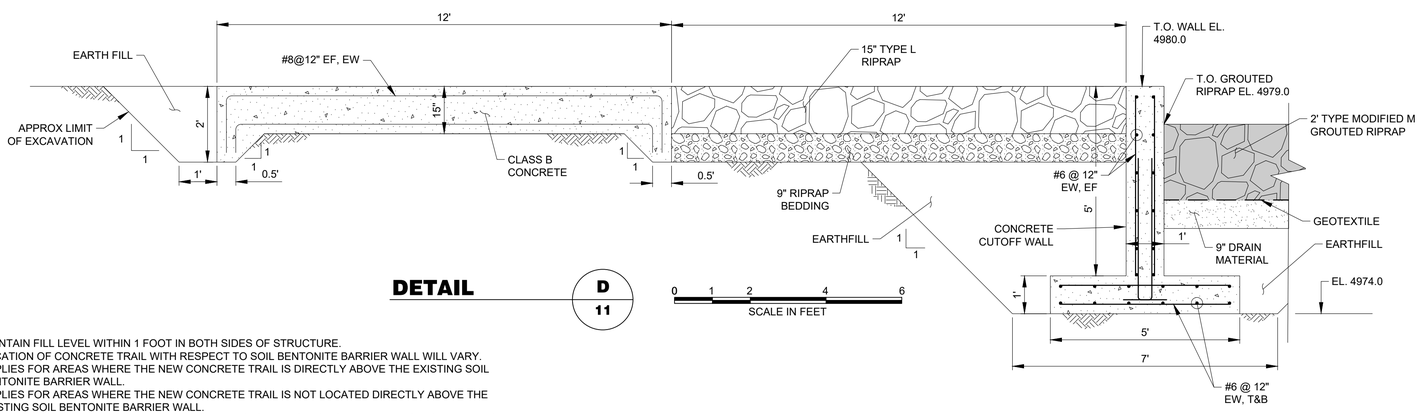


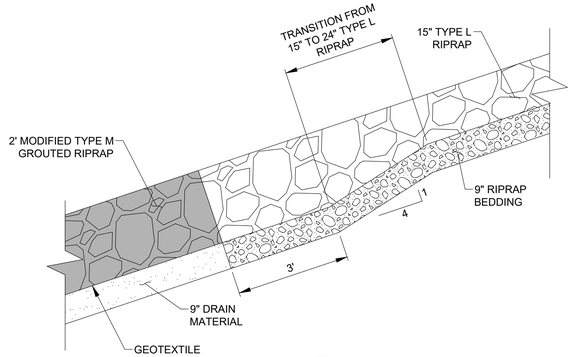
TYP. SECTION
(NOTE 5)

0 2 4 8 12
SCALE IN FEET



DETAIL D/11

0 1 2 4 6
SCALE IN FEET



DETAIL F/11

0 1 2 4 6
SCALE IN FEET

NOTES:
1. MAINTAIN FILL LEVEL WITHIN 1 FOOT IN BOTH SIDES OF STRUCTURE.
2. LOCATION OF CONCRETE TRAIL WITH RESPECT TO SOIL BENTONITE BARRIER WALL WILL VARY.
3. APPLIES FOR AREAS WHERE THE NEW CONCRETE TRAIL IS DIRECTLY ABOVE THE EXISTING SOIL BENTONITE BARRIER WALL.
4. APPLIES FOR AREAS WHERE THE NEW CONCRETE TRAIL IS NOT LOCATED DIRECTLY ABOVE THE EXISTING SOIL BENTONITE BARRIER WALL.
5. USE AT TRANSITION BETWEEN AREAS OF RIPRAP SLOPE PROTECTION AND UNPROTECTED AREAS.
6. SOIL-BENTONITE BARRIER WALL CAP.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HAHN
11/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

MISCELLANEOUS DETAILS

SHEET ID
13
13 OF 14

100% DESIGN

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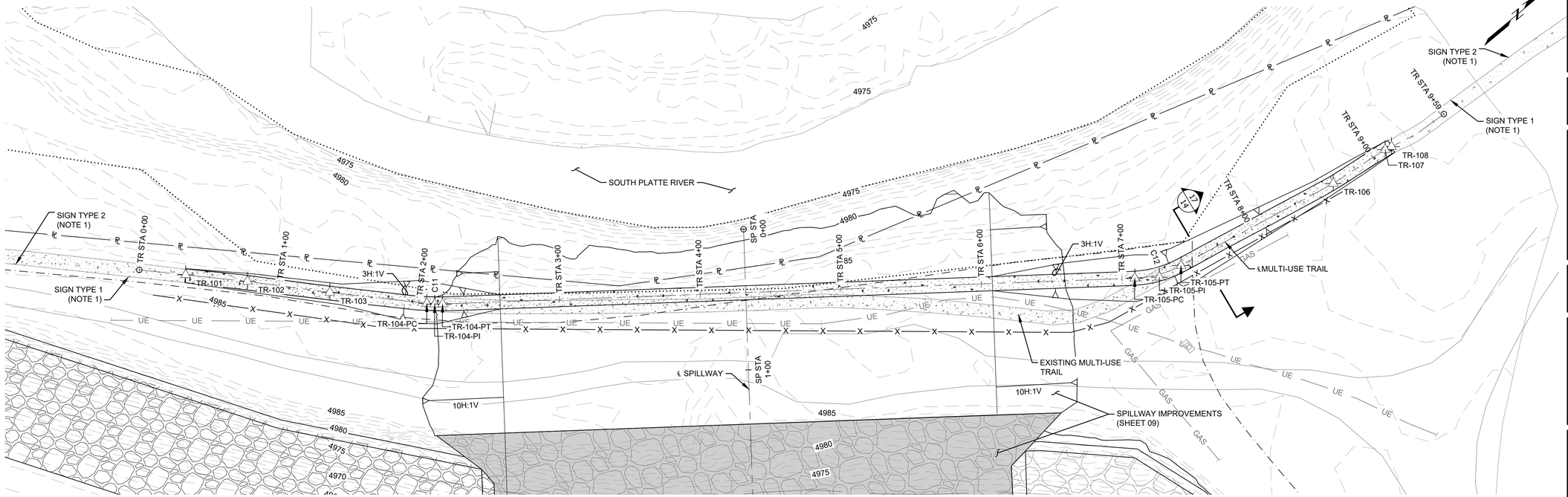
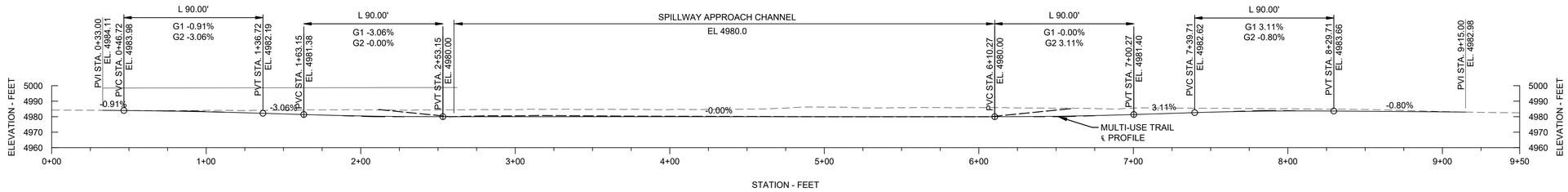


MULTI-USE TRAIL PLAN

0 20 40 80 120

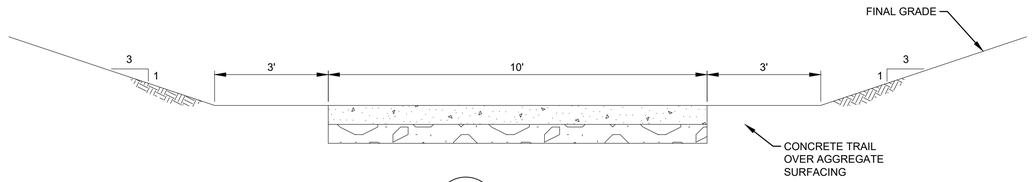
SCALE IN FEET



MULTI-USE TRAIL PROFILE

0 20 40 80 120

SCALE IN FEET



SECTION 17/14

0 1 2 4 6

SCALE IN FEET

DETAIL
SIGN TYPE 1

DETAIL
SIGN TYPE 2

NOTES:
1. COORDINATE PERMANENT TRAFFIC SIGN LOCATIONS WITH ENGINEER AND TRAFFIC CONTROL PLAN.

RJH CONSULTANTS
CONSULTANTS, INC.

RJH CONSULTANTS
9800 MT PYRAMID COURT, SUITE 330
ENGLEWOOD, CO 80112

Brighton℠

CITY OF BRIGHTON

COLORADO LICENSED
ERIC MATTHEW HALL
11/7/24
43260
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION
1	11/24	100-PERCENT DESIGN

DESIGNED BY:	RMW	
DRAWN BY:	RMW	
CHECKED BY:	JDN	
APPROVED BY:	EMH	

RJH PROJECT NUMBER
22143

KEN MITCHELL CELL #3
SPILLWAY AND SLOPE
PROTECTION PROJECT

MULTI-USE TRAIL PLAN AND PROFILE

SHEET ID
14
14 OF 14

100% DESIGN

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KEN MITCHELL LAKES CELL #3 SPILLWAY AND SLOPE PROTECTION PROJECT SPECIFICATIONS

100-PERCENT DESIGN

BRIGHTON, COLORADO

BY: _____

ENGINEER: **ERIC M. HAHN, P.E.**
RJH CONSULTANTS, INC.
9800 MT. PYRAMID COURT, SUITE 330
ENGLEWOOD, COLORADO 80112

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KEN MITCHELL LAKES CELL #3
SPILLWAY AND SLOPE PROTECTION
100-PERCENT DESIGN
NOVEMBER 2024
SPECIFICATION INDEX

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 GENERAL

A. The completed Work will provide OWNER with a riverside spillway at the South Platte River and riprap slope protection along the interior reservoir slopes. The Work described in these specifications includes the following general items:

1. Excavation, foundation preparation, and placing fill to achieve final lines and grades.
2. Placing grouted riprap underlain by geotextile and drain material.
3. Constructing a reinforced concrete cutoff wall.
4. Constructing a concrete access road and multi-use trail.
5. Placing riprap underlain by riprap bedding.
6. Temporary facilities, survey control, reservoir control, dewatering, multi-use trail detour, and other items of work incidental to the Work items listed above.

1.2 WORK NOT COVERED BY CONTRACT DOCUMENTS

A. Unless specifically stated as being furnished and/or performed by others, all Work described in the Contract Documents shall be performed by CONTRACTOR.

1.3 OWNER-FURNISHED ITEMS

A. Non-potable construction water from Cell #1.

1.4 LOCATION AND INSPECTION OF SITE

A. Cell #3 is located east of the South Platte River and west of W. Bromley Lane.

1.5 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. Comply with codes and standards applicable to each type of Work, and as listed in individual sections.

1. Where reference documents are not specified by date, the applicable version of the document shall be the version current as of the date established for receipt of bids.

1.6 MANUFACTURER'S SPECIFICATIONS

A. Materials, applications, and tests specified by reference to published standards of a society, association, code, or other published standards are included in the Specifications as if written in their entirety.

B. Products and processes included in the Specifications shall confirm to the manufacturer's latest published specifications, as of the date established for receipt of bids.

C. Provide sworn affidavits from manufacturers certifying that material, products, ad, processes delivered and used on the project meet the specified requirements. Affidavits shall not relieve CONTRACTOR from his responsibility for full compliance with the requirements of the Specifications.

1.7 MEANS AND METHODS

A. Means and methods of construction shall be such as CONTRACTOR or Subcontractors may choose; subject, however, to OWNER's right to reject means and methods proposed by CONTRACTOR that:

1. Constitute a hazard to the Work, persons, or property.
2. Will not produce finished Work in accordance with terms of the Contract.
3. Are contrary to specified means or methods required in the Contract.

B. The right to reject means and methods of CONTRACTOR or Subcontractor shall not be construed or interpreted as acceptance of control of means or methods by OWNER.

C. OWNER's approval or failure to exercise right to reject means and methods shall not relieve CONTRACTOR of his obligation to complete the Work required by the Contract.

D. Sole responsibility for control of all means and methods lies with CONTRACTOR for all Work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.

B. Measurement and payment criteria applicable to portions of the Work performed under a lump sum payment method.

1.2 SUBMITTALS

A. Administrative Submittals

1. Schedule of Values
2. Monthly Payment Application.
3. Final Payment Application.

1.3 APPLICATION FOR PAYMENT

A. In accordance with the GENERAL CONDITIONS and SPECIAL CONDITIONS except as modified by these Specifications.

B. No payment shall be made for materials or equipment stored on-site and not installed without acceptance of OWNER in the field.

C. Preparation:

1. Use detailed Application for Payment Form provided by OWNER.
2. List each approved Change Order and each approved item executed prior to date of submission as separate line item. Totals to equal those shown on the Transmittal Summary Form, as applicable.
3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s), and all supporting data (survey information for quantities, receipts of materials, etc.) for each item for which payment is requested.

D. Updated progress schedule: With each pay request.

E. Along with monthly pay estimate, submit an estimate of the work that will be completed during the upcoming month.

F. Submit photographic documentation of all phases of construction with Payment Form.

G. Include backup data and calculations for unit price items.

1.4 MEASUREMENT - GENERAL

A. General:

1. Field surveys, measurements and computations necessary for determination of payment quantities shall be performed by CONTRACTOR, and are subject to review, verification and approval by ENGINEER or OWNER.

2. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.
3. Where measurement of quantities depends on elevation of existing ground, prior to any work, elevations obtained during construction will be compared with those shown on Drawings. Variations of 1 foot or less will be ignored, and contours shown on Drawings will be used for calculating quantities.
4. Tolerance: to the nearest 0.1 foot for plan and elevation measurements, unless otherwise noted. Round to the nearest whole unit for computed pay quantities.

B. By Volume:

1. All materials which are specified for volume measurement shall be computed using length, width, and height or thickness. Measurement will be in-place after acceptance of Work based on the design lines (neat lines) shown on the drawings unless otherwise specified.
2. Unless specified otherwise, volumes shall be computed by the average-end-area method with cross section spacing of 50 feet or less. On curved alignments, volume computation shall utilize the actual curve length between the centroid of each area at adjacent cross sections rather than the nominal cross sections spacing along the alignment.

C. By Length: All pay items specified for linear measurement by the linear foot, measured in place, shall be based on the actual length installed, measured horizontally.

D. By Area: All pay items specified for aerial measurement by the square foot, square yard, or acre, measured in place, shall be based on a horizontal projection or slope area of the actual area installed, as specified; except where specified.

E. Units of measure shown on the Schedule of Values shall be as follows unless specified otherwise.

Item	**Method of Measurement**
AC	Acre – Horizontal Projection measured In-Place, within the limits specified or shown unless otherwise specified.
SF	Square Foot – Horizontal (or vertical, where specified) projection measured in-place, within the limits specified or shown.
CY	Cubic Yard – Measured In-Place, within the limits specified
LF	Linear Foot – Horizontal Projection measured in-place
SY	Square Yard – Horizontal projection measured in-place within the limits specified unless otherwise specified.
AC-FT	Acre-feet – Measured by calibrated and accepted flow meter.

1.5 PAYMENT

A. Progress payments will be made monthly.

B. No payment will be made for excavation or for fill placed in excavations made by CONTRACTOR below the required foundation surface as shown or established in the field by ENGINEER. This applies to excavations such as haul road cuts or access ramps made for CONTRACTOR's convenience, as well as excavation to remove damaged subgrade material that has become desiccated, softened, eroded, frozen, or otherwise disturbed by exposure to the elements or CONTRACTOR's operations.

C. Separate payment will not be made for preparation of foundation or subgrade surfaces. All foundation preparation is considered incidental to other items of Work.

D. Payment for each item on the Schedule of Values covers all Work necessary to furnish and install the items.

E. Neat line is the line shown on the drawings defining the limits of an aspect of construction.

1.6 PAYMENT FOR UNIT PRICE ITEMS

A. Unit Price Work:

1. Reflect unit price quantity and price breakdown from the Bid Form.
2. Estimated quantities shown on the Bid Form are approximate and are given only for a comparison of bids. OWNER does not either expressly or by implication warrant that the actual quantities will correspond to the estimated quantities. OWNER reserves the right to increase or decrease the amount of work performed under unit price items, or to omit work altogether. No adjustments in contract unit prices will be made except as provided in the General Conditions.

B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the OWNER, multiplied by the unit price for Work that is incorporated in or made necessary by the Work.

1.7 PAYMENT FOR LUMP SUM ITEMS

A. Payment for lump sum Work shall be made in accordance with the Schedule of Values.

B. An unbalanced or front-end loaded schedule will not be acceptable.

C. Mobilization shall not exceed 10 percent of the total original contract amount (at the time of award). Payment for mobilization shall the made as follows:

1. When 5 percent of the total original contract amount is earned from other pay items, 50 percent of the amount for mobilizations will be paid.
2. When 10 percent of the total original contract amount is earned from other pay items, 90 percent of the amount for mobilization will be paid, exclusive of any amount already paid for previous progress payment.
3. When CONTRACTOR has demobilized from the site, the balance of the amount for mobilization will be paid.

1.8 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for the following:

1. Materials excavated or placed beyond the Design Lines shown on the Drawings, except as specifically required by ENGINEER.
2. Loading, hauling, and disposing of rejected material.
3. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
4. Rejected loads of material, including material rejected after it has been placed by reason of failure of CONTRACTOR to conform to provisions of Contract Documents.
5. Material not unloaded from transporting vehicle.
6. Defective work not accepted by OWNER.
7. Material remaining on hand after completion of Work.

1.9 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: Partial payments will be made for materials and equipment delivered or stored with verifiable product data and quantity data provided to ENGINEER and accepted by OWNER.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to CONTRACTOR unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.10 SCHEDULE OF VALUES

A. Schedule of values shall match the bid schedule.

B. Provide break down of lump sum payment items to facilitate review.

C. Description of bid items is provided in the table at the end of this section.

D. The Base Bid consists of items 1 to 21 and generally includes construction of the spillway, installation of slope protection between BL Sta. 0+00 to 3+00, BL Sta. 47+00 to 70+00, and BL Sta. 80+00 to 88+18, and ancillary Work items.

E. Add Alternate 1 consists of items 22 to 28 and allows the OWNER to add additional slope protection from BL Sta. 3+00 to 20+00 at the OWNER'S discretion.

F. Add Alternate 2 consists of items 29 to 35 and allows the OWNER to add additional slope protection from BL Sta. 20+00 to 47+00 at the OWNER'S discretion.

G. Add Alternate 3 consists of items 36 to 42 and allows the OWNER to add additional slope protection from BL Sta. 70+00 to 80+00 at the OWNER'S discretion.

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
Base Bid				
1	Mobilization	Lump Sum	Mobilization shall consist of preparatory work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the site; establishment of all work areas, and other facilities necessary for the Work; obtaining project permits; installing a stabilized construction entrance; and for all other work and operations that must be performed, or costs incurred, prior to beginning of the Work, removal of CONTRACTOR's personnel, equipment, and material from the site.	Measurement will be based on Part 1.7C of this Section
2	Site Preparation	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required for removal and offsite disposal of vegetation and man-made debris from the Work area, and salvaging and stockpiling topsoil.	Measurement will be lump sum based on an estimated percent complete.
3	Demolition	Lump Sum	Demolition of the existing concrete multi-use trail. Work includes excavation, concrete cutting, concrete demolition, and disposal of demolished concrete materials at an off-site location approved by OWNER.	Measurement will be lump sum based on an estimated percent complete.
4	Survey	Lump Sum	Furnishing all equipment, materials, and labor to perform the required pre- and post-construction surveys, to support progress payments, to control the work, for project closeout, and all other surveys and staking required to perform the Work.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
5	Erosion Protection and Sediment Control	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required to construct, install, maintain, and remove when required, erosion protection and sediment control measures during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of waters.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
6	Boat Ramp	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories for subgrade preparation, grading, and installing geocell boat ramp with gravel backfill.	Measurement will be lump sum complete in place.
7	Aggregate Surfacing	Cubic Yards	Furnishing, stockpiling, subgrade preparation, conditioning, processing, hauling, placing, spreading, and compacting Aggregate Surfacing.	Measurement will be based on the volume in-place after compaction between the neat lines.
8	Site Reclamation	Lump Sum	Furnishing all equipment, materials, and labor necessary for topsoil placement; finish grading and preparation of seedbed for	Measurement will be lump sum complete in-place.

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
			planting; furnishing and placing seed, fertilizer, and mulch; and maintaining new vegetation.	
9	Slope Protection Earthwork	Lump Sum	Excavating, hauling, stockpiling, subgrade preparation, processing, placing, spreading, and compacting earthfill as necessary to install riprap slope protection between BL Sta. 0+00 to 3+00, BL Sta. 47+00 to 70+00, and BL Sta. 80+00 to 88+18.	Measurement will be lump sum based on an estimated percent complete.
10	Type L Riprap	Cubic Yard	Furnishing all equipment, materials, and labor for installation of the imported riprap at spillway crest and for slope protection between BL Sta. 0+00 to 3+00, BL Sta. 47+00 to 70+00, and BL Sta. 80+00 to 88+18.	Measurement will be based on the volume in-place, based on the slope area measured in the field times the design line thickness shown on the Drawings.
11	Riprap Bedding	Cubic Yard	Furnishing all equipment, materials, and labor for subgrade preparation, and installation of the riprap bedding at spillway crest and for slope protection between BL Sta. 0+00 to 3+00, BL Sta. 47+00 to 70+00, and BL Sta. 80+00 to 88+18.	Measurement will be based on the volume in-place after placement, based on the slope area measured in the field times the design line thickness shown on the Drawings.
12	Spillway Earthwork	Lump Sum	Excavation and subgrade preparation to install spillway and hauling and placing excess excavation at bottom of reservoir. Coordination with United Power and furnishing all equipment, materials, and labor to relocate the electrical line.	Measurement will be lump sum based on an estimated percent complete.
13	Multi-Use Trail Traffic Control	Lump Sum	Furnishing all equipment, materials, and labor to protect portions of the multi-use trail designated to remain during Phase 1 spillway construction, installing and removing temporary aggregate surfacing for Phase 2 trail detour, utilizing the new concrete access road crossing for the Phase 2 trail detour, and providing traffic control including safety fence, posts, trail crossings, all required warning and safety signage components, flagman if necessary, and obtaining Adams County permits. Furnishing and installing permanent traffic control signs.	Measurement will be lump sum based on an estimated percent complete.
14	Soil-Bentonite Barrier Wall Cap	Lump Sum	Excavating, furnishing bentonite, amending earthfill materials with bentonite, hauling and compacting low-permeable backfill, and furnishing and installing geotextile.	Measurement will be lump sum based on an estimated percent complete.
15	Concrete Multi-Use Trail	Lump Sum	Furnishing all equipment, materials, and labor to install the concrete trail including concrete, reinforcement, backfilling, and other items incidental to the Work.	Measurement will be lump sum based on an estimated percent complete.

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
16	Concrete Access Road Crossings	Lump Sum	Furnishing all equipment, materials, and labor to install the concrete access road crossing including concrete, reinforcement, backfilling, and other items incidental to the Work.	Measurement will be lump sum based on an estimated percent complete.
17	Concrete Cutoff Wall	Lump Sum	Furnishing all equipment, materials, and labor to install the concrete cutoff wall including concrete, reinforcement, foundation preparation, backfill, and other items incidental to the Work.	Measurement will be lump sum based on an estimated percent complete.
18	Type Modified M Grouted Riprap	Cubic Yard	Furnishing all equipment, materials, subgrade preparation, and labor for installation of the grouted riprap test section and spillway.	Measurement will be based on the volume in-place, based on the slope area measured in the field times the design line thickness shown on the Drawings.
19	Drain Material	Cubic Yard	Furnishing all equipment, materials, subgrade preparation, and labor for installation of the drain material.	Measurement will be based on the volume in-place after placement, based on the slope area measured in the field times the design line thickness shown on the Drawings.
20	Geotextile	Square Yard	Furnishing and placing geotextile at spillway chute.	Measurement will be based on the slope area of geotextile in place. No extra payment will be made of overlap areas.
21	Ancillary Project work, contract administration, and submittals	Lump Sum	Work not covered in a specific Bid Item and at a minimum shall include preparing submittals, administering the contract, managing the Work, performing CONTRACTOR's quality control testing, and other items as appropriate.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
Add Alternative 1				
22	Site Preparation	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required for removal and offsite disposal of vegetation and man-made debris from the Work area, and salvaging and stockpiling topsoil.	Measurement will be lump sum based on an estimated percent complete.
23	Survey	Lump Sum	Furnishing all equipment, materials, and labor to perform the required pre- and post-construction surveys, to support progress payments, to control the work, for project closeout, and all other surveys and staking required to perform the Work.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
24	Erosion Protection and Sediment Control	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required to construct, install, maintain, and remove when required, erosion protection and sediment control measures	Measurement will be lump sum based on an estimated percent complete

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
			during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of waters.	prorated over the duration of the work.
25	Site Reclamation	Lump Sum	Furnishing all equipment, materials, and labor necessary for topsoil placement; finish grading and preparation of seedbed for planting; furnishing and placing seed, fertilizer, and mulch; and maintaining new vegetation.	Measurement will be lump sum complete in-place.
26	Slope Protection Earthwork	Lump Sum	Excavating, hauling, stockpiling, subgrade preparation, processing, placing, spreading, and compacting earthfill as necessary to install riprap slope protection between BL Sta. 3+00 to 20+00.	Measurement will be lump sum based on an estimated percent complete.
27	Type L Riprap	Cubic Yard	Furnishing all equipment, materials, and labor for installation of riprap between BL Sta. 3+00 to 20+00.	Measurement will be based on the volume in-place, based on the slope area measured in the field times the design line thickness shown on the Drawings.
28	Riprap Bedding	Cubic Yard	Furnishing all equipment, materials, and labor for subgrade preparation, and installation of riprap bedding between BL Sta. 3+00 to 20+00.	Measurement will be based on the volume in-place after placement, based on the slope area measured in the field times the design line thickness shown on the Drawings.
Add Alternative 2				
29	Site Preparation	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required for removal and offsite disposal of vegetation and man-made debris from the Work area, and salvaging and stockpiling topsoil.	Measurement will be lump sum based on an estimated percent complete.
30	Survey	Lump Sum	Furnishing all equipment, materials, and labor to perform the required pre- and post-construction surveys, to support progress payments, to control the work, for project closeout, and all other surveys and staking required to perform the Work.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
31	Erosion Protection and Sediment Control	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required to construct, install, maintain, and remove when required, erosion protection and sediment control measures during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of waters.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
32	Site Reclamation	Lump Sum	Furnishing all equipment, materials, and labor necessary for topsoil placement; finish grading and preparation of seedbed for	Measurement will be lump sum complete in-place.

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
			planting; furnishing and placing seed, fertilizer, and mulch; and maintaining new vegetation. Measurement will be lump sum complete in-place.	
33	Slope Protection Earthwork	Lump Sum	Excavating, hauling, stockpiling, subgrade preparation, processing, placing, spreading, and compacting earthfill as necessary to install riprap slope protection between BL Sta. 20+00 to 47+00.	Measurement will be lump sum based on an estimated percent complete.
34	Type L Riprap	Cubic Yard	Furnishing all equipment, materials, and labor for installation of riprap between BL Sta. 20+00 to 47+00.	Measurement will be based on the volume in-place, based on the slope area measured in the field times the design line thickness shown on the Drawings.
35	Riprap Bedding	Cubic Yard	Furnishing all equipment, materials, and labor for subgrade preparation, and installation of riprap bedding between BL Sta. 20+00 to 47+00.	Measurement will be based on the volume in-place after placement, based on the slope area measured in the field times the design line thickness shown on the Drawings.
Add Alternative 3				
36	Site Preparation	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required for removal and offsite disposal of vegetation and man-made debris from the Work area, and salvaging and stockpiling topsoil.	Measurement will be lump sum based on an estimated percent complete.
37	Survey	Lump Sum	Furnishing all equipment, materials, and labor to perform the required pre- and post-construction surveys, to support progress payments, to control the work, for project closeout, and all other surveys and staking required to perform the Work.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
38	Erosion Protection and Sediment Control	Lump Sum	Furnishing all labor, materials, equipment, tools, and accessories required to construct, install, maintain, and remove when required, erosion protection and sediment control measures during the life of the Contract to prevent or minimize erosion, sedimentation, and pollution of waters.	Measurement will be lump sum based on an estimated percent complete prorated over the duration of the work.
39	Site Reclamation	Lump Sum	Furnishing all equipment, materials, and labor necessary for topsoil placement; finish grading and preparation of seedbed for planting; furnishing and placing seed, fertilizer, and mulch; and maintaining new vegetation.	Measurement will be lump sum complete in-place.

Listing of Base Bid Items				
No.	**Item**	**Unit of Measure**	**General Description of Work Included**	**Measurement of Payment Terms**
40	Slope Protection Earthwork	Lump Sum	Excavating, hauling, stockpiling, subgrade preparation, processing, placing, spreading, and compacting earthfill as necessary to install riprap slope protection between BL Sta. 70+00 to 80+00.	Measurement will be lump sum based on an estimated percent complete.
41	Type L Riprap	Cubic Yard	Furnishing all equipment, materials, and labor for installation of riprap between BL Sta. 70+00 to 80+00.	Measurement will be based on the volume in-place, based on the slope area measured in the field times the design line thickness shown on the Drawings.
42	Riprap Bedding	Cubic Yard	Furnishing all equipment, materials, and labor for subgrade preparation, and installation of riprap bedding between BL Sta. 70+00 to 80+00.	Measurement will be based on the volume in-place after placement, based on the slope area measured in the field times the design line thickness shown on the Drawings.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Project meetings.

B. Coordination.

C. Utility notification.

D. Requests for Information.

1.2 GENERAL

A. Include appropriate provisions to address the following:

1. The site is located in the 100-year floodplain and floodway of the South Platte River.

1.3 SUBMITTALS

A. Administrative:

1. Project contact information and emergency contact information.
2. Complete list of subconsultants and contact information.

1.4 RELATED WORK AT SITE

A. General:

1. Other Work is anticipated to be performed at Site by others including work at the pump house and general mining and reclamation activities.
2. Coordinate the Work of these Contract Documents with work of others.

B. Reservoir Lowering:

1. OWNER will lower the reservoir to at least El. 4953.0 (NAVD88) prior to construction. The water level in the reservoir will not exceed El. 4953.0 (NAVD88) at any point during construction except if the reservoir is overtopped by the South Platte River during a flood event.

1.5 PROJECT MEETINGS

A. Preconstruction Meetings:

1. Prior to starting any Work, meet with OWNER and ENGINEER to discuss the following items:

a. Project schedule.
b. Project permits.
c. Administrative procedures.

1) Submittals.

2) Progress payments.
3) Changes in the Work.
4) Weekly progress meetings.

d. Construction sequence.
e. Quality control and testing.
f. Site safety.
g. Site access, security, and temporary facilities.
h. OWNER authority and responsibilities.
i. CONTRACTOR authority and responsibilities.
j. ENGINEER authority and responsibilities.

2. The Preconstruction Meetings shall be attended by the following people:

a. OWNER's representative (attendance mandatory).
b. CONTRACTOR's office representative (attendance mandatory).
c. CONTRACTOR's resident superintendent (attendance mandatory).
d. ENGINEER's representative (attendance mandatory).
e. Subcontractors whom CONTRACTOR, ENGINEER or OWNER request to attend.
f. Others, as appropriate.

B. Weekly Meetings:

1. Weekly meetings will be held.
2. CONTRACTOR shall give reports of the following items at each weekly meetings:

a. Progress of construction – verbal.
b. Project schedule, including a detailed projection of activities for the next 3 weeks – written.
c. Status of submittals – written, up-to-date submittal log.
d. Status of progress payments – verbal.
e. Any conflicts, discrepancies, or other difficulties requiring resolution – verbal.

3. Weekly meetings shall be attended by the following:

a. OWNER's representative.
b. CONTRACTOR's resident superintendent.
c. ENGINEER's representative as needed to resolve technical issues.
d. Subcontractors whom CONTRACTOR, ENGINEER, or OWNER request to attend.
e. Others, as appropriate.

4. CONTRACTOR to produce minutes from weekly meeting and distribute.

1.6 CONSTRUCTION COORDINATION

A. If deemed necessary by OWNER, special meetings will be scheduled to discuss construction schedule, technical issues, Quality Control and Quality Assurance activities, public notification requirements, and contract administration before the scheduled start of the activity. Special meetings shall be attended by the following people:

1. OWNER's representative.
2. CONTRACTOR's resident superintendent.
3. ENGINEER's representative as needed to resolve technical issues.
4. Others, as appropriate.

1.7 UTILITY NOTIFICATION

A. Coordinate Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work. Contact the following:

1. Utility Notification Center of Colorado.

a. Telephone (800) 922-1987.

2. City of Brighton.
3. United Power.
4. Coordinate Work with other utilities as required.

1.8 REQUEST FOR INFORMATION

A. Submit questions and requests for clarifications to OWNER using the Request for Information (RFI) form attached at the end of this Section. RFIs shall be used for clarification of information provided in the Specifications or shown on the Drawings.

B. RFIs and responses do not authorize change orders or notice to proceed on scope changes.

C. RFIs shall not be used for submission of material or equipment substitutions.

1.9 FACILITY OPERATIONS

A. Operations During Construction: Provide temporary facilities as necessary to maintain OWNER access through construction work areas.

B. Do not obstruct or impede adjacent mining, processing or reclamation operations.

1.10 FLOODING AND SURFACE WATER CONTROL

A. Cell #3 is within the 100-year floodway and floodplain of the South Platte River.

B. In the event large storms are forecasted, remove construction equipment and materials from areas vulnerable to flooding and otherwise take precautions to secure and protect the Work against damage during passage of the flood. Damage to CONTRACTOR's equipment and stored materials shall be the sole responsibility of CONTRACTOR.

C. Provide, maintain, and operate facilities to control erosion and sediment releases, and to protect Work and existing facilities from flooding during the construction period.

D. Keep existing ditches, culverts, and natural drainageways continuously free of construction materials, debris, and accumulated sediment.

E. Divert water draining onto the site from adjacent properties around the Work area for discharge to downstream receiving area. Do not cause drainage water to back up in culverts or drainageways from adjacent properties or otherwise pond water onto adjacent properties.

F. Design and install protective measures adjacent to earthwork construction areas as specified in Section 31 25 00: EROSION AND SEDIMENTATION CONTROL, prior to beginning earthwork in any given area.

G. Cover soil with drain material or riprap bedding or stabilize the soil as soon as practicable after earthwork is completed in a given area as specified in Section 31 01 01: SITE RESTORATION AND CLEANUP.

1.11 EASEMENT NOTIFICATION

A. Notify Mile High Flood District (MHFD) when work will be performed in the MHFD easement.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

Project Name Ken Mitchell Lakes Cell #3 Spillway and Slope Protection RFI Number:_____

Date:_____

To: _____ From: _____

SUBJECT:	
SPECIFICATION SECTION:	
DRAWING NUMBER:	

QUESTION:

WRITTEN BY: _____ **DATE:** _____

ATTACHMENTS: _____

RESPONSE:

WRITTEN BY: _____ **DATE:** _____

ATTACHMENTS: _____

CONTRACTOR ACCEPTANCE: _____

TITLE: _____ **DATE:** _____

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SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 DEFINITIONS

A. Critical Path Method – Critical path method (CPM) shall be interpreted to be generally as outlined in the Association of General Contractors (AGC) publication. "The Use of CPM in Construction." except that either "i-j" arrow diagrams or precedence diagramming format may be utilized.

B. Construction Schedules – Construction schedules shall include a bar chart, graphic network diagrams, and computerized construction schedule reports.

C. CPM Network – CPM network shall be in a form of a time scaled "i-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating the interface points among the sheets. Individual sheets shall not exceed 22- by 34-inch.

D. Duration Estimates – The duration estimate indicated for each activity shall be computed in days and shall represent the single best estimate considering the scope of the activity work and resources planned for the activity. Except for certain non-labor activities such as curing of concrete or delivery of materials, activity duration shall not exceed 30 days nor less than one day unless otherwise accepted by OWNER or ENGINEER.

E. Float – Unless otherwise provided herein, float as referenced in these documents is total float. Total float is a period of time measured by the number of days each non-critical path activity may be delayed before it and its succeeding activities become part of the critical path. If a non-critical path activity is delayed beyond its float period, that activity then becomes part of the critical path and controls the end date of the project.

F. Float Ownership – Neither OWNER nor CONTRACTOR owns the float time. The project owns the float time. As such, liability for delay of the project completion date rests with the party actually causing delay to the project completion date. For example, if Party A uses some, but not all, of the float time and Party B later uses the remainder of the float time as well as additional time beyond the float time, Party B shall be liable for the costs associated with the time that represents delay to the project's completion date. Party A would not be responsible for any costs since it did not consume all of the float time and additional float time remained; therefore, the project's completion date was unaffected.

1.2 SUBMITTALS

A. Administrative:

1. Initial CPM Schedule.
2. Updated CPM Schedules.
3. Final CPM Schedule.
4. Construction Photographs.
5. Redline drawings and final survey data.

1.3 CPM SCHEDULE

A. A time-scaled network diagram of the “i-j” activity-on-arrow or precedence type. The network diagram shall describe the activities to be accomplished and their logical relationships and show the critical path.

B. Submission of CONTRACTOR’s CPM schedule to OWNER shall not relieve CONTRACTOR of total responsibility for scheduling and sequencing the Work.

C. The initial CMP schedule shall be submitted prior to the pre-construction meeting.

1.4 UPDATED CPM SCHEDULE

A. A revised CPM schedule shall be submitted monthly with the payment request. Failure to include the updated schedule will cause OWNER to withhold the monthly progress payment.

B. Each schedule update submitted must be complete, including all information requested in the original CPM schedule submittal. In addition, the updated submittal shall include the following information:

1. Delays in submittals, resubmittals, or deliveries.
2. Changes in the sequences of Work.
3. Revisions to durations and completion dates.
4. Changes in the number or length of shifts, or changes in the number of days worked per week.

C. Each update shall continue to show all Work activities including those already completed. These completed activities shall reflect the “as built” information by indicating when the Work was actually started and completed. The updated schedule should reflect actual construction progress, changes to the schedule as a result of Change Orders, construction delays, and other schedule impacts.

D. Changes or delays that do not affect the controlling operator or operations of the critical path will not be considered as a basis for a time adjustment. Changes or delays that do not affect the controlling operations or the critical path will be considered in granting an extension of time for completion of the contract only if the total float is absorbed by the delay.

E. If CONTRACTOR fails to complete activities that are on the critical path, then CONTRACTOR shall submit in writing a statement as to how CONTRACTOR intends to correct the deficiency and return the Work to an acceptable schedule.

1.5 FINAL CPM SCHEDULE

A. Submit a final CPM schedule at the end of construction that updates the CPM schedule to reflect actual construction progress.

1.6 PROJECT STATUS REPORTING

A. Provide monthly project status reports in the form of a written narrative report to be submitted in conjunction with the revised CPM Schedules.

1.7 CONSTRUCTION PHOTOGRAPHS

A. Photographically document all phases of construction including site access routes, preconstruction, construction progress, and post construction.

B. OWNER shall have the right to select the subject matter and vantage point from which photographs are to be taken.

C. Preconstruction and post construction:

1. Preconstruction photos shall be after the Effective Date of the Agreement but before Work begins at the site. Post construction photos shall be at the issuance of Substantial Completion.
2. Take a minimum of 24 exposures of the site and property adjacent to the site including Ken Mitchell and mine roads. Photos for post construction shall be taken at the same vantage points as the Preconstruction photos.

D. Format:

1. Digital Images

a. Submit on ftp site or thumb drive
b. Date stamp on all photos

2. Label each photo with the following:

a. Project name
b. Date
c. Description of photo

1.8 REDLINE DRAWINGS

A. Provide and maintain at the project site, one complete set of prints of the project Drawings. Keep the Drawings in good, clean, and readable condition.

B. Neatly inscribe on the project Drawings all changes in Work including relocation of lines, change in type of materials, etc. Note changes with red pencil or red ink. Note date of change. Note all data and changes on these record drawings in sufficient detail and clarity and provide information necessary for preparation of record drawings. Project Drawings shall be kept current and shall be updated weekly.

C. Review changes with OWNER at monthly pay request submittal.

D. Make redline edits within 24 hours of change occurring.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL PROCEDURES

A. The word "submittals" shall be interpreted to include Work plans or procedures, Drawings, shop drawings, schedules, data, manuals, certifications, test reports, curves, samples, brochures, and other items furnished by CONTRACTOR for approval, information, or other purposes.

B. Each submittal will be returned within 14 days following receipt of submittal, unless otherwise indicated in the Specification section. Resubmittals shall be subject to the same review time.

C. Do not perform Work related to submittals prior to obtaining the required approval from OWNER.

D. Utilize a 10-character submittal identification numbering system in the following manner:

1. The first 6 digits shall be the applicable Specification section number.
2. The next three digits shall be the numbers 001 to 999 to sequentially number each initial separate item or submittal under each specific section number.
3. The last character shall be a letter (A to Z) indicating the submission, or resubmission of the same Submittal, i.e., “A = 1st submission, B = 2nd submission (first resubmission), C = 3rd submission, etc. A typical submittal number would be as follows: 31 37 00 - 008 – B.

E. Submittals are required until accepted. Delays resulting from resubmittals will not entitle CONTRACTOR to a Contract Time extension or change in Contract Price, including multiple resubmissions.

F. If the items as submitted describe variations and show a departure from the Contract requirements which OWNER finds to be in the interest of OWNER and to be so minor as not to involve a change in Contract Price or Contract Time, OWNER may return the reviewed submittals without noting an exception.

G. Complete and submit a transmittal form with each submittal package. A copy of the form is attached at the end of this Section.

1.2 SUBMITTALS

A. Administrative:

1. Submit a schedule of submittals, including:

a. List of submittals (group by Specification number)
b. Estimated submission date
c. Estimated start date for corresponding items of Work

1.3 SHOP DRAWINGS

A. Copies: Submit one electronic copy in pdf format.

B. Shop drawings are those submittals that reflect processes, layout, or method of construction. All shop drawing submittals shall contain the following information:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. The name of CONTRACTOR (and Subcontractor where applicable).
4. Identification of the items/submittal/product, with the Specification section number, page, and paragraph(s), and Drawing reference, if any.
5. Field dimensions, clearly identified as such.
6. Relation to adjacent or critical features of the Work or materials.
7. Design Data: show calculations, dimensions, logic, and assumptions upon which the design is based.
8. Applicable standards, such as ASTM, ANSI, or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. A blank space suitably sized for CONTRACTOR and CONTRACTOR's engineer (if necessary) stamps.

C. Prepare the submittal as follows:

1. Present in a clear and thorough manner. Include sufficient detail to show the kind, size, arrangement, and function of components or materials and compliance with the Contract Documents.
2. Include drawings that are to scale.
3. Mark pertinent products or models and show performance characteristics, capacities, dimensions, clearances, anchorages, external connections, or supports required.
4. Submit an electronic format that is compatible with printing on 8-½- by 11-inch or 11- by 17-inch paper. If paper larger than 11- by 17-inch is required, use 22- by 34-inch format.

D. Disposition: ENGINEER will review and mark up submittals and distribute marked-up copies as described below.

1. Accepted:

    a. One copy to OWNER
    b. One copy to ENGINEER
    c. One copy to CONTRACTOR
    d. CONTRACTOR may begin Work described in the submittal

2. Accepted as Noted:

    a. One copy to OWNER
    b. One copy to ENGINEER
    c. One copy to CONTRACTOR
    d. CONTRACTOR may begin Work described in submittal in accordance with ENGINEER's notations, subject to CONTRACTOR's written verification and acceptance of ENGINEER's notations.

3. Not Accepted:

    a. One copy retained by OWNER.
    b. One copy retained by ENGINEER.
    c. One copy returned to CONTRACTOR appropriately annotated.
    d. CONTRACTOR shall make corrections or develop a replacement submittal and resubmit.

4. Incomplete:

    a. One copy retained by OWNER.
    b. One copy retained by ENGINEER.

c. One copy returned to CONTRACTOR appropriately annotated.
d. CONTRACTOR shall complete and resubmit or submit missing portions of the submittal.

1.4 SAMPLES

A. Unless otherwise noted, submit three samples for each required submittal.

B. Sample submittals are those submittals that reflect type or quality of product. All sample submittals shall contain the following information:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. The name of CONTRACTOR (and Subcontractor where applicable).
4. Identification of the items/submittal/product, with the Specification section number, page, and paragraph(s), and Drawing reference, if any.
5. Applicable standards, such as ASTM, ANSI, or Federal Specification numbers.
6. Identification of deviations from Contract Documents.
7. Identification of revisions on resubmittals.
8. Source, location, date obtained, and who obtained the sample.

C. Prepare the sample submittal as follows:

1. Present in a clear and thorough manner. Include sufficient detail to show the kind, size, arrangement, and function of components or materials, and compliance with the Contract Documents.
2. Mark pertinent products or models and show performance characteristics, capacities, dimensions, clearances, anchorages, external connections, or supports required.

D. Disposition: ENGINEER will review and mark up submittals and distribute marked-up copies as described below.

1. Accepted:

a. One copy of transmittal and one sample to OWNER.
b. One copy of transmittal and one sample to ENGINEER.
c. One copy of transmittal and one sample to CONTRACTOR.
d. CONTRACTOR may begin Work described in the submittal.

2. Accepted as Noted:

a. One copy of transmittal, with annotations, and one sample to OWNER.
b. One copy of transmittal, with annotations, and one sample to ENGINEER.
c. One copy of transmittal, with annotations, and one sample to CONTRACTOR.
d. CONTRACTOR may begin Work described in submittal in accordance with ENGINEER’s notations, subject to CONTRACTOR’s written verification and acceptance of ENGINEER’s notations.

3. Not Accepted:

a. One copy of transmittal and one sample retained by OWNER.
b. One copy of transmittal and one sample retained by ENGINEER.
c. One copy of transmittal and one sample returned to CONTRACTOR appropriately annotated.
d. CONTRACTOR shall make corrections or develop a replacement submittal and resubmit.

4. Incomplete:

    a. One copy of transmittal, with annotations, and one sample retained by OWNER.
    b. One copy of transmittal, with annotations, and one sample retained by ENGINEER.
    c. One copy of transmittal with annotations and one sample returned to CONTRACTOR appropriately annotated.
    d. CONTRACTOR shall complete and resubmit or submit missing portions of the submittal.

1.5 ADMINISTRATIVE SUBMITTALS

A. Copies: Submit one electronic copy in pdf format.

B. Administrative submittals are those submittals that do not reflect quality of product or method of construction. Administrative submittals include, but are not limited to, the following items:

1. Application For Payment
2. Construction Photographs
3. Schedules
4. Submittals Required By Law, Regulations Or Governing Agencies
5. Record Documents

C. All administrative submittals shall contain the following information:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. The name of CONTRACTOR (and Subcontractor where applicable).
4. Identification of the items/submittal/product, with the Specification section number, page, and paragraph(s), and Drawing reference, if any.
5. Identification of deviations from Contract Documents.
6. Identification of revisions on resubmittals.

D. Prepare the administrative submittal as follows:

1. Present in a clear and thorough manner. Include sufficient detail to show compliance with the Contract Documents.
2. Include drawings that are to scale.
3. Submit on in an electronic format that is compatible with printing on 8-½- by 11-inch or 11- by 17-inch paper. If paper larger than 11- by 17-inch is required, use 22- by 34-inch format.

E. Disposition: ENGINEER will review and mark up submittals and distribute marked-up copies as described below.

1. Accepted:

    a. Acceptance shall indicate that the submittal generally conforms to the requirements of the Contract Documents as to form and substance.
    b. One copy to OWNER.
    c. One copy to ENGINEER.
    d. One copy to CONTRACTOR.
    e. CONTRACTOR may begin Work described in the submittal.

2. Not Accepted:

    a. One copy retained by OWNER.

b. One copy retained by ENGINEER.
c. One copy returned to CONTRACTOR, appropriately annotated.
d. CONTRACTOR shall make corrections or develop a replacement submittal and resubmit.

1.6 QUALITY CONTROL SUBMITTALS

A. Copies: Submit one electronic copy in pdf format.

B. Quality control submittals are those submittals that present results of inspections or tests or compliance with the Specifications. All quality control submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. The name of CONTRACTOR (and Subcontractor where applicable).
4. Identification of the items/submittal/product, with the Specification section number, page, and paragraph(s), and Drawing reference, if any.
5. Applicable standards, such as ASTM, ANSI, or Federal Specification numbers.
6. Identification of deviations from Contract Documents.
7. Identification of revisions on resubmittals.

C. Prepare the quality control submittal as follows:

1. Certificates:

a. Manufacturer's Certificates of Compliance or Manufacturer's Certificate of Installation: Submit in accordance with the provisions of the individual Specification section.
b. Testing Certificates: Submit in accordance with the provisions of the individual Specification section.

2. Statement of Qualifications: Evidence of qualification, certification, or registration.
3. Inspection or Test Reports: Include the following information, as a minimum:

a. Test date, testing laboratory, name of inspector.
b. Date and time of test or sample, location of test or sample, temperature at time of the test, weather conditions at the time of the test.
c. Related Specification section, type of test or inspection performed, results of test or inspection, and Specification requirement.

D. Disposition: ENGINEER will review and mark up submittals and distribute marked-up copies as described below.

1. Accepted:

a. Acceptance shall indicate that the submittal generally conforms to the requirements of the Contract Documents as to form and substance.
b. One copy to OWNER.
c. One copy to ENGINEER.
d. One copy to CONTRACTOR.
e. CONTRACTOR may begin Work described in the submittal.

2. Not Accepted:

a. One copy retained by OWNER.
b. One copy retained by ENGINEER.
c. One copy returned to CONTRACTOR, appropriately annotated.

d. CONTRACTOR shall make corrections or develop a replacement submittal and resubmit.

1.7 REDLINE DRAWINGS

A. Submit redline drawings at time of final acceptance and prior to final payment.

1.8 GUARANTEES, WARRANTIES, AND CERTIFICATES

A. Submit all guarantees, warranties, and certificates prior to final payment.

1.9 TEST REPORTS

A. Refer to Section 01 45 00: QUALITY CONTROL.

1.10 DELIVERY TICKETS

A. Submit to OWNER one legible copy of each delivery ticket as required by the Specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

Project Name: Ken Mitchell Lakes Cell #3 Spillway and Slope Protection

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL
(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____
_____
_____
_____
_____

SUBMITTAL NO.: _____
☐ **NEW SUBMITTAL** ☐ **RESUBMITTAL**
PREVIOUS SUBMITTAL NO.: _____
SPECIFICATION SECTION NO.: _____
(COVER ONLY ONE SECTION WITH EACH TRANSMITTAL)

FROM: _____
CONTRACTOR

SCHEDULE DATE OF SUBMITTAL:
_____
_____
_____
_____

SUBMITTAL TYPE: ☐ **SHOP DRAWING** ☐ **ADMINISTRATIVE**
☐ **QUALITY CONTROL** ☐ **SAMPLE**

THE FOLLOWING ITEMS ARE HEREBY SUBMITTED:

NUMBER OF COPIES	DESCRIPTION OF ITEM SUBMITTED (TYPE, SIZE, MODEL NUMBER, ETC.)	SPEC. PARA. NO.	DRAWING OR BROCHURE NUMBER	CONTAINS VARIATION TO CONTRACT	
				NO	YES

CONTRACTOR hereby certifies that (i) CONTRACTOR has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____ Date Received: _____
CONTRACTOR (Authorized Signature)

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SECTION 01 42 00
REFERENCES

PART 1 GENERAL

1.1 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall meet the requirements of applicable codes and the applicable requirements of the following documents.

B. References herein to “ASTM” shall mean the American Society for Testing and Materials.

C. References herein to “ACI” shall mean the American Concrete Institute.

D. References herein to “OSHA Regulations for Construction” shall mean **Title 29, Part 1926, Construction Safety and Health Regulations for Construction**, Code of Federal Regulations (CFR), including all changes and amendments thereto.

E. References herein to “OSHA Standards” shall mean **Title 29, Part 1910, Occupational Safety and Health Standards**, Code of Federal Regulations, including all changes and amendments thereto.

F. Applied Standard Specifications: References in the Contract Documents to “Standard Specifications” or SSPWC shall mean the **Standard Specifications for Public Works Construction,** 1994 Edition.

1.2 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. All Work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Laws and Regulations governing the storage and conveyance of hazardous materials, including petroleum products.

1.3 ABBREVIATIONS

A. Abbreviations used throughout the Specifications and the organization or document represented are:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway Transportation Officials
ACI	American Concrete Institute
ADM	Arrow Diagramming Method
AGA	American Gas Association
AGCA	Association of General Contractors of America
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ALSC	American Lumber Standards Committee
AMCA	Air Moving and Conditioning Association, Inc.
AMA	American Materials Association
ANSI	American National Standards Institute
APA	American Plywood Association (formerly DFPA)
APHA	American Public Health Association
ARI	Air-Conditioning and Refrigeration Institute

ASA	American Standards Association (now USAS)
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWPA	American Wood Preserver's Association
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CPM	Critical Path Method
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards of U.S. Department of Standards
CSI	Construction Specifications Institute
DFPA	Douglas Fir Plywood Association (now APA)
EPA	Environmental Protection Agency
FAR	Federal Acquisition Regulations
FGMA	Flat Glass Marketing Association
FML	Factory Mutual Laboratories
FS	Federal Specifications
HVAC	Heating, Ventilating, and Air Conditioning
IBR	Institute of Boiler and Radiator Manufacturers
MBMA	Metal Building Manufacturer's Association
MHFD	Mile High Flood District
MLA	Metal Lath Association
MSHA	Mine Safety and Health Administration
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code
NBFU	National Bureau of Fire Underwriters
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPS	National Forest Products Association
NPC	National Plumbing Code
NPDES	National Pollutant Discharge Elimination System
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturing Association
OSHA	Occupational Safety and Health Administration, U.S. Department of Labor
PCA	Portland Cement Association
PDM	Precedence Diagramming Method
PEI	Porcelain Enamel Institute
SBI	Steel Boiler Institute
SCPI	Structural Clay Products Institute
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPCC	Spill Prevention Control and Countermeasure
SPI	Steel Products Institute
SPR	Simplified Practice Recommendation
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
UBC	Uniform Building Code
UL	Underwriters Laboratories
UPC	Uniform Plumbing Code

USAS	United States of America Standards (formerly ASA)
USBR	U.S. Bureau of Reclamation
USCOE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WPCF	Water Pollution Control Federation
WWPA	Western Wood Products Association

B. Additional abbreviations, if any, will be defined as they appear in the Specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.1 CONTRACTOR QUALITY CONTROL

A. General

1. CONTRACTOR is responsible for the initial and subsequent quality control inspections and test of CONTRACTOR's Work to ensure that the Work conforms with the Contract Documents.
2. Testing for quality control purposes shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and regulations and applicable State and local statutes. In the event State license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements.

    a. Recommended Requirements for Independent Laboratory Qualification, published by the American Council of Independent Laboratories.
    b. Basic requirements of ASTM E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection, as applicable.
    c. Calibrate testing requirements at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

B. CONTRACTOR's Testing Responsibilities:

1. Material property tests for all earthwork items from on-site and off-site sources. Testing requirements are listed in individual Specification sections.
2. Field and laboratory quality control for subgrade preparation and fill placement operations.
3. Tests on items manufactured or fabricated off-site.
4. Mix designs for grout and concrete signed and sealed by a licensed Professional Engineer in the State of Colorado.
5. Field and laboratory tests for concrete and grout placement operations.

C. Earthwork, concrete and grout quality control testing schedule shall be as outlined in the individual Specification sections.

D. Perform all other testing and certifications as outlined in these Specifications.

E. Provide copies of test results to OWNER by the end of the next working day, following completion of the tests.

F. Provide ENGINEER a Concrete Placement Form with the upper checkout items completed prior to every concrete placement. ENGINEER will then complete the Concrete Placement Form(s), as appropriate for each element of concrete work. A blank placement form is included in this Section for CONTRACTOR's use.

1.2 OWNER QUALITY CONTROL

A. OWNER's Testing Responsibilities:

1. Additional tests of earthwork materials from off-site sources to check CONTRACTOR's data, as determined appropriate by OWNER.
2. Tests and observe excavations and bearing surfaces.
3. Field testing and visual observation of in-place earthwork materials.
4. Laboratory testing of earthwork materials.

B. Unless otherwise indicated, results of all completed tests by OWNER will be available to CONTRACTOR by the end of the next working day following completion of the tests.

C. OWNER may perform additional laboratory tests on earthwork materials obtained from off-site sources as deemed necessary by OWNER to check CONTRACTOR's test results and verify continued compliance with Specification requirements. If additional testing by OWNER is required, CONTRACTOR shall provide representative samples to OWNER from off-site stockpiles or storage bin(s) for testing at no additional cost to OWNER. OWNER reserves the right to sample materials at the source of production.

D. Final acceptance of the Work will be based on a review of the quality control tests, as well as on visual observation made by OWNER of CONTRACTOR's work, including any work effort required to complete the project in compliance with these Contract Documents and the quality level required by ENGINEER's design.

1.3 TESTING STANDARDS

A. Earthwork quality control testing:

1. Compaction - ASTM D 698 or ASTM D 1557
2. Moisture Content, Oven Method - ASTM D 2216
3. Specific Gravity - ASTM D 854
4. Field Density, Sand Cone Method (plus one-point compaction and moisture content) - ASTM D 1556
5. Field Density, Drive Cylinder Method (plus one-point compaction and moisture content) - ASTM D 2937
6. Field Density and Moisture Content, Nuclear Gage Method (plus one-point compaction and moisture content) - ASTM D 6938
7. Maximum Index Density – ASTM D 4253
8. Minimum Index Density – ASTM D 4254
9. Particle Size Distribution - ASTM D 6913
10. Liquid Limit, Plastic Limit, and Plasticity Index - ASTM D 4318
11. Resistance to Degradation - ASTM C 131
12. Sodium Sulfate Soundness - ASTM C 88
13. Test Agency Qualifications – ASTM D 3740

B. Concrete quality control testing:

1. Sampling fresh concrete – ASTM C 172
2. Unit Weight – ASTM C 138
3. Air Content – ASTM C 231
4. Slump – ASTM C 143
5. Temperature – Thermometer
6. Concrete Test Cylinders – ATM C 31
7. Compressive Strength – ASTM C 39
8. Capping Concrete Cylinders – ASTM C 617
9. Concrete Cores – ASTM C 42
10. Laboratory Qualifications – ASTM C 1077
11. Split Tensile Strength – ASTM C 496

C. The percent compaction requirements for earthwork will be evaluated as follows: The in-place density as compacted by CONTRACTOR will be determined by the field density test using the sand-cone method or the nuclear gage method. The maximum dry density of

the fill at the location of the in-place density test will be estimated using one-point compaction tests and full-curve compaction tests (family of curves) of representative fill materials. Both the one-point compaction tests and the full-curve compaction tests will be performed according to ASTM D 698 or ASTM D 1557, as appropriate. The one-point compaction data will be used in conjunction with the representative compaction curves to estimate the maximum dry density of the compacted fill at the location of the in-place density test. The percent compaction in-place will be calculated as the ratio (in percent) of the in-place dry density of the compacted fill at the location of the in-place density test to the estimated maximum dry density of the material.

D. Riprap, riprap bedding, and drain material materials testing:

1. ASTM C 127 - Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
2. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. ASTM C 150 - Standard Specification for Portland Cement.
4. ASTM C 535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
5. ASTM D 5519 – Standard Test Methods for Particle Size Analysis of Natural and Manmade Riprap Materials.
6. ASTM D 7012 - Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens Under Varying States of Stress and Temperatures.

E. Other test requirements as described in individual Specification sections.

1.4 SUBMITTALS

A. Administrative

1. Statement of Qualifications for CONTRACTOR's independent materials testing firm.
2. Materials testing firm shall have had experience within the last 5 years with at least three projects of similar size and scope.
3. Materials firm shall be accredited by the American Association for Laboratory Accreditation (A2LA).

B. Testing schedule as outlined in individual Specification sections.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 TEST REPORTING

A. Provide verbal test results to OWNER and ENGINEER at the times field tests are performed.

B. Provide written copies of all field tests to OWNER and ENGINEER within 48 hours after test is performed.

C. Provide written copies of all laboratory tests within 48 hours of completion of the test.

END OF SECTION

CONCRETE PLACEMENT FORM

PROJECT Ken Mitchell Lakes Cell #3 Spillway and Slope Protection

FEATURE _____

STATION _____

OFFSET _____

ELEVATION _____

CONTRACTOR _____ DATE OF PLACEMENT _____

CHECKOUT ITEM	CONTRACTOR REP	ENGINEER REP	DATE	TIME
SUB-GRADE OVER EXCAVATION COMPACTION				
BEDDING DEPTH COMP.				
FINAL CROSS SECTION				
REINFORCING STEEL				
EMBEDDED PIPING				
EMBEDDED MISC. MECHANICAL				
EMBEDDED MISC. METAL				
EMBEDDED ELECTRICAL				
DRAIN PIPING				
LINE AND GRADE				
FORMING				
BLOCKOUTS				
WATERSTOP				
PLACEMENT EQUIPMENT				
PROTECTION FOR CONCRETE				
OTHER ITEM				
FINAL CLEANUP				
OK TO PLACE CONCRETE				

ALL OF THE ABOVE MUST BE INSPECTED AND APPROVED BEFORE ORDERING CONCRETE.

		_____ MIX	_____ MIX	_____ MIX
CONCRETE ORDERED				
CONCRETE WASTED:	SPILLAGE			
	OUT OF SPEC			
	OVER ORDER			
TOTAL WASTED				
TOTAL PLACED				

TRUCK #								
START								
COMPLETE								
TRUCK #								
START								
COMPLETE								

FINISHING COMPLETE TIME: _____

REMARKS _____

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 GENERAL

A. Construction facilities and temporary controls include those items necessary for performance of the Work that are not part of the permanent construction.

1.2 SUBMITTALS

A. Shop Drawings:

1. Plan for on-site security.
2. Plan for staging and stockpile areas.
3. Plan for obtaining water and delivering water to the necessary construction areas.
4. Plan for site access. Plan shall include permits and approvals.
5. Plan for temporary utilities.

B. Administrative:

1. Copies of permits obtained by CONTRACTOR. Submit prior to beginning related parts of Work.
2. CONTRACTOR Health and Safety Plan.

1.3 MOBILIZATION AND PREPARATORY WORK

A. For the purposes of providing for expenses incidental to the initiation of construction, an item has been included in the Schedule of Values to provide for payment for mobilization and preparatory work. The item for payment for mobilization and preparatory work is intended to compensate CONTRACTOR for operations including, but not limited to, the following items:

1. Obtaining project permits.
2. Moving equipment, supplies, and incidentals to the site.
3. Installing temporary utilities at the site.
4. Having CONTRACTOR's superintendent at the site full time.

B. All facilities, plants, and equipment that are established at, or brought to, the work site shall be deemed to be subject to the provisions of this paragraph unless OWNER specifically provides otherwise in writing for a particular item or items. CONTRACTOR shall be solely responsible for the adequacy, efficiency, use, protection, maintenance, repair, and preservation of all facilities, plants, and equipment. No facilities, plants, or equipment shall be dismantled or removed from the work site prior to completion of the Work under the contract without the written permission of OWNER.

PART 2 PRODUCTS

2.1 STABILIZED CONSTRUCTION ENTRANCE

A. Aggregate for the stabilized construction entrance shall conform to the requirements of CDOT aggregate base course Class 2 except as modified by these specifications.

1. Gradation

Sieve Name	Percent by Weight
4-inch	100
3-inch	50 – 100
2 ½-inch	0 – 90
1 ½-inch	0 – 5
No. 200	0 – 2

PART 3 EXECUTION

3.1 TEMPORARY UTILITIES

A. Water

1. Non-potable water for use in construction activities will be made available by OWNER from Cell #1.
2. Provide means to obtain, transport, and store water from Cell #1 to areas used for fill processing, dust control, or other construction activities.
3. Provide and maintain adequate supplies of drinking water for CONTRACTOR personnel.

B. Sanitary Facilities

1. Provide and maintain suitable, weather-tight, painted, sanitary toilet facilities for all work persons during the construction period. When toilet facilities are no longer required, promptly remove from site. Disinfect and clean or treat the area as required.
2. Keep all toilet facilities clean and supplied with toilet paper at all times.

C. Lighting

1. Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials, and observation and inspection of the Work.

3.2 CONSTRUCTION ACCESS ROAD

A. Construction access into the site shall be from the mine entrance at the east end of the site.

B. Access roads constructed on-site shall be constructed within the limits of site disturbance.

C. Maintain drainage ways. Install culverts to allow water to pass without disturbing the roadway.

3.3 PROTECTION OF EXISTING ROADS

A. Obtain all permits required by the CDOT and City of Brighton during construction. Repair damage to public as required by public agencies.

B. Promptly remove soil and other material that is deposited on public roads.

C. Prior to using public and mine access roads, perform a condition survey of these roads. The conditions survey shall be performed by competent personnel that are qualified and experienced in this work. Sufficient notes, measurements, photographs, videotapes, or other documentation of the existing condition of the roads shall be performed.

3.4 PROTECTION OF WORK AND PROPERTY

A. General

1. Use of Explosives: No blasting or use of explosives will be allowed on the Site.
2. Support and protect all existing facilities or portions of facilities not otherwise scheduled for modification.
3. Perform Work within rights-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
4. Where utilities are parallel to or cross the Work, determine the true location and depth of utilities prior to beginning the Work.
5. Where completion of Work requires temporary or permanent removal and/or relocation of an existing utility, coordinate all activities with owner of said utility and perform all work to their satisfaction.
6. Protect, shore, brace, support, and maintain underground pipes, conduits, drain, and other underground utility construction uncovered or otherwise affected by construction operations.
7. In areas where CONTRACTOR's operations are adjacent to or near a utility such as gas, telephone, television, electric power, water, sewer, or irrigation system and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection thereof have been made by CONTRACTOR.
8. Notify property owners and utility offices that may be affected by construction operation at least 3 days in advance.

    a. Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to CONTRACTOR's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.

9. Maintain original site drainage wherever possible.

3.5 CONTRACTOR PARKING AREAS

A. Parking for the employees of CONTRACTOR, ENGINEER and for OWNER personnel will be allowed in the staging and stockpile areas.

3.6 STAGING AREA

A. Stockpile equipment, supplies, imported earthfill materials, and other materials incidental to the construction in the staging or stockpile areas or other areas approved by OWNER.

B. Camping and fishing will not be allowed at the construction site.

C. Establish CONTRACTOR shop and offices in the staging and stockpile areas.

3.7 STOCKPILE AREAS

A. All earthfill, and other construction materials shall be stockpiled in CONTRACTOR staging area or borrow areas, identified portion of the reservoir bottom, or other areas approved by OWNER.

B. Stockpiling of materials outside of the limits of CONTRACTOR staging area, borrow areas, or identified portion of the reservoir bottom shall require the approval of OWNER.

3.8 WEATHER PROTECTION

A. Provide protection against weather to maintain all materials, apparatus, fixtures, and work free from damage whether in shipment, in storage, or in place.

3.9 BORROW AREAS

A. Borrow will be from required excavations to install the Work or from the reservoir bottom.

B. During development of borrow areas, drainage shall be provided to remove surface water accumulated at the bottom of the excavation.

3.10 EXISTING FENCES

A. Do not remove existing fences without authorization from OWNER. Protect all existing fences.

3.11 SITE SECURITY

A. Provide adequate security for protection of OWNER's and CONTRACTOR's property, equipment, and facilities.

B. All existing and temporary gates and fences shall be secured and locked during non-working hours. Provide padlocks at all gates. All gates shall be double padlocked to allow OWNER access to the site without disturbing CONTRACTOR's locks.

3.12 OPERATIONS AND STORAGE AREAS

A. Do not enter on or occupy with men, tools, equipment, or material any ground outside OWNER's property without the written consent of the owner of such ground.

B. Other contractors and employees or agents of OWNER may for all necessary purposes enter upon the Work and premises used by CONTRACTOR. Conduct work so as not to impede unnecessarily any work being done by others on or adjacent to the site.

3.13 SAFETY

A. Safety and Health

1. CONTRACTOR shall have sole responsibility for construction site safety in accordance with the provisions of the General Conditions.
2. Maintain an accurate record of, and report to OWNER, all cases of death, occupational diseases, or traumatic injury to employees or the public, and property damage.

3.14 CLEANUP AND DISPOSAL OF SEDIMENT AND WASTE MATERIALS

A. SCOPE

1. The cleanup and disposal of waste materials and rubbish shall be in accordance with these Specifications and applicable Laws and Regulations. Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement shall apply.

B. CLEANUP

1. Keep work and storage areas free from accumulations of waste materials and rubbish, and before completing the Work, remove all plant and storage facilities,

buildings, including concrete footings and slabs, rubbish, unused materials, concrete forms, and other materials that are not a part of the permanent Work.

2. Upon completion of the Work, and following removal of construction facilities and required cleanup, work areas shall be regraded, reclaimed, and left in a neat manner conforming to the natural appearance of the landscape.

C. DISPOSAL OF WASTE MATERIALS

1. Waste materials, including but not restricted to, cleared and grubbed vegetation, refuse, garbage, sanitary wastes, chemical additives, industrial wastes, oil, and other petroleum products, shall be disposed of by CONTRACTOR by removal from the construction area. Dispose of material in an appropriate off-site waste disposal facility. The off-site waste disposal facility shall be approved by OWNER.
2. Burning of cleared vegetation and waste materials shall not be permitted.
3. Disposal of collected sediment shall be at a location in the reservoir bottom designated by OWNER.

3.15 STABILIZED CONSTRUCTION ENTRANCE

A. Place Stabilized Construction entrance (SCE) at site entrance.

B. Inspect the SCE at the end of each work way. Clean the SCE when accumulation of sediment fills the voids on the surface of the SCE.

C. Scarify the SCE once per month regardless of usage.

D. If scarifying is unsuccessful in restoring voids on the surface of the SCE, remove and replace the stone.

E. Maintain SCE until construction traffic is no longer using the entrance(s) to access the Project. Remove at the end of construction.

END OF SECTION

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SECTION 01 55 26
MULTI-USE TRAIL DETOUR

PART 1 GENERAL

1.1 WORK INCLUDES

A. Multi-Use Trail detour and safety fence. Public access to the trail must be provided throughout construction.

B. Furnish, install, maintain, and remove all temporary traffic control signs and devices for bicycle and pedestrian traffic.

C. Obtain traffic control permits as required for work.

1.2 REFERENCES

A. American Society of Testing Materials (ASTM):

1. D 6637: Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

1.3 SUBMITTALS

A. Administrative:

1. Product data showing conformance to the Specifications.
2. Multi-Use Trail Detour Plan

a. Detour sequencing for entire duration of Project.
b. Plan of safety fencing and ancillary detour facilities.
c. Traffic Control Plan and signage

PART 2 PRODUCTS

2.1 SAFETY FENCE

A. High density polyethylene grid.

1. Oval or diamond openings.
2. Color: Safety Orange.
3. Mesh Size: 1.5 to 2.5 inches.
4. Longitudinal Tensile Strength: minimum 75 pounds per foot.
5. Transverse Tensile Strength: minimum 40 pounds per foot.
6. Minimum Height: 4 feet.

2.2 METAL POSTS FOR SAFETY FENCE

A. Minimum 5 feet in length.

B. Minimum weights of 0.85 pounds per foot.

2.3 SIGNS AND BARRICADES

A. All signs shall meet the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and the guidelines of the Guide for Work Area Traffic Control (ATSSA) published by the American Traffic Safety Services Association.

B. All barricades and markers shall meet the requirements of the MUTCD.

PART 3 EXECUTION

3.1 GENERAL

A. Maintain public access along the trail at all times during construction.

3.2 INSTALLATION

A. Submit a traffic control permit and plans showing the temporary traffic control signs, devices, and barricades required by the MUTCD. The permit and plan shall illustrate the traffic control devices for each stage of construction. All traffic control items shall be installed per MUTCD M&S Standard Details of the Colorado Department of Transportation.

B. Erect Multi-use Trail detours and safety fence as shown on the Drawings and as approved by OWNER.

C. Construct the Multi-Use Trail detours using the phased approach shown on the Drawings.

D. Set safety fence posts a maximum spacing of 10 feet.

E. Safety fence posts shall not penetrate, damage, or otherwise disturb concrete access road crossings.

3.3 MAINTENANCE AND REMOVAL

A. Maintain Multi-Use Trail detours during use.

B. Remove and dispose safety fence offsite when no longer required. Salvage and stockpile aggregate surfacing when no longer required. If salvaged material is acceptable to OWNER, coordinate location for delivery with OWNER.

C. If salvaged material is not acceptable to OWNER, dispose of at an approved off-site location.

END OF SECTION

SECTION 01 57 50
PROJECT PERMITS AND ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Project Permits

B. Abatement of Air Pollution

C. Abatement of Noise Pollution

D. Abatement of Water Pollution

E. Landscape Preservation

F. Preservation of Trees and Shrubs

G. Preservation of Historical and Archaeological Data

H. Protection of Endangered Species

1.2 SUBMITTALS

A. Shop Drawings:

1. At least 10 days prior to the start of construction, provide copies of all necessary State and local permits required to complete the Work.

1.3 PROJECT PERMITS

A. Comply with OWNER-obtained permits. OWNER-obtained permits, if required, will be provided to CONTRACTOR.

B. At minimum, anticipated CONTRACTOR-obtained permits will include: City of Brighton Erosion and Sediment Control Permit, and CDPHE Construction Stormwater Permit.

1.4 ABATEMENT OF AIR POLLUTION

A. Abatement of air pollution shall be performed in accordance with the requirements of the Air Pollution Emission Permit and applicable Laws and Regulations concerning the prevention and control of air pollution. Use such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

B. Burning of cleared materials, combustible construction materials, and rubbish will not be allowed.

C. Apply a dust-preventive treatment or periodically water access and haul roads to prevent dust.

1.5 ABATEMENT OF NOISE POLLUTION

A. Abatement of noise pollution shall be performed in accordance with applicable Laws and Regulations regarding the prevention, control, and abatement of harmful noise levels.

1.6 ABATEMENT OF WATER POLLUTION

A. Abatement of water pollution shall be performed in accordance with the requirements of the Stormwater Discharge Permit, and Section 31 25 00: EROSION AND SEDIMENTATION CONTROL.

B. Excavated materials or other construction materials shall not be stockpiled or wasted near or on streambanks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse itself.

C. Include prevention measures to control silting and erosion, and to intercept and settle any runoff of sediment-laden waters. Refer to Section 31 25 00: EROSION AND SEDIMENTATION CONTROL. Wastewater from general construction activities, such as drain water collection, drilling, grouting, or other construction operations, shall not enter flowing or dry watercourses without the use of approved turbidity control methods. All such wastewaters discharged shall contain the least concentration of settleable material possible, and shall meet all conditions of the National Pollutant Discharge Elimination System (NPDES) Section 402 permit.

1.7 LANDSCAPE PRESERVATION

A. Preserve the natural landscape, and conduct operations so as to prevent unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the Work. Movement of crews and equipment within the rights-of-way and over routes provided for access to the Work shall be performed in a manner to prevent damage to grazing land, crops, or property. When no longer required, construction roads shall be restored to original contours and made impassable to vehicular traffic.

1.8 PRESERVATION OF TREES AND SHRUBS

A. Preserve and protect existing vegetation not required or otherwise authorized to be removed. Vegetation shall be protected from damage or injury caused by CONTRACTOR construction operations, personnel, or equipment by the use of protective barriers or other methods. Removal of existing vegetation not specifically required to be removed will require prior approval by OWNER.

1.9 PRESERVATION OF HISTORICAL AND ARCHAEOLOGICAL DATA

A. Should CONTRACTOR, or any of CONTRACTOR's employees, or parties operating or associated with CONTRACTOR, in the performance of this Contract discover evidence of possible scientific, prehistoric, historic, or archeological data, immediately cease work at that location and notify OWNER, giving the location and nature of the findings. Forward written confirmation to OWNER within 2 days. Exercise care so as not to disturb or damage artifacts or fossils uncovered during excavation operations, and provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition by OWNER.

B. Where appropriate by reason of discovery, OWNER may order delays in the time of performance or changes in the Work, or both. If such delays or changes are ordered, an equitable adjustment will be made in the Contract in accordance with the applicable clauses of the Contract.

1.10 PROTECTION OF ENDANGERED SPECIES

A. There are no known endangered species at the Site.

B. Where appropriate by reason of a discovery, OWNER may order delays in time of performance or changes in the Work, or both. If such delays, or changes, or both, are ordered, the time of performance and Contract Price will be adjusted in accordance with the applicable clauses in the Contract.

1.11 PROTECTION OF SOUTH PLATTE FLOODPLAIN

A. Much of the site is located within the 100-year floodplain of the South Platte River, and is subject to special floodplain requirements, including regulations limiting placement of earthen fill above existing grades and regulations limiting construction of structures.

B. Protect all equipment and materials on site as the work areas may be subject to flooding.

C. For the purposes of satisfying floodplain regulations:

1. Be thoroughly familiar with applicable floodplain regulations as required by Adams County, and Mile High Flood District (MHFD).
2. Only construct permanent fills and structures where specifically shown on the Drawings and as indicated in these Specifications.
3. Remove all temporary fill down to existing grades in accordance with the approved schedule.
4. Store soil materials from the temporary cuts in onsite stockpiles and replace cut material to re-establish existing grades at the end of construction.
5. Completely remove temporary stockpiles, facilities, and temporary structures at the end of construction. Dispose of excess soil materials in accordance with the requirements of Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

D. CONTRACTOR-requested exceptions to these requirements must be approved in writing by THORNTON and will be subject to review and approval by regulatory agencies.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01 71 23
LAYOUT OF WORK AND QUANTITY SURVEYS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Perform all layout surveys required for the control and completion of the work, all necessary surveys to compute quantities of work performed, and all surveys necessary to generate a complete topographic map of final conditions.

B. Preserve and maintain survey control points. Survey control points damaged or destroyed by CONTRACTOR may be reestablished by OWNER, and the expense of reestablishment will be deducted from amounts due, or to become due, to CONTRACTOR.

1.2 SUBMITTALS

A. Administrative:

1. Survey Control Plan - a complete plan for the surveying required to lay out and complete the work, including methods and time tables for establishing lines and grades.
2. Surveyor Qualifications - resumes of qualifying experience for the Professional Land Surveyor who will be responsible for the supervision and direction of all of Contractor’s survey work.
3. Topographic Mapping - pre-construction topography at least 15 days prior to starting earthwork operations and final topography of the completed work after finish grading is complete as specified in Section 01 77 00: PROJECT CLOSEOUT and within 21 days of initial acceptance.
4. Soil-Bentonite Barrier Wall - Centerline of soil-bentonite barrier wall at least 5 days prior to beginning placement of low-permeable fill.
5. Quantity Surveys - accompanying progress payment requests, submit a copy of applicable quantity survey notes and computations and an itemized statement for work performed or placed during the progress period measured on the basis of surveying.
6. Survey Books - within 2 days of completing and reducing notes for a survey or portion of survey, submit a copy of such notes. Within 2 days of completing a field survey book, submit a copy of the original field survey book.
7. Daily Notes - if requested by ENGINEER, submit a copy of the workday's survey notes at the conclusion of that workday.

1.3 QUALIFICATIONS

A. Provide experienced construction surveyors. Survey work shall be under the supervision and direction of a Professional Land Surveyor who is registered in the State of Colorado and has a minimum of 2 years responsible charge of construction surveys for construction similar in nature to that required by this contract. Maintain sufficient qualified personnel to perform required surveying work. All survey work performed by CONTRACTOR shall be subject to field and office review by ENGINEER.

1.4 GENERAL

A. Check and verify, before beginning Work, all primary control points. Advise OWNER in writing that the points are acceptable, or if not, the reasons why not.

B. Other survey markers and points may be found in the field. Do not use any survey markers or points that are not identified as survey control on the Drawings. Found markers and points shall be staked, flagged, and preserved throughout the duration of the construction. Any markers and points within the limits of construction that may be disturbed by construction activity shall be brought to the immediate attention of OWNER.

1.5 LAYOUT OF WORK

A. Use survey control points provided in the Drawings to establish all lines and grades necessary to control the Work.

B. Establish, place, and replace as required, such additional monuments, control points, survey stakes, markers, and other controls as may be necessary for control, intermediate checks, and guidance of construction operations. Perform additional surveys as required for foundation mapping.

1.6 QUANTITY SURVEYS

A. Perform such surveys and computations as are necessary to determine quantities of work performed or placed during each progress payment period, and perform all surveys necessary for ENGINEER to determine final quantities of work in place.

B. One electronic version shall be provided to ENGINEER in AutoCAD 2022 or later DXF data file.

1. Include all point data used to generate surface contours saved as an ASCII or .csv file format. An explanation of point abbreviations is also necessary.
2. Include all break lines used to generate surface contours.
3. Contours shall be set to actual elevation (z-value assigned).
4. Index contours to have elevation labels with polylines to remain unbroken for label placement.
5. Index and intermediate contours on separate layers.
6. Provide both horizontal coordinate system and the vertical datum used to produce the survey/topo map.
7. Include the Civil 3D Surface when applicable. If the program used to create a surface is not Civil 3D, export surface data to an XML format.
8. Include the ctb file that is used for proper printout.
9. AECC Objects are not acceptable. AutoCAD or Civil 3D usable entities only.

1.7 CONTRACTOR SURVEYS

A. Surveys required:

1. Pre-Construction Survey - existing topography at least 15 days prior to starting earthwork operations. Survey shall extend from at least 10 feet beyond the limits of the Work.
2. Centerline of soil-bentonite barrier wall at spillway in accordance with Section 31 23 16: EXCAVATION.
3. Final topography - Survey shall extend from at least 10 feet beyond the limits of the Work.

B. Surveys required:

1. Alignment staking - Each 100 feet on tangent; each 50 feet on curves.
2. Slope staking - Each 50 feet on tangent; each 25 feet on curves; re-stake every 10 feet in elevation.

3. Cross section - Each 100 feet on tangent, each 50 feet on curves. Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys.
4. "Record" - As required for structures and other features of the work.

1.8 RECORDS

A. Survey data shall be recorded in accordance with recognized professional surveying standards. Original field notes, computations, and other surveying data shall be recorded in standard survey field books. Notes or data not in accordance with standard formats will be rejected. Illegible notes or data, or erasures on any page of a field book will be considered sufficient cause for rejection of part or all of the field book. Therefore, rejection of part or all of a field book may necessitate resurveying. Corrections by ruling or lining out errors will be satisfactory.

1.9 DEGREE OF ACCURACY

A. Degree of accuracy shall be of an order high enough to satisfy tolerances specified for the work and the following:

1. Alignment of tangents and curves shall be within 0.1 foot.
2. Cross section points shall be located within 0.1 foot, horizontally and vertically.
3. Vertical elevation surveys shall close within 0.05 foot times the square root of the circuit length in miles.
4. Earthwork final grades shall be within 0.1 foot horizontally and vertically.
5. Structure elevations shall be within 0.01 foot.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01 77 00
PROJECT CLOSEOUT

PART 1 GENERAL

1.1 SUBMITTALS

A. Administrative: Submit prior to application for final payment and in accordance with the General Conditions and Special Conditions.

1. Red-line markups.
2. Accepted shop drawings and samples.
3. Special Bonds, Special Warranties, and Service agreements.
4. Consent of Surety for Final Payment.
5. Releases or Waivers of Liens and Claims.
6. Releases from Agreements.
7. Record Survey.
8. Post construction photographs.
9. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00: PAYMENT PROCEDURES.

1.2 FINAL INSPECTION

A. Request a final inspection in writing at least ten (10) calendar days prior to the anticipated date of completion.

B. Perform final inspection with CONTRACTOR, OWNER, and ENGINEER.

C. Work will not be considered ready for final inspection until all Work has been completed, and CONTRACTOR has certified that all items are properly operating and in compliance with all Contract terms and conditions. CONTRACTOR or his project supervisor shall be at the Site during the final inspection.

1.3 REDLINE DRAWINGS

A. Provide and maintain at the project site, one complete set of prints of the project Drawings. Keep the Drawings in good, clean, and readable condition.

B. Neatly inscribe on the project Drawings all changes in Work including relocation of lines, change in type of materials, etc. Note changes with red pencil or red ink. Note date of change. Note all data and changes on these red-line Record Drawings in sufficient detail and clarity and provide information necessary for preparation of Record Drawings. Project Drawings will be kept current and shall be updated weekly. Provide red-line drawings to OWNER upon initial acceptance.

C. Make entries within 24 hours after receipt of information that a change in Work has occurred.

D. Perform survey of completed construction for all areas disturbed by CONTRACTOR. Provide single hard copy drawing (22- by 34-inch) stamped by a Colorado licensed Professional Surveyor and an electronic version in AutoCAD, version 2016. Provide electronic copy as specified in Section 01 71 23: LAYOUT OF WORK AND QUANTITY SURVEYS. Survey with an accuracy equivalent to a scale of 1 inch equals 40 feet and 1-foot contour intervals.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 FINAL CLEANING

A. At completion of Work or of a part thereof and immediately prior to CONTRACTOR's request for Certificate of Substantial Completion; or if no certificate is issued, immediately prior to CONTRACTOR's notice of completion, clean entire site or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a clean condition satisfactory to OWNER.
2. Rake clean all other surfaces.
3. Leave water courses, gutters, and ditches open and clean.

3.2 SITE ACCESS REPAIR

A. Unsurfaced Roads:

1. Re-grade damaged areas to match pre-construction grades and to remove ruts and depressions caused by construction activities.

B. Surfaced Access Roads:

1. Replace aggregate surfacing and re-grade in damaged areas to match pre-construction grades and where construction damage has resulted in the removal or displacement of aggregate surfacing.
2. Replacement aggregate surfacing shall be in accordance with Section 32 11 23: AGGREGATE BASE COURSES.
3. Replace portions of concrete multi-use trails in accordance with Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS if damaged during construction.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Demolition of existing multi-use trail at spillway as shown on the Drawings. Disposal of demolished concrete off-site.

1.2 SUBMITTALS

A. Shop Drawings:

1. Demolition Plan:

a. Schedule of work, as part of and consistent with the progress schedule specified in Section 01 32 00: CONSTRUCTION PROGRESS DOCUMENTATION.
b. Detailed sequence of operations.
c. Methods and equipment for demolition, removal, and disposal.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Protect existing facilities to remain from damage due to demolition of adjacent facilities.

B. Review drawings of existing conditions.

3.2 CONCRETE DEMOLLITION

A. Perform demolition, removal, and disposal operations in accordance with accepted Demolition Plan.

B. Sawcut concrete. Blasting is not permitted.

3.3 DISPOSAL

A. Dispose of demolished items and materials in an approved off-site facility.

B. Conform to the requirements of all applicable environmental and health regulations in handling and disposal of any identified hazardous materials.

END OF SECTION

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SECTION 03 01 30
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.1 WORK INCLUDES

A. Repairs to defective or damaged concrete.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 301 - Specifications for Structural Concrete

2. U.S. Bureau of Reclamation (USBR) Guide to Concrete Repair.

1.3 DEFINITIONS

A. Defective Concrete – Surface defects that include honeycomb, rock pockets, indentations greater than 3/16 inch, cracks 0.005-inch wide and larger; cracks 0.010-inch wide and larger in non-fluid holding structures spalls, chips, air bubbles greater than 3/4 inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

1.4 SUBMITTALS

A. Shop Drawings:

1. Provide plan for repair of defective or damaged concrete. Include method of repair and materials used to perform repair.

PART 2 PRODUCTS

2.1 MATERIALS

A. Non-shrink grout shall conform to the requirements of Section 03 62 00: NON-SHRINK GROUT, Type 1.

B. Epoxy grout shall conform to the requirements of Section 03 62 00: NON-SHRINK GROUT, Type 2.

2.2 GENERAL

A. Conform to ACI 301.

B. Grinding of concrete surfaces shall be limited in depth such that no aggregate particles are exposed more than 1/6-inch in cross section at the finished surface. Where grinding has caused or will cause exposure of aggregate particles greater than 1/6-inch in cross section at the finished surface, concrete shall be repaired by excavating and replacing the concrete.

C. Repairs may be made with non-shrink grout within the first 7 days after concrete placement.

D. Use epoxy grout for repairs made with after 7 days from concrete placement.

2.3 PATCHING HOLES

A. Notify OWNER immediately upon removal of forms.

B. Clean defect prior to placing repair materials. Remove damaged, deteriorated, loosened, or unbound portions of existing concrete. Allow cleaned defect to dry before applying bonding agent.

C. Holes less than 12 inches in their least dimension: Fill with non-shrink grout or epoxy grout.

D. Holes greater than 12 inches in their least dimension: Chip keyway minimum ½-inch deep into edge of opening all around. Fill hole with concrete.

E. Holes greater than 24 inches in their least dimension with no reinforcing steel extending from concrete: Grout reinforcing steel in drilled holes; reinforcing steel shall match the reinforcing in the existing concrete. Fill hole with concrete.

F. Form as necessary to confine the concrete and shape to required lines and grades.

G. Repair exposed reinforcing steel as follows:

1. If more than one-half of the perimeter of a reinforcing bar has been exposed after removal of deteriorated concrete, continue concrete removal to provide a minimum of 1/4 inch clear space behind the reinforcing steel.
2. If more than one-half of the perimeter of a bar is exposed after removal of deteriorated concrete, the bar should be cleaned, inspected by ENGINEER, and, if applicable, repairs can proceed without further concrete removal.

H. Non-Shrink (Type 1) Grout Placement:

1. Use non-shrink grout for filling holes having a depth equal to, or greater than, the least surface dimension of the repair area, for cone bolt, she bolt, core holes, and grout-insert holes; for holes left by the removal of form ties; and for narrow slots cut for repair of cracks.
2. Holes for non-shrink grout applications shall have a minimum depth of 1-1/2 inch and a maximum depth of 6 inches. Non-shrink grout shall not be used for shallow depressions (less than 1-1/2 inches) where lateral restraint cannot be obtained, for filling, behind reinforcement, or for filling holes that extend completely through a concrete section, unless application is approved by ENGINEER.
3. Use an epoxy bonding agent.
4. Prepared holes shall be sharp and square at the surface edges, but corners within the holes shall be rounded, especially when water tightness is required.

I. Epoxy (Type 2) Group Placement:

1. Use epoxy grout for filling holes is allowed where the depth of repair is less than 1-1/2 inches.
2. Epoxy grout may be used to fill holes up to a maximum depth of 6 inches.
3. Place only when the exposure conditions are such that relatively constant temperatures can be expected.
4. Maintain surface temperature of concrete repair areas above 40°F for the first 4 hours after placement.
5. The final surface temperature at the time of epoxy grout placement shall not be greater than 100°F.
6. Prepare, place, and cure the epoxy grout per manufacturer's written instructions and guidelines established in the USBR *Guide to Concrete Repair*.

7. During application of the epoxy grout, confine the grout material to the area being bonded to avoid contamination of adjacent surfaces.
8. Spray application of the epoxy grout will not be allowed without written approval from OWNER.
9. The applied epoxy grout must be in a fluid condition when placed and not allowed to seep outside of the placement area.
10. Additional epoxy grout coats can be placed if the first bond coat surface has not fully cured and still has a tacky state. If the original coat has cured beyond a tacky state and an additional thin coat is required, the entire coat must be removed, surface cleaned, and a new bond coat applied.
11. Surfaces of all epoxy grout repairs shall be finished to the plane of surfaces adjoining the repair areas. The final finished surfaces shall have the same smoothness and texture of surfaces adjoining the repair areas.
12. The epoxy grout shall not be subjected to moisture until after the specified post curing has been completed.

END OF SECTION

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SECTION 03 11 00
CONCRETE FORMING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Design, fabrication, erection, and removal of formwork and accessories for cast-in-place concrete.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 301 - Specifications for Structural Concrete
b. 347R - Guide to Formwork for Concrete

2. U. S. Product Standard PS 1: Construction and Industrial Plywood.

1.3 DEFINITIONS

A. Design Strength: As defined in Section 03 30 50: BASIC CONCRETE MATERIALS.

1.4 SUBMITTALS

A. Shop Drawings:

1. Manufacture’s product data for form ties, spreaders, inserts, other formwork accessories, and form release agent.

1.5 DESIGN REQUIREMENTS

A. Conform to the requirements of ACI 301 and the recommendations of ACI 347 to provide concrete finishes and tolerances specified in Section 03 30 00: CAST-IN-PLACE CONCRETE.

B. Design forms for full hydrostatic pressure when high range water reducer is used in concrete mix.

C. Make joints in forms watertight.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Plywood: Douglas Fir species; solid one side grade; sound, undamaged sheets with straight edges.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to withstand the pressure resulting from placement and vibration of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

C. Lumber: Fir species; No. 2 grade or better; with grade stamp clearly visible.

D. Steel: Minimum 16 gage sheet, well matched, tight fitting, undamaged, stiffened to withstand the pressure resulting from placement and vibration of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.2 FORMWORK ACCESSORIES

A. Form Ties:

1. Removable metal or fixed cone type; ¾- or 1-inch break back dimension; free of defects that will leave holes larger than 1-inch-diameter in concrete surface.
2. Include a swagged or integral metal washer or a neoprene washer in the center of the tie to break surface continuity and minimize water seepage. Minimum size of washer shall be 1/16-inch-thick by 15/16-inch outside diameter.
3. Wire form ties shall not be used.

B. Form Release Agent: Colorless material that will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of concrete.

C. Fillets for Chamfered Corners and All Exposed Edges: Wood strips or rigid plastic; ¾-inch by ¾-inch, unless otherwise shown on the Drawings.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 PREPARATION

A. Hand-trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.

C. Tape, gasket, plug, or caulk joints, gaps, and apertures in forms so joints will be watertight and resist concrete pressure without bulging.

D. Arrange and assemble formwork to permit stripping so that concrete is not damaged during form removal.

E. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.3 ERECTION

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

B. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

C. Provide chamfer strips on all external corners.

D. Construct formwork to maintain tolerances in accordance with Section 03 30 00: CAST-IN-PLACE CONCRETE**.**

3.4 CLEANING

A. Thoroughly clean form surfaces to remove foreign matter as erection proceeds, and before application of form release agent.

B. Ensure that water and debris drain to exterior through cleanout ports.

C. During cold weather, remove ice and snow from forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

3.5 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

B. Do not apply form release agent where concrete surfaces are scheduled to receive special finishes that may be affected by the agent.

C. Where wood forms are used and form release agent is not used, soak contact surfaces with clean water to prevent absorption of water from the concrete. Keep surfaces wet prior to placing concrete.

D. Place concrete within 14 days after form release agent is applied to form. If concrete is not placed within 14 days, remove forms and reapply form release agent.

3.6 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete.

B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts or embedded items.

C. Install accessories in accordance with manufacturer's instructions, level and plumb. Brace and anchor accessories so they will not move during concrete placement.

3.7 FORM REMOVAL

A. Notify OWNER prior to removing formwork.

B. Do not remove forms until concrete has sufficient strength to support its own weight, and construction and design loads that may be imposed upon it. As a minimum, forms shall remain in place for 36 hours after completion of respective concrete placement.

C. Load supporting forms shall remain in place until concrete has attained at least 75 percent of the specified design strength as determined by test cylinders.

D. Do not damage concrete surfaces during form removal.

E. Finish all concrete surfaces prior to applying curing compound in accordance with the requirements of Section 03 30 00: CAST-IN-PLACE CONCRETE.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 WORK INCLUDES

A. Construction, expansion, and contraction joints in concrete.

B. Tooling or chamfering edges of concrete.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
b. D 1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

2. U.S. Army Corps of Engineers Specifications (COE):

a. CRD-C 572-PVC Waterstop
b. Accepted equal.

1.3 SUBMITTALS

A. Shop Drawings:

1. Joint Filler Materials: Manufacturer's product data and installation instructions.
2. Concrete Joints:

a. Layout and location for each type of joint.

B. Samples:

1. 12-inch-long sample of each joint filler material to be used in construction of the Work.

PART 2 PRODUCTS

2.1 JOINT FILLER MATERIAL

A. Conforming to ASTM D 1752; pre-molded sponge rubber fully compressible with recovery rate of minimum 90 percent.

2.2 PLAIN DOWELS

A. Conforming to Section 03 20 00: CONCRETE REINFORCING.

PART 3 EXECUTION

3.1 CONSTRUCTION JOINT (CJ)

A. Locate construction joints at the locations shown on the Drawings and as otherwise determined by CONTRACTOR and approved by ENGINEER to facilitate construction of the Work. Relocation, addition, or elimination of any construction joint shall be subject to written approval of ENGINEER.

B. Bond is required at construction joints regardless of whether or not reinforcing steel is continuous across the joint.

C. Continue reinforcing steel across construction joints, unless otherwise shown on the Drawings.

D. Surface preparation:

1. Remove laitance and spillage from reinforcing steel and plain dowels.
2. Thoroughly clean surface by pressure washing to remove loose or defective concrete, coatings, sand, curing compound, and other foreign material.
3. Roughen surface to minimum of ¼-inch amplitude:

    a. Sandblast if concrete is fully cured.
    b. Water blast if concrete is partially cured.

4. Do not damage waterstop or other embedded items.

3.2 CONTRACTION JOINT (CTJ)

A. Locate contraction joints at the locations shown on the Drawings or as otherwise required by ENGINEER.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean by pressure washing abutting concrete surface of laitance, dirt and debris.

F. Coat abutting surface with curing compound. Curing compound shall conform to requirements of Section 03 30 00: CAST-IN-PLACE CONCRETE. Do not coat waterstop with curing compound.

G. Place abutting concrete.

3.3 EXPANSION JOINTS (EJ)

A. Locate expansion joints at the locations shown on the Drawings or as otherwise required by ENGINEER.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean by pressure washing abutting concrete surface of laitance, dirt and debris.

F. Place joint filler material in accordance with manufacturer’s instructions.

G. Place abutting concrete.

3.4 TOOLED EDGES

A. Tool or chamfer edges of concrete as shown on the Drawings or required by ENGINEER.

B. Where shown on the Drawings, outside edges of concrete shall be neatly finished with an edging tool. The radius of the tooled edges shall not be greater than 1/4 inch

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Steel reinforcement and accessories for all concrete.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 301 – Specifications for Structural Concrete
b. 315 – Details and Detailing of Concrete Reinforcement
c. 318/318R – Building Code Requirements for Structural Concrete and Commentary

2. American Society for Testing and Materials (ASTM):

a. A 185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
b. A 497 – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
c. A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
d. A 706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
e. A 767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

3. Concrete Reinforcing Steel Institute (CRSI):

a. Manual of Standard Practice
b. Plain Reinforcing Bars
c. 63 – Recommended Practice for Placing Reinforcing Bars
d. 65 – Recommended Practice for Placing Bar Supports, Specifications, and Nomenclature

4. American Welding Society (AWS):

a. D1.4 – Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

A. Shop Drawings:

1. Prepare in accordance with ACI 315 and CRSI Manual of Standard Practice. As a minimum, include the following:

a. Sizes, spacings, locations, and quantities of reinforcing steel and wire fabric; bending and cutting schedules; locations and dimensions of all bends, hooks, lap splices, and dowels; stirrup spacing; supporting and spacing devices.

b. Relationships to formed openings, embedded items, and equipment; relationships to adjoining concrete structures; coordination with concrete placement schedule.
c. Locations of all welded connections and mechanical couplers.

2. Product data for mechanical couplers.

B. Administrative:

1. Statement of qualifications for welder(s).

C. Quality Control:

1. Mill test certificates for reinforcing steel, indicating physical and chemical analysis, with each load of reinforcement delivered to the site.
2. Results of field testing.

1.4 QUALIFICATIONS

A. Welders: In accordance with AWS D1.4.

PART 2 PRODUCTS

2.1 STEEL REINFORCING MATERIALS

A. Reinforcing Steel: ASTM A 615, Grade 60, deformed bar, uncoated; ASTM A 706, Grade 60, deformed bar, uncoated for reinforcing steel to be welded.

B. Galvanized Reinforcing Steel: ASTM A 767, Grade 60, deformed bar.

C. Plain Dowels: ASTM A 615, Grade 60, plain bar, uncoated.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage, annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete. Accessories fully or partially exposed after forms are removed shall be plastic, galvanized steel or plastic-coated steel.

2.3 MECHANICAL COUPLERS

A. Use only where shown on the Drawings or approved by ENGINEER.

B. Couplers shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcement bars being spliced.

C. Products:

1. C2D Rebar Flange Coupler, Williams Form Engineering Co., Grand Rapids, MI.
2. Richmond DB-SAE Dowel Bar Splicer, Richmond Screw Anchor Co., Inc., Fort Worth, TX.
3. Lenton Reinforcing Steel Coupler, Erico Products, Inc., Cleveland, OH.

2.4 WELDED WIRE FABRIC

A. Deformed Wire: ASTM A 497, wire sizes and center-to-center spacings as shown on Drawings. Provide by sheet type.

B. Plain Wire: ASTM A 185, wire sizes and center-to-center spacings as shown on the Drawings. Provide by sheet type.

PART 3 EXECUTION

3.1 FABRICATION

A. Follow CRSI Manual of Standard Practice.

B. Bend bars cold.

C. Locate reinforcing splices not indicated on the Drawings at points of minimum stress.

3.2 DELIVERY, STORAGE, AND HANDLING

A. In accordance with CRSI publication “Placing Reinforcing Bars.”

3.3 REINFORCING BARS

A. Bundle or space bars, instead of field bending, where construction access through reinforcing is necessary.

B. Spacing and Positioning: Conform to ACI 318/318R.

C. Location Tolerances: Conform to CRSI 63.

D. Place, support, and secure reinforcement to prevent displacement during concrete placement.

E. Splicing:

1. Conform to requirements of ACI 318/318R.
2. Use lap splices unless otherwise shown on the Drawings or approved by ENGINEER.
3. Stagger splices in adjacent bars unless otherwise shown on Drawings.
4. Install mechanical couplers in accordance with manufacturer’s instructions. Protect as necessary to prevent concrete, cement paste, or water from entering.

F. Bend tie wires away from concrete surface to provide minimum clearance of 1-inch from finished surface of concrete.

G. Field bending of reinforcing bars will not be allowed.

H. Do not field cut reinforcing bars unless approved by ENGINEER. Do not torch cut reinforcing bars if field cutting is allowed.

I. Extend each end of reinforcing steel bars a minimum of one standard embedment length beyond openings in concrete.

J. Welding Reinforcement:

1. Only ASTM A 706 reinforcing bars may be welded.
2. Welding of reinforcing bars will be allowed only where shown on the Drawings or approved by ENGINEER.
3. Conform to AWS D1.4.

K. Plain Dowels:

1. Properly position and secure in place to prevent displacement during concrete placement.
2. Place so that one-half of the dowel is embedded on each side of the joint; set parallel with the finished concrete surface.
3. Grease one end of each dowel to prevent bond to the concrete.

3.4 WELDED WIRE FABRIC

A. Wire fabric shall be installed in lengths as long as practicable and shall be wire-tied at all laps and splices. End laps shall be offset in adjacent widths. Lap welded wire fabric in accordance with applicable requirements of ACI 318.

B. Where required welded wire fabric shall be secured in position with suitable supports, accessories, and tie wire as indicated and required to ensure against movement from workers and placement of concrete lift fabric as concrete is placed to assure proper embedment at position indicated. Do not place welded wire reinforcement on grade and subsequently raise it into position during placement of concrete.

C. For slabs-on-ground, extend welded wire reinforcement to within 2 inches of concrete edge. Unless otherwise specified or permitted, do not extend welded wire reinforcement through control joints.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 WORK INCLUDES

A. Cast-in-place conventional concrete required for construction of the Work.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 117 – Standard Specifications for Tolerances for Concrete Construction and Materials
b. 301 – Specifications for Structural Concrete
c. 302.1R – Guide for Concrete Floor and Slab Construction
d. 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete
e. 304.2R – Placing Concrete by Pumping Methods
f. 305R – Guide to Hot Weather Concreting
g. 306.1 – Standard Specification for Cold Weather Concreting
h. 309R – Guide for Consolidation of Concrete
i. 318/318R – Building Code Requirements for Structural Concrete and Commentary

2. American Society for Testing and Materials (ASTM):

a. C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
b. C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
c. C 143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
d. C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
e. C 1218 – Standard Test Method for Water Soluble Chloride in Mortar and Concrete
f. E 329 – Standard Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction

B. Where these Specifications differ from the requirements of ACI or ASTM, the more stringent requirements shall apply.

1.3 DEFINITIONS

A. Exposed Concrete: Concrete surfaces that can be inside or outside of structures, regardless of whether concrete is above or below water, dry at all times, or can be seen when structure is drained.

B. Hydraulic Structures: Water retention or containment structures.

C. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16 inch, cracks 0.005-inch wide and larger and any crack that leaks for liquid containment basins and below grade habitable spaces; cracks 0.010-inch wide and larger in non-fluid holding structures spalls, chips, air bubbles greater than 3/4 inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form

joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

D. New Concrete: Concrete less than 60-days old.

E. Design Strength: As defined in Section 03 30 50: BASIC CONCRETE MATERIALS.

1.4 SUBMITTALS

A. Shop Drawings:

1. Placement drawings:

a. For all Class A and B concrete.
b. Identify locations of joints; coordinate with required submittals for Section 03 15 00: CONCRETE ACCESSORIES.

2. Plan for cold weather concreting procedures; including procedures for transporting, placing, protecting, curing, and monitoring temperature of concrete during cold weather. Include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Include procedures for protecting the subgrade from frost, and for preventing the accumulation of ice or snow on reinforcement or forms prior to placement.
3. Plan for hot weather concreting procedures; including procedures for transporting, placing, protecting, curing, and monitoring temperature of concrete during hot weather.

B. Administrative:

1. Manufacturer’s application instructions for curing compound.
2. Statement of Qualifications:

a. CONTRACTOR’s resident superintendent for concrete placement.

3. Pre-installation Conference minutes.

C. Quality Control:

1. Concrete batch ticket for each load of concrete delivered to the site.

a. Statement identifying reactivity of aggregates. Determine water-soluble chloride in each component of aggregates in accordance with ASTM C 1218.
b. For each trial concrete mix design and signed by a qualified mix designer; including cylinder compressive strength test results for laboratory concrete mixes.
c. Field quality control test results.

1.5 QUALITY ASSURANCE

A. Pre-installation conference:

1. Meeting attendees:

a. CONTRACTOR, including pumping and placing subcontractors. (Attendance mandatory.)
b. ENGINEER, including field inspection personnel. (Attendance mandatory.)
c. Concrete supplier representative. (Attendance mandatory.)
d. Quality control testing and sampling personnel. (Attendance mandatory.)

e. OWNER's representative. (Attendance optional.)

2. Agenda will include, as a minimum, the following topics:

a. Status of submittals.
b. Mix designs; required slump and air content requirements; admixture types, dosage, performance, and re-dosing at site; concrete placement temperature requirements.
c. Placement methods and equipment, consolidation, finishing, curing, and protection of concrete.
d. Quality control requirements and procedures.
e. Hot and cold weather procedures.
f. Other specified items requiring coordination.

PART 2 PRODUCTS

2.1 CONCRETE

A. Conform to the requirements of Section 03 30 50: BASIC CONCRETE MATERIALS.

2.2 CURING COMPOUND

A. Conform to the requirements of Section 03 39 00: CONCRETE CURING.

PART 3 EXECUTION

3.1 GENERAL

A. Conform to ACI 301 and ACI 304R, except as modified by these Specifications.

B. Notify ENGINEER a minimum of 24 hours prior to commencement of concreting operations.

3.2 PREPARATION

A. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

B. Remove debris and standing water from placement area. Dampen all earth and wood surfaces against which concrete will be placed. Keep surfaces moist until concrete is placed.

C. Reinforcing steel shall be free of all debris, scale, oil, soil, and all other contamination at the time concrete is placed.

D. Do not place concrete until all formwork, reinforcement, and embedded items are properly placed and secured.

E. Supply concrete placement checkout forms satisfactory to OWNER, and a watertight container for the forms at a convenient location near each placement site. List on the checkout forms all of the various work items required prior to concrete placement. Each work item for the respective placement shall be completed and the form signed by CONTRACTOR. Each work item shall then be inspected and the form signed by ENGINEER. Concrete placement may commence when all work items have been completed, inspected, and signed by both CONTRACTOR and ENGINEER. The use of placement checkout forms may be waived by ENGINEER where their use is judged to be impracticable.

F. Have all necessary placing equipment on site prior to ordering concrete.

3.3 PLACING CONCRETE

A. Place class of concrete indicated on the Drawings. If a concrete class is not indicated, place Class A concrete.

B. Place concrete in as nearly a continuous operation as practical.

C. Place concrete in near horizontal layers no more than 2 feet deep prior to consolidation. Use spreading equipment that prevents segregation and that produces layers of widths and thickness appropriate for proper consolidation. Place each successive layer as soon as practicable after the preceding layer is completed.

D. Use delivery and placement methods that do not cause segregation. The maximum free-fall drop height allowed for concrete placement shall be 4 feet.

E. Do not disturb reinforcement, inserts, embedded items, or formed joints.

F. Do not break or interrupt successive placements such that cold joints occur.

G. Prevent debris or other objectionable material from becoming embedded in the concrete.

H. Pumping Concrete:

1. Conform to ACI 304.2R.

I. Placement Time: Place concrete within 90 minutes after water is added to cement, unless appropriate set delay admixtures are used. Use of set delay admixtures must be approved by ENGINEER.

J. Allow a minimum of 7 days between adjacent placements at construction joints and contraction joints, unless otherwise indicated on the Drawings.

K. Inclement Weather:

1. Do not place concrete during heavy rain; defined as more than 0.3 inch per hour or 0.03 inch in 6 minutes (as defined by the Weather Bureau Glossary of Meteorology).
2. If unusual adverse weather, such as heavy rain, severe cold or heavy snow, occurs or is forecast to occur during placement, an interruption in placing operations may be approved or required by ENGINEER.
3. Fully consolidate all placed concrete materials prior to stopping work.

L. Cold Joints: Cold joints created by interruption of placement operations for any reason shall be treated as a construction joint in accordance with the requirements of Section 03 15 00: CONCRETE ACCESSORIES.

3.4 CONSOLIDATING CONCRETE

A. Conform to ACI 309R.

B. Use immersion-type power vibrators, suitable for the concrete mix proportions and placement conditions of the respective placement.

C. Provide at least one standby vibrator prior to concrete placement.

D. Vibrators should be immersed into the current concrete placement until previous wet lift is penetrated or foundation base is contacted.

E. Do not consolidate concrete by placing vibrator against reinforcing steel.

3.5 COLD WEATHER PLACEMENT

A. Follow approved cold weather placement plan when the ambient air temperature is less than 40°F, or if the ambient air temperature is approaching 40°F and falling.

B. Develop cold weather placement plan in general conformance to ACI 306.1.

C. Do not place concrete against frozen earth or ice, or against forms or reinforcement with frost or ice present.

D. Maintain surface temperature of concrete above 40°F for minimum of 7 days after placement is completed.

E. Do not locally heat or dry concrete when using heating units to meet Specification requirements.

3.6 HOT WEATHER PLACEMENT

A. Follow approved hot weather placement plan. Include in the plan ambient weather conditions, considering combined effects of air temperature, humidity, wind speed and solar radiation, under which hot weather placement procedures will be implemented.

B. Develop hot weather placement plan in general conformance to ACI 305R.

C. Maintain temperature of concrete at or below temperature requirements in Section 03 30 50: BASIC CONCRETE MATERIALS, until concrete is placed.

D. Provide shading, fog spraying, sprinkling, wet cover, or other means of maintaining concrete below the maximum specified temperatures.

3.7 QUALITY CONTROL

A. Responsibility:

1. CONTRACTOR’s independent materials testing firm will perform all field quality assurance testing, obtain all field quality assurance samples, and perform all laboratory testing of field quality assurance samples for all cast-in-place concrete.
2. CONTRACTOR will verbally advise ENGINEER of results of field quality assurance test results upon completion of respective tests. Copies of THORNTON’s field quality control test results will be provided to ENGINEER within 24 hours after testing.

B. General:

1. Quality control test results will be evaluated in accordance with ACI 301 and these Specifications.
2. Frequency of testing may be changed at ENGINEER’s discretion.
3. Concrete samples for pumped concrete will be taken from the placement (discharge) end of the pumping line. Where sampling at the pump discharge is impractical, samples will be taken at the pump supply hopper.
4. Water cannot be added between the batch plant and the site.
5. Air content can be adjusted once at the site.
6. Repeat all QC tests if batch is modified (add air, water, etc.) after initial testing.
7. Do not place concrete in work if results of tests do not meet the Specifications.

C. Compressive Strength:

1. Cylinder Preparation: ASTM C 31.
2. Each set shall consist of five cylinders.

3. 3 extra cylinders will be cast for each set cast during cold weather concreting operations. The extra cylinders will be field cured. Protect field curing cylinders; place and maintain cylinders in the curing environment of the representative concrete.
4. Frequency: At least 1 set for each placement.
5. Laboratory Test Procedure: ASTM C 39.
6. For each set:

    a. One cylinder will be tested at 7 days
    b. 2 cylinders will be tested at 28 days
    c. 2 field cured cylinders will be tested at 28 days
    d. Remaining cylinders will be retained for additional testing as needed, including testing at 56 days, if required.

D. Slump:

1. Test Procedure: ASTM C 143.
2. Frequency: 1 test for each truckload or batch.

E. Air Content:

1. Test Procedure: ASTM C 231.
2. Frequency: 1 test for each truckload or batch.

F. Temperature:

1. Frequency: 1 test for each truckload or batch.
2. Measure temperature immediately prior to placement.

END OF SECTION

SECTION 03 30 50
BASIC CONCRETE MATERIALS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Material and mix requirements for conventional concrete and grout.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 117 – Standard Specifications for Tolerances for Concrete Construction and Materials
b. 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
c. 301 – Specifications for Structural Concrete
d. 318/318R – Building Code Requirements for Structural Concrete and Commentary

2. American Society for Testing and Materials (ASTM):

a. C 33 – Standard Specifications for Concrete Aggregates
b. C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
c. C 88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
d. C 94 – Standard Specifications for Ready-Mixed Concrete
e. C 150 – Standard Specifications for Portland Cement
f. C 157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
g. C 192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
h. C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
i. C 260 – Standard Specification for Air-Entraining Admixtures for Concrete
j. C 494 – Standard Specification for Chemical Admixtures for Concrete
k. C 595 – Standard Specification for Blended Hydraulic Cements
l. C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

B. Where these Specifications differ from the requirements of ACI or ASTM, the more stringent requirements shall apply.

1.3 DEFINITIONS

A. Design Strength: Required minimum compressive strength of concrete at respective age, as specified in this Section.

B. Cementitious Materials: Portland cement and fly ash.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product Data: Cement, fly ash, aggregate, admixtures, and water.

a. Cement and fly ash (if used), indicate sources of materials; include certification(s) of compliance with specified requirements.
b. Coarse and fine aggregates; include sources of materials and test data demonstrating compliance with specified gradation and quality requirements.
c. Admixtures; include manufacturers and certification(s) of compliance with specified requirements.
d. Indicate source(s) and chemical test results of water source(s) for use in all concreting operations.

2. Mix Design Data: Include mix proportions and complete test results demonstrating compliance with specified requirements. Include mix design provisions for pumping concrete if applicable to proposed means and methods for construction.

B. Administrative:

1. Statement of Qualifications:

a. Mix designer.
b. Batch plant.

C. Quality Control:

1. Manufacturers' Certificates of Compliance:

a. Portland Cement.
b. Fly Ash.
c. Coarse Aggregate.
d. Fine Aggregate.
e. Admixtures.

1.5 QUALIFICATIONS

A. Mix designer shall be a licensed professional engineer registered in the State of Colorado or a Colorado Department of Transportation approved concrete mix designer, with a minimum of 5 years of experience in the design of concrete mixes.

B. Batch plant shall be currently certified by the National Ready Mixed Concrete Association.

C. Do not batch or mix on site.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement:

1. ASTM C 150, Portland Type II, Type I/II, or approved equivalent.
2. Gray color.
3. Furnish from one source.

B. Fly Ash:

1. Class F, meeting applicable requirements of ASTM C 618.

2. Loss on ignition: Maximum 3 percent.

C. Aggregates:

1. Fine and coarse aggregates shall conform to applicable requirements of ASTM C 33 as modified by these Specifications.
2. Fine and coarse aggregates shall not be potentially reactive as determined in accordance with the provisions of ASTM C 33 Appendix X1.
3. Fine and coarse aggregates shall not be of a carbonate-based rock, unless its suitability and durability is proven by tests and approved by ENGINEER.
4. Fine aggregate shall be composed of natural sands.
5. Coarse aggregates shall be composed of natural gravel, crushed gravel, crushed stone, or combinations thereof.
6. Coarse aggregates shall contain no more than 15 percent flat or elongated particles, with maximum-to-minimum dimensions of 5 to 1.
7. Limit deleterious substances in coarse aggregate in accordance with the requirements for Class Designation 3S in Table 4 of ASTM C 33.
8. Coarse aggregate gradations shall conform to the requirements in Table 1.

TABLE 1

Concrete Class	ASTM C 33 Size No.	Nominal Maximum Aggregate Size (inches)
A	67	3/4
B	67	3/4
D	57	1-1/2
H	8	3/8
I	67	3/4

D. Admixtures:

1. Furnish each admixture from a single manufacturer.
2. Air-Entraining Admixture:

   a. ASTM C 260.

3. Water-reducing Admixture:

   a. ASTM C 494, Type A or Type D.
   b. Products:

      1) Pozzolith or Polyheed, Master Builders, Inc., Cleveland, OH.
      2) WRDA or HYCOL, W.R. Grace & Co., Cambridge, MA.
      3) Eucon WR-91, Euclid Chemical Co., Cleveland, OH.

4. High Range Water Reducing Admixture (Superplasticizer):

   a. ASTM C 494, Type F or Type G.
   b. Products:

      1) Rheobuild or Polyheed, Master Builders, Inc., Cleveland, OH.
      2) Daracem, W.R. Grace & Co., Cambridge, MA.
      3) Eucon 537, Euclid Chemical Co., Cleveland, OH.

E. Water:

1. Conforming to applicable provisions of ASTM C 94.

2.2 CONCRETE MIX PROPORTIONS

A. Provide the following classes of conventional concrete for use in the Work:

1. Class A: general use in structural reinforced concrete elements.
2. Class B: use for concrete access road crossing at spillway.
3. Class D: use for backfill in lieu of earthfill.
4. Class H: use in grouted riprap.

B. Conform to the requirements of Table 2.

TABLE 2

Concrete Class	Minimum Compressive Strength (psi)	Slump Range at Placement Site (inches)	Maximum Water-Cementitious Ratio	Minimum Cementitious Content (lbs per cubic yard)	Air Content (%)
A	4000 @ 28 days	3 - 5	0.45	520	4.0 – 7.0
B	5200 @ 28 days	3 - 5	0.45	520	4.0 – 7.0
D	2500 @ 28 days	3 - 5	0.65	400	1 – 12
H	3500@ 28 days	7 - 9	0.45	560	2.0 – 5.0

C. All concrete shall be air-entrained. Air content at the point of placement shall conform to the requirements of ACI 301. Unless otherwise approved by ENGINEER, all exposures shall be considered “Severe.”

D. Fly ash may constitute up to 20 percent by weight of the total cementitious content.

E. Use set-retarding admixtures during hot weather only when approved by ENGINEER.

2.3 CONCRETE TEMPERATURE

A. Batch concrete as necessary to achieve the following placement temperatures between 50°F and 90°F.

2.4 BATCHING, MIXING AND TRANSPORTING

A. Batch, mix and deliver to placement site in accordance with ASTM C 94.

PART 3 EXECUTION

3.1 MIX DESIGN

A. Develop mix design for each class of concrete required for the Work.

B. Conform to ACI 211.1 and ACI 301.

C. Supporting test data and documentation must represent the actual mix proportions proposed, including all admixtures.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Finishing concrete.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
b. 301 - Specifications for Structural Concrete

B. Where these Specifications differ from the requirements of ACI or ASTM, the more stringent requirements shall apply.

1.3 DEFINITIONS

A. Exposed Concrete: Concrete surfaces that can be inside or outside of structures, regardless of whether concrete is above or below water, dry at all times, or can be seen when structure is drained.

B. Hydraulic Structures: Water retention or containment structures.

C. Defective Areas: As defined in Section 03 01 30: MAINTENANCE OF CONCRETE.

D. New Concrete: Concrete less than 60-days old.

E. Design Strength: As defined in Section 03 30 50: BASIC CONCRETE MATERIALS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

A. Conform to ACI 301, except as modified by these Specifications.

3.2 FINISHING

A. Chamfer or round off all exposed edges as shown on the Drawings. Round off all exposed edges where edge treatment is not otherwise indicated. Round off with steel edging tool with a 1/4-inch radius.

B. Classes of finish for formed concrete surfaces are designated as **F1**, **F2**, or **F4**.

1. **F1**: Applies to formed surfaces upon or against which fill material or concrete will be placed.

a. Protect form tie rod ends from moisture on surfaces that will be in contact with fill material if they are below the maximum water table elevation. Protection shall consist of recessing the tie rod ends and filling the recesses with dry pack or other approved material or by an alternative system approved by ENGINEER.
b. Cut off form tie rod ends flush with formed surfaces that will be in contact with concrete above the maximum water table elevation, or recess form tie rod ends without filling.

2. **F2**: Applies to all formed surfaces not permanently concealed by fill material or concrete, or not required to receive finish **F4**.

a. Recessed form tie rods to allow removal with a minimum of 1-inch recess to the tie rod ends. Dry pack finish recess to match adjacent concrete surface texture and color.

3. **F4**: Applies to formed surfaces for which accurate alignment and evenness of surface are of paramount importance from the standpoint of reducing destructive effects of high-velocity water flow. All formed surfaces requiring finish **F4** are shown on the Drawings.

C. Classes of finish for unformed concrete surfaces are designated as **U1**, **U2**, or **U3**.

1. **U1** (screed finish): Applies to unformed surfaces that will be covered by fill material or by concrete. Finish **U1** is also the first stage of finishes **U2** and **U3**. Finishing operations shall consist of sufficient leveling and screeding to produce even, uniform surfaces.
2. **U2** (float finish): Applies to unformed surfaces not permanently concealed by fill material or concrete, or not required to receive finish **U3** (**U2B** requires brooming after floating). Finish **U2** is also the second stage of finish **U3**.

a. Floating may be performed with hand- or power-driven equipment.
b. Begin floating as soon as the screeded surface has stiffened sufficiently. Float only as necessary to produce a surface that is free from screed marks and uniform in texture.
c. If finish **U3** is to be applied, continue floating until a small amount of mortar without excess water is brought to the surface, so as to permit effective troweling.

3. **U3** (trowel finish): Applies generally to concrete surfaces that will be subjected to high-velocity water flows. All unformed surfaces requiring finish **U3** are shown on the Drawings.

a. Begin steel troweling when the floated surface has hardened sufficiently to prevent an excess of fine material from being drawn to the surface.
b. Perform steel troweling with firm pressure so as to flatten the sandy texture of the floated surface and to produce a dense uniform surface, free from blemishes and trowel marks.

4. Slope interior surfaces for drainage where shown on the Drawings or required by ENGINEER. Surfaces that will be exposed to the weather and that would normally be level shall be sloped for drainage. Narrow surfaces, such as tops of walls and curbs, shall be sloped approximately 3/8-inch per foot of width; and broader surfaces, such as walks, roadways, platforms, and decks, shall be sloped approximately ¼-inch per foot; unless the use of other slopes or level surfaces is indicated on the Drawings or required by ENGINEER.

D. Do not add extra water to the surface of the concrete to aid in finishing.

E. Broom finish: Perform after trowel finish (U3) on concrete trails, slabs, and pavement. Finish in direction perpendicular to normal walking direction or as directed by the ENGINEER.

3.3 PROTECTING CONCRETE

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical damage.

B. Do not allow construction vehicles or equipment on concrete until it has attained its specified design strength.

3.4 TOLERANCES

A. Tolerances are defined as allowable variation from specified lines, grades, and dimensions, and as allowable magnitude of surface irregularities.

B. Allowable Variation From Specified Lines, Grades, and Dimensions:

1. Conform to ACI 117.
2. Variation is defined as the distance between the actual position of the structure or any element of the structure and the specified position of the respective structure or element.

C. Allowable Magnitude of Surface Irregularities:

1. As specified in Table 1.
2. Concrete surface irregularities are defined as bulges, depressions, and offsets in hardened concrete surfaces.
3. Concrete surface irregularities are classified as "abrupt" or "gradual" and are measured relative to the actual concrete surface.
4. Abrupt Surface Irregularities:

    a. Defined as: offsets of the finished surface of formed surfaces, such as those caused by mis-aligned or loose forms, loose knots in form lumber, or other similar forming faults; and offsets of the finished surface of unformed surfaces, such as those caused by differential movement at joints.
    b. Measured using a 6-inch-long straight edge, held firmly against the concrete surface at the offset.
    c. The magnitude is the greatest distance from the concrete surface to the edge of the straight edge nearest the concrete

5. Gradual Surface Irregularities:

    a. Defined as bulges and depressions resulting in gradual changes on the concrete surface.
    b. Measured using a template conforming to the design profile of the concrete surface being examined, held firmly against the concrete surface. Provide necessary templates, with a minimum length of 10 feet.
    c. The magnitude is the greatest distance from the concrete surface to the nearest edge of the template.

TABLE 1
TOLERANCES FOR CONCRETE SURFACE IRREGULARITIES

A. Offsets (abrupt irregularities) on surfaces subject to high velocity hydraulic flow:
1. F4 Surfaces
   Parallel to the flow: 0.25 in
   Other Orientations: 0.125 in
2. U3 Surfaces
   Parallel to the flow: 0.25 in
   Other Orientations: 0.125 in

B. Offsets (abrupt irregularities) on surfaces not subject to high velocity hydraulic flow:
1. F1 Surfaces: 1 in (depressions only)
2. F2 Surfaces: 0.25 in
3. U1 Surfaces: 0.375 in
4. U2 Surfaces: 0.25 in
5. Broom Finish Surfaces (including multi-use trail): 0.25 in, and in accordance with the SPECIAL CONDITIONS

C. Gradual Changes (gradual irregularities) on surfaces subject to high velocity hydraulic flow:
1. F4 Surfaces
   Parallel to the flow: 0.25 in per 10 ft, 0.75 in max deviation
   Other Orientations: 0.125 in per 10 ft, 0.5 in max deviation
2. U3 Surfaces
   Parallel to the flow: 0.25 in per 10 ft, 0.75 in max deviation
   Other Orientations: 0.125 in per 10 ft, 0.5 in max deviation

D. Gradual changes (gradual irregularities) on surfaces not subject to high velocity hydraulic flow:
1. F2 Surfaces: 0.25 in per 10 ft, 0.75 in max deviation
2. U2 Surfaces: 0.25 in per 10 ft, 0.75 in max deviation
3. Broom Finish Surfaces (including multi-use trail): 0.25 in per 10 feet, and in accordance with the SPECIAL CONDITIONS

3.5 QUALITY CONTROL

A. Tolerances:

1. Variation of all hardened concrete structures or elements of structures will be measured as necessary to verify compliance with Specification requirements.
2. Provide appropriate templates for ENGINEER's use in measuring variation measurements.

END OF SECTION

SECTION 03 37 16
PUMPED CONCRETE

PART 1 GENERAL

1.1 WORK INCLUDES

A. Pumped concrete required for construction of the Work.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 301 - Specifications for Structural Concrete
b. 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete

B. Where these Specifications differ from the requirements of ACI or ASTM, the more stringent requirements shall apply.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PUMPED CONCRETE

A. Pumping Concrete:

1. Conform to ACI 304.2R, except as modified by these Specifications.
2. Pipelines shall be steep pipe or flexible hose. Do not use aluminum pipe.
3. Inside diameter of pipeline shall be minimum three times the maximum aggregate size of the concrete mix.
4. Water introduced at any point in the pump shall be ejected outside the concrete placed for the Work. Concrete in the pump that exceeds 90 minutes for the point water was added to the cement shall be wasted.

END OF SECTION

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SECTION 03 39 00
CONCRETE CURING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Curing concrete surfaces.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. 301 – Specifications for Structural Concrete
b. 308.1 – Standard Specification for Curing Concrete

2. American Society for Testing and Materials (ASTM):

a. C 171 – Standard Specification for Sheet Materials for Curing Concrete
b. C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
c. C 1315 –- Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

3. American Association of State Highway and Transportation Officials (AASHTO):

a. M 182 – Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

B. Where these Specifications differ from the requirements of ACI or ASTM, the more stringent requirements shall apply.

1.3 DEFINITIONS

A. Exposed Concrete: Concrete surfaces that can be inside or outside of structures, regardless of whether concrete is above or below water, dry at all times, or can be seen when structure is drained.

1.4 SUBMITTALS

A. Shop Drawings:

1. Concrete curing methods; manufacturer’s data for curing compound.
2. Plan for cold weather concrete curing procedures.
3. Plan for hot weather concrete curing procedures.

B. Administrative:

1. Manufacturer’s application instructions for curing compound.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store in a suitable location and protect from weather, corrosion, vandalism or other damage. Do not store directly on ground surface.

PART 2 PRODUCTS

2.1 CURING COMPOUND

A. Water based, high solids content non-yellowing curing compound meeting the requirements of ASTM C 309 and ASTM C 1315.

B. Curing compound shall be the same color as the concrete.

2.2 IMPERVIOUS SHEET MATERIALS

A. Conform to the requirements of ASTM C 171, except that polyethylene sheet shall not be used.

2.3 BURLAP AND COTTON MAT

A. Conform to the requirements of AASHTO M 182.

2.4 WATER

A. Provide water that is clean and free from injurious amounts of fuel, oil, salt, etc.

PART 3 EXECUTION

3.1 GENERAL

A. Conform to ACI 301 and ACI 308.1, except as modified by these Specifications.

B. Maintain surface temperature of concrete above 40°F and below 90ºF for minimum of 7 days after placement is completed. Provide a high/low thermometer at the concrete surface to record temperature for the duration of the curing period.

C. Protect the concrete from rapid temperature changes for the curing period. Rapid temperature changes are more than 5 ºF in one hour.

D. Do not locally heat or dry concrete when using heating units to meet Specification requirements.

E. Provide shading, fog spraying, sprinkling, wet cover, or other means of maintaining concrete below the maximum specified temperatures.

3.2 CURING CONCRETE

A. Cure concrete in walls using one of the following methods:

1. Option 1 – Leave form work in place and keep forms and exposed concrete surfaces wet constantly for 7 days.
2. Option 2 – Remove forms and apply curing compound. Do not apply curing compound to surfaces of construction joints.
3. Option 3 – Remove forms and keep concrete surfaces wet constantly for 7 days.

B. Cure concrete in slabs using one of the following methods:

1. Option 1 – Maintain ponded water on exposed surface for 7 days.
2. Option 2 – Cover exposed surface with wet burlap. Keep burlap wet constantly for 7 days. Remove and dispose of burlap after curing is completed.
3. Option 3 – Apply curing compound to exposed surface. Do not apply curing compound to surfaces of construction joints. Do not use curing compound when temperatures are below 50 degrees Fahrenheit within 24 hours.

C. Apply curing compound in accordance with manufacturer's instructions.

3.3 PROTECTING CONCRETE

A. Protect concrete from premature drying, excessively hot or cold temperatures, rain, and mechanical damage.

B. Do not allow construction vehicles or equipment on concrete until it has attained its specified design strength.

END OF SECTION

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SECTION 03 62 00
NON-SHRINK GROUT

PART 1 GENERAL

1.1 WORK INCLUDES

A. The following grout types:

1. Cement based non-shrink grout (Type 1)
2. Non-shrink epoxy grout (Type 2)
3. Epoxy anchor grout (Type 3)
4. Cement-bentonite non-shrink grout (Type 4)

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. C 109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in or 50 mm Cube Specimens)
b. C 531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
c. C 579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
d. C 827 – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
e. C 881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
f. C 882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear
g. C 939 – Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
h. C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non shrink)
i. C 1181 – Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
j. D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
k. D 1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product data of all grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
3. Forming method for fluid grout placements.
4. Curing method for all grouts.

B. Administrative:

1. Manufacturer’s instructions.
2. Statement of Qualifications for grout manufacturer.

C. Quality Control:

1. Manufacturer's Written Instructions:

a. Cement-water ratio of grout topping.
b. Mixing of grout.

2. Manufacturer's Certificate of Compliance:

a. Grout free from chlorides and other corrosion-causing chemicals.
b. Non-shrink grout properties of Type 2 and 3, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and non-shrink properties are not based on gas or gypsum expansion.
c. Statements of Qualification: Non-shrink grout manufacturer's representative.

1.4 QUALIFICATIONS

A. Non-shrink grout manufacturer shall have a minimum of 1 year experience in installation of similar grouting or grout placement.

PART 2 PRODUCTS

2.1 CEMENT

A. Cement for grout shall conform to the requirements of Section 03 30 50: BASIC CONCRETE MATERIALS.

2.2 CEMENT BASED NON-SHRINK GROUT (TYPE 1)

A. Type 1 non-shrink grout shall have a minimum 28-day compressive strength of 7,000 psi, when mixed at a fluid consistency.

B. Type 1 non-shrink grout shall meet the requirements of ASTM C 1107, Grade C, when tested using the amount of water needed to achieve the following properties:

1. Fluid consistency (20 to 30 seconds) in accordance with ASTM C 939.
2. At temperatures of 45, 70, and 90ºF.
3. The grout when tested shall not bleed or segregate at maximum allowed water.

C. Provide certification that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas production or gypsum expansion.

D. Fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.

E. Grout shall be pre-tested to meet the specified grout test requirements.

F. Type 1 non-shrink grout shall be Masterflow 928 by Master Builders; or ENGINEER-accepted comparable product.

2.3 NON-SHRINK EPOXY GROUT (TYPE 2)

A. Type 2 grout shall be a flowable, non-shrink, 100 percent solids system. Type 2 grout shall have three components: resin, hardener, and specially blended aggregate, all pre-

measured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the Manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

B. Provide certification that the vertical volume change at all times before hardening shall be between 0.004 percent shrinkage and 4.0 percent expansion when measured according to ASTM C 827 (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).

C. Provide certification that the length change after hardening shall be negligible (less than 0.0006 in/in) and the coefficient of thermal expansion shall be less than 0.00003 in/in ºF when tested according to ASTM C 531.

D. The compressive creep at one year shall be negligible (less than .001 in/in) when tested under a 400 psi constant load at 140ºF according to ASTM C 1181.

E. The 7-day compressive strength shall be minimum 15,000 psi when tested according to ASTM C 579, modified to 1-1/2-inch square cubes.

F. The grout shall be capable of maintaining a flowable consistency for a minimum of 30 minutes at 70ºF.

G. The shear bond strength to Portland cement concrete shall be greater than the shear strength of the concrete when tested according to ASTM C 882.

H. Do not reduce aggregate loading or add solvents to increase flowability.

I. Type 2 grout shall be Five Star Epoxy Grout by Five Star Products, Inc.; MasterFlow 648 by BASF; or ENGINEER-accepted comparable product.

2.4 EPOXY ANCHOR GROUT (TYPE 3)

A. Type 3 grout shall conform to ASTM C 881, Type IV, Class B and C, Grade 3.

B. Manufacturer shall certify that the epoxy grout will maintain 90 percent of the required strength up to a temperature of 140ºF.

C. Type 3 grout shall come in two-chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

D. Type 3 grout shall be capable of being used in submersed applications.

E. If average working temperature will be over 100ºF, use cement based non-shrink grout.

F. Epoxy grout shall be HIT-RE 500-V3 by Hilti, or accepted equal.

2.5 CEMENT-BENTONITE NON-SHRINK GROUT (TYPE 4)

A. Type 4 grout shall be a mixture of cement, pulverized bentonite, and water. The cement-bentonite mixture shall contain 10 gallons of water and between 4 to 6 pounds of bentonite for each 94-pound sack of cement. The cement and water shall be mixed first. Then:

1. For Type 4 grout that is to be pumped into a borehole, add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being pumpable.

2. For Type 4 grout that will be placed as backfill, add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being placeable.
3. The amount of bentonite added will vary depending on the application and desired mixture consistency.

2.6 BENTONITE

A. Bentonite products shall be as manufactured by American Colloid Co., Arlington Heights, IL. Bentonite shall have the following characteristics:

1. Minimum purity of 90 percent montmorillonite clay.
2. Moisture content no more than 10 percent as packaged.
3. Ground to pass a No. 200 sieve.
4. Meet criteria defined by the American Petroleum Institute (API) Specification 13.

PART 3 EXECUTION

3.1 GENERAL

A. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized by ENGINEER.

B. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of saturation period excess water shall be removed. Concrete substrate shall not be wet prior to placement of grouts.

C. Except for cement-bentonite grout all surfaces that will be in contact with grout shall be free of grease, oil, dirt, loose rust, curing compounds, laitance, loose concrete, and other deleterious materials.

3.2 GROUTING PROCEDURES

A. General:

1. All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Base Plate Grouting:

1. Provide a 1-inch-thickness of grout, 1/2-inch plus tolerance, except as shown on the Drawings.
2. After the base plate has been set in position, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink grout. The mixture shall be of a trowelable consistency and tamped or rodded into the space between the plate and the base concrete.

C. Epoxy Anchor Grout:

1. Grout shall be proportioned and mixed with automatic equipment.
2. Unless otherwise indicated by the manufacturer, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar, but shall not be less than 8 diameters for threaded rod, or 12 diameters for reinforcing or smooth bars.

D. Topping Grout and Concrete Fill:

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. To ensure bonding to the base slab, the base slab shall be given an exposed finish.
2. The minimum thickness of grout topping and concrete fill shall be 1 inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface, it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry, prior to placing topping and fill.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots, which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.

E. Cement Based Non-Shrink Grout used for anchor bolts:

1. When the bolt diameter is 1 inch or less, the hole diameter should be a minimum of 2 inches. When the bolt's diameter is greater than 1 inch, the hole diameter should be at least twice the bolt diameter.
2. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

3.3 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

3.4 CURING

A. Grout should be cured according to the manufacturer's recommendations.

B. Temperature of the foundation plate, supporting concrete foundation, and the grout should be maintained between 40ºF and 90ºF during grouting, and for a minimum of 24 hours afterward. Machinery and baseplates will cool at low temperatures or heat up at hot temperatures or in the sun more rapidly than the grout and should be avoided during the curing period.

C. Cement based grout should be protected from extreme drying conditions by covering all exposed grout surfaces with continually wetted burlap for a minimum of 3 days. Immediately after the moist curing period, two coats of a curing compound shall be applied.

END OF SECTION

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SECTION 31 01 01
SITE RESTORATION AND CLEANUP

PART 1 GENERAL

1.1 WORK INCLUDES

A. Protecting existing facilities and vegetation.

B. Restoration of disturbed areas.

C. Construction and debris removal, road clean-up during construction, dust prevention, and cleanup.

PART 2 PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be as defined in Section 31 23 23: FILL.

B. Topsoil shall not contain toxic materials harmful to grass growth.

PART 3 EXECUTION

3.1 GENERAL

A. Reclaim areas where construction work has been completed as soon as possible after completion of the Work.

B. Grade all areas to drain. The maximum slope steepness shall be 3H:1V unless otherwise shown on the Drawings or approved in writing by ENGINEER.

C. Remove all CONTRACTOR's equipment, debris, temporary fences or gates, and all other CONTRACTOR's properties in accordance with Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

D. Eliminate uneven areas and low spots. Remove debris, roots, branches and stones in excess of 3-inch size.

E. Scarify subgrade soil to a depth of 4 inches where topsoil is required or other areas to receive seed that have been disturbed by equipment used for hauling and has compacted the subgrade soil.

F. Upon completion and approval of the rough grading, place topsoil over all areas disturbed during construction that are above normal pool elevation, except those areas which will be covered with slope protection or aggregate surfacing.

3.2 PROTECTION

A. Protect areas outside the approved limits of site disturbance from damage.

B. Reclaim any disturbance of vegetation or native ground outside of the limits of site disturbance.

C. Pay the cost of any fines incurred by OWNER due to Work being performed by CONTRACTOR outside the limits of site disturbance.

3.3 SITE RESTORATION

A. At all times during the work, keep construction areas clean and orderly.

B. Stockpile excavated materials in a manner that will cause the least damage to adjacent areas.

C. Final grade all areas to drain or as directed by the ENGINEER or OWNER.

D. Restore landscaped or grassed areas that are damaged by construction activities to a condition equal to, or better than, that immediately prior to construction. Care for restored areas until growth is established.

3.4 PLACING TOPSOIL

A. Place a minimum of 6 inches of topsoil, or as required by ENGINEER.

B. Do not place topsoil in a frozen or muddy condition.

C. Compact topsoil by making at least four coverages with a CAT D6 bulldozer or larger. Track perpendicular to slope.

D. Grade final surface of the topsoil to a relatively smooth surface using mechanical or hand raked methods. There shall not be any localized low spots that will allow water to accumulate.

3.5 SEEDING

A. Seed reclaimed areas in accordance with Section 32 92 00: TURF AND GRASSES.

3.6 ROAD CLEAN-UP DURING CONSTRUCTION

A. Thoroughly clean all spilled dirt, gravel, or other foreign material caused by the construction operations at the conclusion of each day’s operation.

3.7 DUST PREVENTION

A. Give all unpaved streets, roads, detours, or haul roads used in the construction area a dust-preventive treatment approved by OWNER or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly followed.

3.8 CLEANUP

A. Upon completion of Work, repair all damage caused by equipment and leave the project site free of debris or excess material of any sort.

B. Maintain the site, material stockpiles, and other like areas in a reasonable state of order and cleanliness.

C. If the CONTRACTOR fails to perform cleanup, it may be performed by OWNER at the expense of the CONTRACTOR.

END OF SECTION

SECTION 31 05 19
GEOSYNTHETICS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Geotextile below grouted riprap.

B. Geocell for boat ramp.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. D 1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique
b. D 1603 – Standard Test Method for Carbon Black Content in Olefin Plastics
c. D 1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
d. D 4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
e. D 4491 – Standard Test Method for Water Permeability of Geotextiles by Permitivity
f. D 4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles
g. D 4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
h. D 4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
i. D 5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
j. D 5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles
k. D 6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
l. D 7747 – Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Finish Methods for Reinforced Geomembranes

1.3 DEFINITIONS

A. Geocell – A honeycomb-shaped structure consisting of strips of HDPE welded together to form individual cells.

B. Geosynthetic Manufacturer(s) – The parties responsible for manufacturing geosynthetic products.

C. Geotextile – A permeable, woven or non-woven fabric comprised solely of synthetic fibers.

D. Installer – The party responsible for field handling, transporting, storing, deploying, seaming, and seam testing the geosynthetic.

E. Lot – A unit of production, or a group of other units or packages, taken for sampling or statistical examination, having one or more common properties and being readily separable

form other similar units. Finished roll will be identified by a roll number traceable to the resin lot used.

F. Minimum or Maximum Average Roll Value (MARV) – The mean minus two standard deviations of a particular physical property of a material; provides 97.7 percent confidence that the property in question will meet the published value.

G. Overlap – The width of geosynthetic in contact with the adjacent geosynthetic panel. The distance is measured perpendicular from overlying edge of one geosynthetic panel to the underlying edge of the adjacent panel.

H. Panel – The unit area of geosynthetic that will be seamed in the field. A panel is identified as a roll or portion of a roll that is equal to or larger than 100 square feet.

I. Patch – Unit area of a geosynthetic that will be seamed in the field that is less than 100 square feet.

J. Prepared Surface – The soil or bedrock layer surface that immediately underlies a geosynthetic material.

K. Seam – The connection of two or more pieces of material by mechanical or fusion methods that provides the integrity of a single piece of material.

1.4 SUBMITTALS

A. Samples:

1. One square yard of each proposed geosynthetic material.

B. Administrative:

1. Manufacturer Qualifications.
2. Manufacturer’s literature including recommendations for storage and installation.

C. Quality Control:

1. Manufacturer’s certified test reports and certificates of compliance demonstrating that both the raw materials used in the manufacture of the geosynthetic materials and the final products conform to the requirements specified.

PART 2 PRODUCTS

2.1 GEOTEXTILE

A. Geosynthetics shall consist of new products designed and manufactured specifically for the purpose of this Work.

B. Geotextile materials shall consist of long-chain polymeric fibers composed of polypropylene, polyester, or polyethylene that are needle punched to form a non-woven stable network such that the fibers remain in their relative position.

C. Geotextiles shall be free from defects or tears, and shall be mildew, insect, and rodent resistant, inert to chemicals commonly found in soil, and resistant to UV light exposure. They shall also be free from any treatment or coating that might adversely alter the hydraulic or physical properties of the material after installation.

D. Geotextiles delivered to the site shall be clearly labeled with pertinent quality assurance information including roll number, batch number, type, and date of manufacture.

E. The geosynthetic shall conform to the requirements in Table 1.

TABLE 1

Property	ASTM Standard	Value[1]
Mass/Unit Area (oz/yd^2)	D 5261	10[2]
Thickness (mils)	D 5199	100[2]
Grab Tensile Strength (lbs)	D 4632	
Machine Direction		250
Cross Direction		250
Elongation (%)	D 4632	50
Trapezoidal Tear Strength (lbs)	D 4533	
Machine Direction		100
Cross Direction		100
Static (CBR) Puncture Strength (lbs)	D 6241	450
UV Resistance after 500 hrs. (% strength)	D 4355	70[2]
Apparent Opening Size (AOS) – Max. (U.S. Sieve)	D 4751	100
Flow Rate (gpm/sf)	D 4491	70[2]

Notes:
1. Minimum average roll value unless otherwise indicated.
2. Smaller values may be accepted by ENGINEER.

F. Manufacturers:

1. TenCate Mirafi – Mirafi 1100 N. TenCate Geosynthetics North America, 385 South Holland Drive, Pendergrass, GA 30567.
2. US Fabrics – US 250NW. US Fabrics, Inc., 3904 Virginia Avenue, Cincinnati, OH 45227.
3. Or accepted equal.

2.2 GEOCELL

A. Geocell shall consist of new products designed and manufactured specifically for the purpose of this Work.

B. Geocell shall have a minimum depth of 6 inches.

C. Materials:

Material Properties	Test Method	Unit	Value
Material	ASTM D1505	g/cm3	High Density Polyethylene with density >0.94
Carbon Black Content	ASTM D1603	% wt.	1.5% minimum
Environmental Crack Resistance	ASTM D1693	Hours	6,000
Seam Peal Strength	ASTM D7747	lbf	480

D. Model and manufacturers:

1. Envirogrid, Contech Engineered Solutions, West Chester, OH.
2. GD Geocell, CORE Driveway, Comex, BC, Canada.
3. Accepted equal.

PART 3 EXECUTION

3.1 GEOTEXTILE

A. Delivery, Storage, and Handling:

1. Store and handle geosynthetics per manufacturer's recommendations. Cover geosynthetics with tarps or opaque plastic and shield geosynthetics from prolonged exposure to direct sunlight. Secure geosynthetics with sand bags or straps as necessary to prevent wind damage. Protect geosynthetics from petroleum-based solvents such as gasoline and diesel fuel.
2. Verify quality assurance data displayed on the labels of materials. Label data must indicate compliance with submitted quality assurance documentation at time of material delivery.

B. Geosynthetic Installation:

1. Install per manufacturer's recommendations, except where the requirements of these Specifications are more stringent.
2. Place geosynthetics only on prepared surfaces that are generally free of ruts, large rocks, debris or vegetation, or other deleterious items that may damage the geosynthetic.
3. Lay and maintain geosynthetic smooth and free of tension, folds, wrinkles or creases.

C. Joints:

1. Unseamed Joints:

a. Overlapped.
b. Overlap, minimum 18 inches.

D. Placing Riprap over Geosynthetics:

1. General:

a. Place riprap over geosynthetics in accordance with the requirements of Section 31 37 00: RIPRAP.
b. Place riprap over geosynthetics so that geosynthetic is not damaged.
c. Place riprap by back dumping and spreading only.
d. Do not operate heavy equipment or machinery directly on installed geosynthetics or on riprap placed over geosynthetics.
e. Do not push riprap over geosynthetics.

2. Geosynthetic Damage:

a. Mark punctures, tears, or other damage to geosynthetics so repairs may be made.
b. Clear overlying fill as necessary to repair damage.

E. Repair:

1. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geosynthetic.
2. Repair Procedure:

a. Place patch of undamaged material over damaged area and at least 18 inches in all directions beyond damaged area.
b. Remove interfering material as necessary to expose damaged area for repair.
c. Sew patches or secure them by other means accepted by ENGINEER.

F. Compaction around geosynthetics:

1. Do not operate heavy vehicles or machinery directly on installed geosynthetics. Prevent tracked equipment from turning within 12 inches of buried geosynthetics.
2. Use small compaction equipment and hand tools as necessary to avoid damage to geosynthetics. The minimum required cover depth for heavy equipment to operate above or near geosynthetics is 12 inches.

3.2 GEOCELL

A. Delivery, Storage, and Handling:

1. Store and handle geocell in accordance with manufacturer's recommendations. Protect geocell from petroleum-based solvents such as gasoline and diesel fuel.

B. Installation:

1. Prepare subgrade in accordance with Section 31 23 13: SUBGRADE PREPARATION.
2. Install geocell in accordance with manufacturer's recommendations including recommendations for anchoring geocell to prepared subgrade and fastening adjacent geocell panels.
3. Infill geocell with boat ramp gravel in accordance with Section 31 23 23: FILL.
4. Place infill material to approximately 1-inch above the top of the geocell.
5. Compact infill materials using hand-operated or walk behind equipment. Do not operate heavy equipment on geocell.
6. When compaction is complete, the infill should be level with or slightly above the top of the geocell.

END OF SECTION

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SECTION 31 11 00
SITE PREPARATION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Site clearing, grubbing, and stripping of topsoil from construction and staging areas prior to excavation or placement of overlying fill, drain material, or riprap bedding.

B. Dispose of all cleared and grubbed material in accordance with the requirements of Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

C. Salvaging and stockpiling topsoil from stripping for use in site reclamation.

1.2 SUBMITTALS

A. Shop Drawings:

1. Drawings showing the sequence and limits of site clearing and grubbing.

1.3 SCHEDULE AND SEQUENCE

A. Begin site clearing and grubbing only after erosion and sediment control provisions are in place.

1.4 QUALITY ASSURANCE

A. Obtain OWNER'S approval of stocked clearing, grubbing, and stripping prior to commencing clearing, grubbing, and stripping.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that existing plant life and features designated to remain or to be protected are tagged or identified.

B. Provide sediment and erosion control measures according to Section 31 25 00: EROSION AND SEDIMENTATION CONTROLS, prior to any clearing and grubbing operations.

3.2 PROTECTION

A. Protect any trees, plant growth, and features not requiring removal for the Work.

B. Protect benchmarks and survey monuments from damage or displacement. Repair or replace all benchmarks and survey monuments damaged during clearing and grubbing.

C. The limits of site disturbance to install measures such as silt fences and diversions shall be held to a minimum and be in accordance with the accepted submittal.

D. The limits of site disturbance shall be no more than 10 feet outside of required work areas except as approved by OWNER.

3.3 CLEARING

A. Clearing shall mean removing, hauling, and disposing of all trees, shrubs, grasses, weeds, debris, trash, rubble, downed timer, branches and other materials on the surface within the limits of earthfill and slope protection.

B. Cut off vegetation to within 2 inches of ground surface.

3.4 GRUBBING

A. Grubbing shall mean the removal of stumps, main root balls, and root systems so that no vegetative matter remains in the area below excavation, earthfill, riprap or grouted riprap, riprap bedding, and drain material within the limits of earthfill and slope protection. Trees within limits of spillway channel shall be cut to limit of excavation, root balls do not need to be removed in this area.

3.5 STRIPPING

A. Do not remove topsoil until after clearing and grubbing.

B. Selectively strip areas where topsoil is present to a minimum depth of 6 inches or to top of subsoil, whichever is less. Do not remove subsoil with topsoil.

C. Stockpile strippings meeting requirements of Section 31 23 23: FILL, for topsoil, separately from other excavated materials. Stockpile topsoil at a location where it does not interfere with other items of the work.

3.6 DISPOSAL

A. Dispose of all brush, tree trunks, stumps, roots, and debris from clearing operations as required by Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

3.7 MAINTENANCE OF CLEARED AREAS

A. Maintain cleared work areas in a condition free from additional vegetation growth for the duration of the project. Use of herbicides to discourage plant growth shall not be allowed. CONTRACTOR shall be compensated for clearing each work area only once.

END OF SECTION

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Preparing the finished excavated surface for placement of overlying fill, drain material, or riprap bedding.

B. Protection of subgrade until foundation preparation is completed and placement of overlying fill, backfill, drain material, or riprap bedding begins.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
b. D 2216 – Standard Test Method for Laboratory Determination of Water Content of Soil and Rock by Mass.
c. D 2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
d. D 4643 – Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.
e. D 6938 – Standard Test Method for In-Place Density and Water Content of Soil an d Soil-Aggregate by Nuclear Methods.

1.3 DEFINITIONS

A. Prepared Foundation: Subgrade surface after completion of foundation preparation activities as specified prior to placement of overlying fill, backfill, drain material, riprap bedding, or structure.

B. Subgrade: Ground surface after completion of required clearing, grubbing, stripping, and excavation prior to placement of fill or structure.

C. Temporary Cover: Native material left in place over final foundation subgrade to protect subgrade from damage by wetting, drying, freezing, erosion, and physical disturbance by construction equipment traffic and personnel until the time of final foundation excavation and preparation.

1.4 QUALITY ASSURANCE

A. ENGINEER or OWNER will conduct visual observation of the excavated foundation surface before placement of fill, drain material, or riprap bedding. Provide 24 hours' notice to OWNER when final foundation excavation is to be performed for a particular area so that OWNER can make arrangements for visual observation.

B. Notify OWNER when excavation has reached the designated subgrade elevation.

C. Notify OWNER when soft, loose, or wet subgrade zones are detected.

1.5 SEQUENCING AND SCHEDULING

A. Perform foundation preparation only when subgrade is unfrozen, and free of ice, snow, and surface water. Perform foundation preparation only during daylight hours.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Shape excavation to produce as uniform and regular profile as possible, with no abrupt changes in slope, sharp projections, steps, overhangs, or benches except as shown on the Drawings or as approved by ENGINEER.

B. Preserve the foundation below and beyond the lines of excavation in the soundest possible condition. Repair any damage from CONTRACTOR's operations as directed by ENGINEER.

C. Keep subgrade free of ponded water and deleterious materials during foundation preparation. Prepare foundation when unfrozen and free of snow and ice.

D. Do not use sections of prepared foundation as haul roads. Protect prepared foundation from traffic.

E. Maintain prepared foundation in finished condition until overlying fill, or drain mateiral is placed.

3.2 PREPARED FOUNDATIONS ON SOIL

A. Temporary Cover Requirements: none

B. Subgrade Compaction: Scarify, moisture condition, and compact top 8 inches of subgrade as specified:

1. Compaction: Not less than 95 percent relative compaction (ASTM D 698).
2. Compaction Moisture: Between 2 percent below and 2 percent above optimum water content (ASTM D 698).

C. Correction for Soft or Loose Subgrade: Where subgrade cannot be compacted as specified, or in areas identified by ENGINEER that display yielding or excessive rutting during construction activities, adjust moisture content and recompact, or overexcavate as specified in Section 31 23 16: EXCAVATION, and replace overexcavated material as specified in Section 31 23 23: FILL.

D. Scarification and compaction of excavation slopes steeper than 2H:1V will not be required. Remove exposed soil that is desiccated, frozen, soft, wet, or otherwise disturbed, to the satisfaction of ENGINEER prior to placing overlying or adjacent fill, backfill or concrete.

3.3 QUALITY CONTROL

A. CONTRACTOR shall retain a qualified testing laboratory with experience performing tests for heavy civil projects to perform quality control tests prior to fill and backfill placement. Test frequencies specified are minimums. Additional testing may be required where minimum frequencies are unrepresentative for variable materials or inconsistent construction operations, and to retest previously failed materials after corrective actions have been implemented or as requested by the ENGINEER.

B. CONTACTOR shall perform tests at the locations, depths, and times requested by OWNER or ENGINEER.

C. Field Quality Assurance Tests

1. Prior to fill and backfill placement, tests are required during construction at the specified frequency and whenever material variation occurs such that existing information is not representative.

2. CONTRACTOR will perform In-Place Density and Moisture Content:

a. Prior to fill and backfill placement, in-place density testing on subgrade using one, or a combination of the following methods: ASTM D 6938, D 2937, and D 2216 for each type of material placed each day, and one test shall be made for every 3000 SY of prepared subgrade.
b. The maximum dry density and optimum water content at the location of the in-place density test shall be evaluated using the one-point compaction test and full-curve compaction tests (family of curves) of representative subgrade materials. Determine the maximum dry density and optimum water content in accordance with the Maximum Density and Optimum Water Content Calculation section and the Appendix section of AASHTO T272.
c. Retests of failed areas after corrective measures have been implemented are required; retests will reference the prior failing test number.

3. Correlations:

a. In-place density and moisture content measurements determined in accordance with ASTM D 2937 (drive-cylinder density) and D 2216 (oven-dried moisture) will be correlated with similar measurements made in accordance with ASTM D 6938 (nuclear density and moisture) for same material type.
b. Where moisture content determinations are made in accordance with ASTM D 2216 (oven-dried) and D 4643 (microwave dried), ENGINEER will develop correlation between oven-dried and microwave-dried moisture contents for the same material type.
c. Correlations and applicable nuclear gage and microwave correction factors will be developed to evaluate subgrade preparation.

END OF SECTION

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SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Required excavation to place earthfill, grouted riprap, riprap, riprap bedding, and drain material.

B. Disposal of excess excavation at bottom of reservoir as authorized by OWNER.

1.2 DEFINITIONS

A. Borrow Areas

1. Required excavations for riprap, riprap bedding, and drain material or identified locations in the reservoir bottom that are sources of material for fill and backfill.

B. Prewetting: Moisture conditioning borrow materials in advance of excavation by a coordinated sequence of 1) ripping, grinding, or scarification to facilitate moisture penetration, 2) spray irrigation for efficient application of water, 3) curing time between water applications to allow uniform wetting, and 4) disking. The sequence is repeated as necessary prior to and during excavation to achieve uniform moisture conditions throughout the layer of prewet materials.

C. Drying: The process of reducing the water content of earth materials through gravity or vacuum drainage, natural evaporation, heating, or mechanical processing to hasten evaporation, to the extent necessary for proper handling and to meet the intended use of such earth materials. The term does not imply a specific numeric reduction in water content, or a specific numeric final water content after drying.

D. Unclassified Excavation: All materials to be encountered in excavations, including soil and rock, regardless of hardness or moisture content.

E. Unsuitable Foundation Soils: Soils that display yielding, excessive rutting, excessive water content, or have desiccated and are determined by ENGINEER or OWNER to be unsuitable for support of overlying earthfill, riprap bedding, or drain material.

1.3 SUBMITTALS

A. Administrative:

1. Copy of excavation permit(s) as required by law.
2. Excavation Plan – the plan shall include:

a. Methods and sequencing of excavation in various areas.
b. Anticipated difficulties and proposed regulations.
c. Proposed locations of stockpile materials.

1.4 QUALITY CONTROL

A. Provide adequate survey control to avoid unauthorized overexcavation.

1.5 EXCAVATION SAFETY

A. CONTRACTOR is solely responsible for making all excavations in a safe manner.

B. Stability of all temporary slopes identified on the Drawings is solely CONTRACTOR's responsibility. Shore, sheet, brace, or slope temporary slopes to conform to all applicable regulations.

C. Install and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of the excavation, to keep and prevent any movement that may damage adjacent structures or foundation, damage or delay the Work, or endanger life and health. Install and maintain shoring, sheeting, bracing, and sloping as required by OSHA and other applicable governmental regulations or agencies.

1.6 BLASTING

A. No blasting will be allowed.

1.7 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32ºF shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently or is appropriately moisture conditioned for proper compaction.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Pothole to locale existing soil bentonite barrier wall within limits of spillway before excavating within 25 feet of barrier wall. Pothole at a minimum of 10-foot spacing.

B. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

C. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot except where dimensions or grades are shown or specified as maximum or minimum. Allow for working space, topsoil, riprap, riprap bedding and drain material, and similar items, wherever applicable.

D. Do not excavate to beyond the lines and grades shown without written authorization of ENGINEER or OWNER.

E. Excavation shall be performed in the dry.

F. Selectively excavate, handle, haul, stockpile and process borrow materials as necessary to yield suitable types and sufficient quantities of the various fill and backfill materials required for construction of the Work.

3.2 MOISTURE CONDITIONING OF BORROW MATERIAL

A. Moisture condition excavated materials at the point of excavation where possible when removed materials will be subsequently placed as fill and backfill.

B. When practicable and where needed, pre-wet materials in advance of excavation. Sequence and coordinate pre-wetting with excavation from various borrow areas to produce borrow materials with uniform and consistent moisture conditions.

3.3 FINAL EXCAVATION FOR SUBGRADE

A. Take all necessary precautions to preserve the material below and beyond the established lines of all excavation in the soundest possible condition. Repair any damage to foundation material beyond the required excavation lines due to frost, wetting, drying, erosion, physical disturbance, ineffective dewatering, or CONTRACTOR's operations.

3.4 PERMANENT EXCAVATION SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross sections shown, with proper allowance for topsoil or riprap, riprap bedding, and drain material, where shown.

B. Remove stones and rock that exceed 6-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

3.5 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Confine stockpiles to within approved work areas.

C. Do not stockpile excavated material adjacent to trenches and other excavations unless excavation sideslopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

D. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce settlement.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATION

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, in bottom of reservoir or as directed by ENGINEER or OWNER.

B. Moisture content of excavated materials alone shall not be reason for wasting material. Moisten or dry material to the specified moisture content and use in permanent construction.

C. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk.

3.7 OVEREXCAVATION OF UNSUITABLE FOUNDATION SOILS

A. Unsuitable foundation materials shall be removed. Excavate down to the top of suitable foundation material as determined by ENGINEER. Backfill the excavated area using materials and placement procedures for the materials that are to be placed above the excavated area. Do not excavate below the limits shown on the Drawings without authorization from ENGINEER.

END OF SECTION

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SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.1 WORK INCLUDES

A. Design dewatering systems for the control, collection, and disposal of groundwater or surface water for the proper construction of all Work.

B. Install and maintain pumps, piping, drains, well points, wells, and other facilities for the control, collection, and disposal of groundwater for the proper construction of all Work.

C. Maintain prepared foundations and all other parts of the Work free from seepage or standing water as required for constructing each part of the Work.

D. Comply with all applicable environmental protection laws and requirements in operation of the dewatering system and disposal of collected water.

E. Remove all components of the dewatering systems when no longer required.

F. OWNER will lower the reservoir to at least El. 4953.0 (NAVD88). OWNER will maintain the reservoir at El. 4953.0 (NAVD88) for the remainder of construction except during and after precipitation events.

1.2 SUBMITTALS

A. Administrative:

1. Dewatering Plan: Submit a Dewatering Plan at least 14 days prior to the start of excavation. The plan shall include, at a minimum, the following:

a. Drawings and narrative that provides details regarding the anticipated types, sizes, capacities, and locations of various dewatering facilities to substantiate the designs and selected facilities.
b. Drawings and narrative that describes all items of Work including such items as supplemental drainage channels, sedimentation pond (if required), and silt barriers.
c. Expected discharge volumes from each isolated system and points of discharge.
d. Methods to control water prior to and during excavation subgrade preparation, fill placement, concrete placement, and back filling.
e. Methods and procedures to fill openings and voids left by removal of the dewatering system.

2. Discharge permits.

B. Revised plan if system is modified.

C. Quality Control Submittals:

1. Discharge permits.

D. Acceptance by ENGINEEER of the dewatering systems proposed by CONTRACTOR will only be with respect to the basic principles CONTRACTOR intends to employ. Acceptance by ENGINEER does not relieve CONTRACTOR of the full responsibility for the adequacy of the dewatering systems.

PART 2 PRODUCTS

2.1 DEWATERING SYSTEM

A. Dewatering system may consist of single- or multiple-stage wellpoints, deep wells, or collection sumps and trenches, used for dewatering that fulfill the dewatering requirements specified in this Section.

PART 3 EXECUTION

3.1 GENERAL

A. Review available topographic, subsurface, and hydrogeologic data for the project site.

B. At all times during construction, provide ample means and devices to remove promptly and dispose of properly all water entering excavations and keep the bottoms of the excavations firm and free of standing water until the structures to be built therein are completed and/or the backfill to be placed therein has been placed.

C. Perform dewatering operations so that no disturbance to the bearing soil or rock, or to soil or rock supporting any other work will result.

D. Discharge water so that it shall not cause siltation, erosion, or other negative environmental impacts.

3.2 DEWATERING

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in the dry.

B. Continuously maintain excavation free of water, regardless of source, until backfilled to final grade.

C. Design and operate dewatering systems:

1. To maintain the level of groundwater at least 2 feet below the bottom of all excavations.
2. To prevent loss of ground as water is removed.
3. To avoid inducing settlement or damage to existing facilities

3.3 INSTALLATION AND OPERATION

A. Locate every element of dewatering systems to avoid interference with excavation and construction activities.

B. When the dewatering system does not meet the specified requirements, and as a consequence loosening or disturbance of the foundations strata, instability of the slopes, or damage to the foundations occur, restore foundation, fill soil, or slopes to the satisfaction of ENGINEER.

3.4 DISPOSAL OF WATER

A. Discharge shall conform to Colorado Department of Public Health and Environment (CDPHE) criteria.

B. Treat water collected by dewatering or surface water control operations to prevent contamination of receiving waters.

C. Discharge water in a manner that will not cause erosion, flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

D. Clear water may be discharged into Cell No. 1.

E. Water dewatered from outside of the barrier wall shall be discharged to the South Platte River in accordance with CDPHE Construction Dewatering Permit.

3.5 REMOVAL

A. Obtain written acceptance from OWNER or ENGINEER before discontinuing the operation of any portion of the dewatering system.

B. All elements of the dewatering systems shall be removed from the site at the completion of the dewatering work.

C. Fill all voids left as a result of the dewatering system. Use earthfill or Class D Concrete.

END OF SECTION

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SECTION 31 23 23
FILL

PART 1 GENERAL

1.1 WORK INCLUDES

A. Low-permeable fill for barrier wall cap.

B. Fill required to construct spillway and slope protection.

C. Miscellaneous fill or backfill not specifically covered in other sections.

D. Does not include special earth materials covered in other Specification sections, including Section 31 37 00: RIPRAP, and Section 32 11 23: AGGREGATE BASE COURSES.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. C 33, Standard Specification for Concrete Aggregates.
b. C 88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
c. C 117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
d. C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
e. C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
f. C 796, Standard Test Method for Foaming Agents for Use in producing Cellular Concrete Using Preformed Foam.
g. C 869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
h. D 75, Standard Practice for Sampling Aggregates.
i. D 422, Test Method for Particle-Size Analysis of Soils.
j. D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
k. D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
l. D 1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
m. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lbf/ft^3 (2,700 kN-m/m^3)).
n. D 2166, Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.
o. D 2216, Laboratory Determination of Water (Moisture) Content of Soil Rock, and Soil-Aggregate Mixtures.
p. D 2488, Practice for Description and Identification of Soils (Visual-Manual Procedure).
q. D 2937, Test method for Density of Soil in Place by the Drive-Cylinder Method.
r. D 3740, Minimum Requirements for the Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

s. D 4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils using a Vibratory Table.
t. D 4254, Standard Test methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
u. D 4318, Standard Test Method for Liquid Limit, Plastic Limit, Plasticity Index of Soils.
v. D 4832, Standard Test Method for preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
w. D 4959, Test Method for Determination of Water Content (Moisture) by Direct Heating Method.
x. D 5084, Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
y. D 6023, Standard Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM).
z. D 6103, Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM).
aa. D 6938, In-Place Density and Water Content of Soil and Soil-Aggregates In Place by Nuclear Methods (Shallow Depth).

2. American Association of State Highway and Transportation Officials (AASHTO):

a. T272, Standard Method of Test for Family of Curves-One Point Method, in the Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Part II Tests.

3. American Petroleum Institute (API):

a. Specification 13A – Drilling Fluid Materials.
b. P 13B-1: Recommended Practice for Fluid Testing Water-based Drilling Fluids.

4. Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction (CDOT Standard Specifications).
5. American National Standards Institute (ANSI): Z35.1, Safety Color Red.
6. American Public Works Association (APWA): Uniform Color Code for Temporary Marking of Underground Utility Locations.

1.3 DEFINITIONS

A. Backfill: Fill materials placed in trenches, over-excavated areas, and around and below structures, pipes, and other facilities.

B. Borrow Material: Material from required excavations.

C. Certified/Certification: Reviewed, approved, stamped, and signed by a Professional Engineer registered in the State of Colorado.

D. Completed Course: A course or layer that is ready for the next phase of Work.

E. Coverage: One coverage is defined as the requirement for successive trips of a piece of compaction equipment, which by means of sufficient overlap, will ensure contact on the entire surface of the layer by the equipment.

F. Deleterious Materials: Organic matter, trash, rubbish, debris, oversize materials, and soluble materials.

G. Fill: All materials used to raise existing grade.

H. Fines: Material passing the No. 200 sieve as determined in accordance with ASTM D 422.

I. Geosynthetics: Geotextiles, geogrids, or geomembranes.

J. Imported Material: Material obtained from sources off site.

K. Lift: Loose (uncompacted) layer of material.

L. Optimum Water Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field water content on basis of fraction passing 3/4-inch sieve.

M. Oversize Materials: Soil particles, soil clods, sedimentary fragments, rocks, and other materials having a maximum dimension in excess of the specified limits.

N. Particle Size: The size of a particle before compaction measured parallel to its longest dimension.

O. Period of Inactivity or Extended Shutdown: 4 days.

P. Prepared Foundation: Ground surface after completion of required clearing and grubbing, stripping of topsoil, excavation to grade, and foundation preparation.

Q. Processed Borrow: Borrow that is physically modified by CONTRACTOR to derive a material that is suitable for a specific use.

R. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D 698.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by ENGINEER.

S. Relative density:

1. Ratio, in percent, of the difference between the dry unit weight of a cohesionless soil in its loosest state and as-compacted state to the difference between the dry unit weight in the loosest and densest states and as defined by ASTM D 4254.

T. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack of one or more sizes.
2. Does not define numerical value that must be placed or coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.4 SUBMITTALS

A. Shop Drawings:

1. Backfill Plan to include:

a. Proposed procedures, methods, equipment, and sequence for placing backfill.
b. Protection for completed backfill during shutdowns and preparation methods prior to resuming placement after shutdowns.

c. Proposed utilization of various excavation material types as borrow for various backfill materials.
d. Order of constructing the various components of the work.
e. Narrative with figures to illustrate the plan.
f. Proposed material handling and processing methods for backfill.
g. Location of stockpile areas for various materials.

2. Catalog and manufacturer's data sheets for all equipment to be used to compact fill and backfill.

B. Quality Control Submittals:

1. Certified test results documenting conformance with all Specification requirements for:

a. Imported materials and bentonite.

C. Samples:

1. Imported materials taken at source.

1.5 CONTRACTOR QUALITY CONTROL

A. Perform water content, field density, gradation, and other tests during excavation, processing, and fill placement as needed to develop and manage operations and produce consistent fill and backfill meeting the Specifications.

B. Notify ENGINEER when any of the following occur:

1. Fill is about to be placed on prepared foundation, or fill operations are about to be resumed after a period of inactivity.
2. Structures are ready for backfilling or backfilling operations are about to resume after a period of inactivity.
3. Soft or loose surface is encountered where fill is to be placed.
4. Materials appear to be deviating from the Specifications.
5. Initial sampling of imported material is to be conducted or importing of a material to the site is about to begin.
6. Borrow excavation is about to be shifted from one area to another, or a change in borrow materials is encountered.

1.6 OWNER QUALITY ASSURANCE

A. OWNER may perform field quality control tests to measure density and water content of soil in place, laboratory full compaction and associated one-point compaction tests, and gradation or index tests to confirm that materials placed meet the requirements of these Specifications.

B. OWNER's tests may be performed on materials taken at the place of excavation, stockpiles, conveyors, and on the fill. CONTRACTOR shall remove surface material and provide assistance as necessary with sampling and testing.

C. CONTRACTOR shall pay for retesting due to failed tests. No additional placement shall occur until passing tests are achieved.

1.7 SEQUENCING AND SCHEDULING

A. Place backfill against concrete structures only after the concrete has attained compressive strength specified in Section 03 30 50: BASIC CONCRETE MATERIALS. Obtain ENGINEER's acceptance of concrete work and attained strength prior to placing backfill.

B. Place fill and backfill upon prepared foundation only after the prepared foundation has been accepted by OWNER.

PART 2 PRODUCTS

2.1 EARTHFILL

A. Excavated onsite materials derived from required excavations having a maximum particle size of 6 inches, at least 90 percent finer than 3 inches, at least 60 percent passing the No. 4 sieve, minimum 40 percent fines, a plasticity index less than 40, and free of deleterious materials.

B. Allowable Unified Soil Classifications System (USCS) classification of: CH, CL, SC-SM, SC, SM.

C. It is expected that earthfill will be derived from the required excavations.

D. Blend adequately during placement such that the compacted earthfill material forms a uniform, homogeneous, very stiff or dense, void-free compacted embankment fill.

E. Remove cobbles, boulders, hard bedrock fragments, or other particles larger than 6 inches.

2.2 LOW-PERMEABLE FILL

A. Low-Permeable Fill:

1. Soil from on-site excavations amended with bentonite.
2. Soil shall have a maximum particle size of 3 inches, between 40 and 70 percent fines, a plasticity index of less than 20, and be free of deleterious materials
3. Allowable Unified Soil Classification System (USCS) classification of SC or CL.
4. Add and thoroughly blend between 6 and 9 percent bentonite (dry weight of bentonite to dry weight of soil).
5. Bentonite shall consist of approximately 90 yield (90 barrels of bentonite per ton of bentonite) natural Wyoming sodium bentonite powder ground to pass a No. 200 sieve and conforming to the latest standards set forth for bentonite in API specification in 13A, Section 4 - Drilling Fluid Materials.
6. Blend and mix bentonite with fill material to prepare uniform and homogeneous material prior to placing low-permeable fill.
7. Blend continuously during placement such that the compacted low permeability fill material forms a uniform, homogeneous, stiff, void free, and relatively impervious compacted layer.

2.3 BOAT RAMP GRAVEL

A. Imported, hard, durable, natural crushed stone or crushed sand and gravel within the specified gradation limits and conforming to the requirements of ASTM C 33 for soundness and deleterious substances.

B. Gradation as determined by ASTM C 117 and ASTM C 136:

Sieve Size	Percent Passing by Weight
2-inch	100
1 1/2-inch	90 – 100
1-inch	20 - 55
3/4-inch	0 - 15
3/8	0 – 5

2.4 TOPSOIL

A. Obtain topsoil from site preparation and stripping that meets the following requirements:

1. A maximum particle size of 1 inch.

2. Sufficient organics to support vegetative growth.
3. Free from deleterious materials.

2.5 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

2.6 CONDITIONING EQUIPMENT

A. Provide water trucks or tankers and other supplemental equipment necessary to uniformly apply water in borrow areas and to loose lifts of material for proper compaction and for watering of completed courses until overlying courses are placed.

B. Watering equipment shall be equipped with pressurized distributor bars or other means necessary to assure uniform application of water.

C. Provide blades, discs, and other supplemental equipment necessary to process borrow materials, blend non-uniform fill and backfill materials, for aerating and drying out wet materials, and for scarification of completed courses.

2.7 COMPACTION EQUIPMENT

A. Provide dedicated compaction equipment of suitable type, capable of achieving the requirements of the Specifications, and which provide a satisfactory uniform, homogeneous fill.

B. Hauling or placement equipment shall not be considered compaction equipment.

C. Provide hand-operated equipment for use in confined areas not accessible to regular compaction equipment or where regular compaction equipment might damage structures. Compaction equipment shall be subject to the acceptance of ENGINEER.

D. Equipment used for compaction of earthfill material shall consist of a heavy-duty, self-propelled sheepsfoot or tamping foot roller capable of kneading material into a uniform embankment. The weight of each roller shall be at least 3,300 pounds per foot of drum length and the feet shall be at least 8 inches long measured from the drum surface. Rollers shall be free to pivot about an axis parallel to the direction of travel.

E. Equipment used for compaction of granular material shall consist of a heavy-duty, self-propelled steel drum vibratory roller. The static weight of the roller shall be at least 3,000 pounds.

F. Equipment used for compaction of earthfill adjacent to structures or in tight, restricted areas shall consist of a vibratory plate compactor. Vibratory plate compactors shall have a minimum static weight of 270 pounds and a minimum dynamic force of 1,000 pounds.

G. Equipment used for compaction of granular material adjacent to structures and in tight restricted areas shall consist of a tamping rammer (jumping jack) compactor. Jumping jack compactors shall have a minimum static weight of 100 pounds.

PART 3 EXECUTION

3.1 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill in materials in horizontal lifts of uniform thickness in a manner that avoids segregation. Compact each lift at the specified moisture content, using the specified equipment, and to specified densities, prior to placing succeeding lifts.

C. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

D. Process by blading, discing, harrowing, or other ENGINEER-accepted methods as necessary to provide sufficient disaggregation and blending of fill.

E. Maintain moisture content of delivered materials and compact materials in the lift to produce the specified fill characteristics.

F. During filling around structures, keep level of fill within 1 foot vertically on all sides of structure.

G. Do not place fill if material is frozen, or if surface upon which fill is to be placed is frozen.

H. Materials exposed on the slopes shall be at the as-compacted density and moisture content when the overlying slope protection or topsoil are placed.

I. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1-foot unless dimensions or grades are shown or specified otherwise.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

3.2 MOISTURE CONDITIONING AND PROCESSING

A. Moisture condition and process material during excavation or stockpiling so that material is within the specified moisture content and particle size limits at the time it is ready for use as fill and backfill.

B. Provide supplemental sprinkling on the fill to keep material within specified moisture content limits throughout the placement and compaction process, and to preserve moisture in completed courses until placement of overlying courses.

C. Blend material by discing, blading, or harrowing to maintain uniform moisture content throughout the lift.

D. Do not attempt to compact material that contains excessive moisture. Material that becomes too wet shall be removed or reworked. Aerate material by blading, discing, harrowing, or other methods to hasten the drying process.

E. Provide suitable types and numbers of watering and blending equipment to keep pace with fill placement activities. Provide additional equipment or restrict material placement rates if watering and blending equipment cannot keep pace with fill placement.

F. Maintain moisture conditions of the fill surface during nights, weekends, holidays, and other periods of temporary work stoppage.

3.3 COMPACTION

A. Compact all soil by mechanical means. If tests indicate that compaction or moisture content is not as specified, or if compaction equipment being used is not as specified, terminate material placement and take corrective action prior to resuming material placement.

B. Operate compaction equipment in strict accordance with manufacturer's instructions and recommendations. Maintain equipment in such condition that it will deliver the manufacturer's rated compactive effort.

C. Operate tamping foot rollers at a speed less than 5 miles per hour, and vibratory drum roller at a speed less than 3 miles per hour.

D. Operate sheepsfoot and tamping foot rollers to maintain the spaces between the individual feet clear of adherent materials that impair the effectiveness of the roller.

E. Where a minimum number of coverages is specified, provide 20 percent overlapping roller passes for each complete roller coverage per lift.

F. Provide suitable numbers of equipment to keep pace with fill placement activities. Restrict material placement rates if compaction equipment cannot keep pace with fill placement.

3.4 FILL

A. All materials exposed on the compacted slopes shall be at the as-compacted density and moisture content when the overlying slope protection and topsoil are placed.

B. Maintain the fill, including sloping the surfaces to drain, preventing or repairing gullies, and maintaining surfaces free of weeds or other vegetation until final completion and acceptance of all Work.

C. After a layer has been dumped and spread to less than the maximum specified lift thickness, disc as necessary to blend the materials.

D. Remove and rework by discing and scarifying any smooth hard surfaces and deep ruts in the surface of the fill resulting from passage of construction equipment prior to placing overlying embankment.

E. Protect fill during periods of inactivity or extended shutdown. Grade surfaces to facilitate runoff and wheel roll or compact with a smooth drum roller to reduce infiltration and softening. A loose lift of the specified material type can be placed to protect slopes during periods of frost.

F. After periods of inactivity or extended shutdowns, prepare the fill surface prior to resumption of fill activities.

1. For all fill material, recondition the fill surface by scarifying to a minimum depth of 8 inches, moisture conditioning, and recompacting as specified. If previously placed fill has become damaged by saturation, frost, or desiccation to a depth greater than 8 inches, over-excavate damaged material and replace/re-compact.
2. No separate payment will be made for fill restoration after periods of inactivity or shutdown.

G. Maximum lift thickness for all materials is 6 inches when compaction is with hand operated or remote operated equipment.

H. Earthfill and Low-Permeability Fill:

1. Maximum Lift Thickness: 8 inches.
2. Compaction: Not less than 97 percent relative compaction (ASTM D 698) except for the first 3 feet directly above and along the soil-bentonite barrier wall as shown on the Drawings, where the relative compaction shall not be less than 95 percent.
3. Compaction Moisture:

    a. Earthfill: Between 2 percent below and 2 percent above optimum water content (ASTM D 698).

b. Low-Permeable Fill: Between 1 percent below and 2 percent above optimum.

3.5 FILL UNDER AND BACKFILL AROUND STRUCTURES

A. Place backfill within 5 feet of structures in 6-inch-thick lifts and at a moisture content between 2 percent below and 2 percent above optimum water content. Compact each lift to at least 97 percent relative compaction (ASTM D 698). Use hand-operated or walk-behind compaction equipment within 5 feet of walls and footings. Stop backfill at required grade; make allowances for topsoil, slope protection, and other fills, where required.

3.6 COMPACTED FILL QUALITY CONTROL

A. Perform quality control tests prior to and during fill and backfill placement as required to develop means and methods and to confirm work meets the requirements of the Specifications. CONTRACTOR shall retain a qualified testing laboratory with experience performing tests for heavy civil projects.

B. Test Reporting:

1. Written copies of all field quality control tests shall be available on-site at all times.

C. Test frequencies provided are a minimum. Additional testing may be performed where minimum frequencies are unrepresentative for variable materials or inconsistent construction operations, and to re-test previously failed materials after corrective actions have been implemented.

D. Field Quality Control Tests:

1. An initial number of tests are required prior to placement of fill or backfill; additional tests are required during construction at the specified frequency and whenever material variation occurs such that existing information is not representative.
2. CONTRACTOR's independent materials testing firm will perform moisture-density relationship:

a. Prior to placement of fill and backfill, a minimum of two laboratory compaction density tests in accordance with ASTM D 698.
b. Apply rock corrections to density and moisture content determinations for oversize materials larger than ¾-inch.
c. During fill and backfill placement, additional laboratory compaction tests are required whenever material variation occurs such that the existing relationships are not representative, and at the following minimum frequencies.

1) One laboratory compaction test or index densities test per 1,000 cy of fill material that is placed.
2) One-point laboratory compaction test in conjunction with in-place field density and moisture tests for materials with greater than 12 percent fines.

3. CONTRACTOR's independent materials testing firm will perform gradation and Atterberg limits:

a. Prior to placement of fill and backfill, two gradation tests and three Atterberg limits tests; tests shall correspond with samples used for initial laboratory compaction tests. Gradation test shall be performed in accordance with ASTM D 422, and Atterberg limits tests shall be performed in accordance with ASTM D 4318.

b. During fill and backfill placement, additional gradation and Atterberg limits tests are required whenever material variation occurs and appears to deviate from the Specifications, and at the following minimum frequencies:

1) Earthfill: One per 1,000 cy
2) Low-Permeable Fill: One per 100 cy
3) Atterberg limits tests are not required for material with less than 12 percent fines.

4. CONTRACTOR's independent materials testing firm will perform in-place density and moisture content:

a. During fill and backfill placement, in-place density testing using one, or a combination of the following methods: ASTM D 6938, D 2937, and D 2216 for each type of material placed each day, and one test shall be made for each 12-inch rise in filled area elevation for each work area, but not less than the minimum frequencies specified below:

1) Earthfill: One per 400 cy
2) Low-Permeable Fill: One per 100 cy

b. The maximum dry density and optimum water content at the location of the in-place density test shall be evaluated using the one-point compaction test and full-curve compaction tests (family of curves) of representative fill materials. Determine the maximum dry density and optimum water content in accordance with the maximum density and optimum water content calculation section and the appendix section of AASHTO T272.
c. Re-tests of failed areas after corrective measures have been implemented are required; re-tests will reference the prior failing test number.

5. Correlations:

a. In-place density and moisture content measurements determined in accordance with ASTM D 2937 (drive-cylinder density) or ASTM D 1556 (sand cone density), and D 2216 (oven-dried moisture) will be correlated with similar measurements made in accordance with ASTM D 6938 (nuclear density and moisture) for same material type.
b. Where moisture content determinations are made in accordance with ASTM D 2216 (oven-dried) and D 4643 (microwave dried), ENGINEER will develop correlation between oven-dried and microwave-dried moisture contents for the same material type.
c. Correlations and applicable nuclear gage and microwave correction factors will be developed to evaluate fill and backfill placement.

E. Test Reporting:

1. Verbal pass/fail reports by independent materials testing firm shall be provided to ENGINEER immediately after completion of each test.

3.7 QUALITY ASSURANCE

A. Field Quality Assurance Testing:

1. OWNER may perform supplemental quality assurance testing to confirm that the materials placed conform to the Specification requirements, for both acceptance and documentation purposes, and to confirm the accuracy of CONTRACTOR's quality control testing.
2. OWNER's quality assurance testing will utilize the same test methods specified for CONTRACTOR's quality control testing.

3. Cooperate with OWNER in performing sampling and testing, and in resolving any discrepancies between quality assurance and quality control test results.

B. OWNER may perform quality assurance test prior to and during fill and backfill placement.

C. Test frequencies provided are a minimum. Additional testing may be performed where minimum frequencies are unrepresentative for variable materials or inconsistent construction operations, and to re-test previously failed materials after corrective actions have been implemented.

END OF SECTION

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SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Design, install, and maintain erosion protection and sediment control, and remove when no longer needed.

1. Erosion protection and sediment control measures shall comply with all requirements for Local, State, and Federal permits associated with erosion protection and sediment control. This shall include, but may not be limited to, the requirements described in Section 01 57 50: PROJECT PERMITS AND ENVIRONMENTAL CONTROLS.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D 3776 – Standard Test Methods for Mass per unit Area (Weight) of Fabric.
2. D 4354 – Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing.
3. D 4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
4. D 4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
5. D 4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
6. D 4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
7. D 4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
8. D 5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
9. D 5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
10. D 5262 – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.
11. D 6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

B. Colorado Department of Transportation (CDOT):

1. Erosion Control and Storm Water Quality Guide.

C. Mile High Flood District (MHFD):

1. Urban Storm Drainage Criteria Manual, Volume 3 – Stormwater Quality.

D. City of Brighton

1. Municipal Code Chapter 14 – Storm Drainage.
2. Standards and Specifications Manual, Chapter 6.

1.3 DEFINITIONS

A. Sediment and Erosion Control devices as defined herein shall mean silt fences, sediment control logs, sandbag cofferdams, sediment ponds, sediment traps, or other devices approved by ENGINEER.

1.4 SUBMITTALS

A. Administrative Submittals:

1. Erosion Protection and Sediment Control Plan (EPSCP). EPSCP at least 7 days before mobilization. The EPSCP shall include, at a minimum, the following information:

a. Facilities, products, and procedures to meet the requirements of erosion protection and sediment control requirements of all required project permits and requirements in these Specifications.
b. Procedure, installation details of constructing all required erosion protection and sediment control facilities.
c. Procedures and schedule to inspect, maintain, monitor, and repair erosion protection and sediment control facilities.
d. Product data of proposed materials to be used to control erosion and sediment.
e. Drawings that clearly show erosion and sediment control measures to be used for each stage of construction.
f. Schedule of removal of sediment and erosion control devices.

2. Copies of permit applications.

1.5 COORDINATION

A. Colorado Water Quality Act:

1. Assume responsibility for:

a. The preparation of the SWMP for the Project.
b. Permit application as specified in Section 01 57 50: PROJECT PERMITS AND ENVIRONMENTAL CONTROLS.
c. The receipt of permit from Colorado Water Quality Control Division.
d. Conformation to provisions of permit and SWMP requirements.
e. Annual fee.
f. The performance of a site inspection at least every 7 days and after significant precipitation events.

PART 2 PRODUCTS

2.1 SILT FENCE

A. Pervious Sheet: Polyester, polypropylene, or nylon filaments, woven into a uniform pattern, distinct and measurable openings.

B. Geotextiles shall be free from defects or tears, and shall be mildew, insect, and rodent resistant, inert to chemicals commonly found in soil, and resistant to UV light exposure. They shall also be free from any treatment or coating that might adversely alter the hydraulic or physical properties of the material after installation.

C. Geotextiles delivered to the site shall be clearly labeled with pertinent quality assurance information including roll number, batch number, type, and date of manufacture.

D. Geotextiles shall be comprised of extruded and slit polymeric film yarns woven into a geotextile, or non-woven polypropylene staple fibers.

E. In accordance with requirements of Table 1:

TABLE 1

Physical Property	Required Value	Test Method
Weight, oz./sq.yd., minimum	4	ASTM D 3776
Grab Tensile Strength, lb., minimum	120	ASTM D 4632
Elongation, % maximum	15	ASTM D 4632
Ultraviolet Radiation Resistance, % Strength Retention	70	ASTM D 4355
Flow Rate, gal/minute/sq.ft, minimum	10	ASTM D 4491

F. Support Fence:

1. Wire Mesh Material: As recommended by manufacturer of geotextile; strong enough to support applied loads.
2. Support Posts: As recommended by manufacturer of geotextile.
3. Fasteners: Heavy-duty wire stables at least 1 inch long, tie wires or hog rings, as recommended by manufacturer of geotextile.

2.2 SEDIMENT CONTROL LOGS

A. Straw-filled tube of flexible netting material. Machine-produced tube of compacted rice straw that is Certified Weed Free Forage. Netting shall consist of seamless, high-density polyethylene and ethyl vinyl acetate and contain ultraviolet inhibitors.

B. Meet the minimum performance requirements in Table 2.

TABLE 2

Physical Property	Test Method	Required Value
Mass per Unit Weight, lbs/ft	Field Measured	1.6
Dimension, inch diameter	Field Measured	8.0 – 9.0
Net Strand Thickness, inch	Field Measured	0.030
Netting Unit Weight, ounces/ft.	Certified	0.35
Sediment Retention Capacity, lbs/ft	Rainfall Sim.(1)	30
Installed Free-Board Ht., inches	Field Measured	6.0 – 7.0
Soil Loss(1), % effectiveness	Rainfall Sim.(1)	58(2)
De-Stabilizing Moisture, % Retained (max.)	Rainfall Sim.(1)	11

Notes:
1. Minimum of three 10-year predicted storm events on 3H:1V slope with clayey sand type soil.
2. Minimum sediment yield reduction value.

2.3 RIPRAP FOR EROSION CONTROL

A. Riprap for erosion control shall conform to the requirements of Section 31 37 00: RIPRAP.

2.4 SEDIMENT AND EVAPORATION PONDS

A. Sediment and evaporation ponds shall be formed by partial excavation and/or constructed embankment or other construction method that will result in formation of a basin that will retain runoff until sediment settles out.

2.5 DRAINAGE CHANNELS

A. Temporary drainage channels shall be excavated and stabilized to provide for controlled collection and routing of sediment laden water to sediment and evaporation ponds or for diversion of clean water away from construction or disturbed site area.

B. Such temporary drainage channels shall be designed to minimize overtopping and erosion concerns in accordance with project permit requirements.

PART 3 EXECUTION

3.1 SEDIMENT AND EROSION CONTROL

A. Install sediment and erosion control facilities prior to work involving site clearing, stripping and stockpiling topsoil, excavation, and earthwork.

B. Maintain and repair sediment and erosion controls during course of construction.

3.2 SILT FENCE

A. Silt fence shall be one-piece or continuously sewn to make one-piece geotextile for full height of the fence, including portion buried in the toe trench.

B. When joints are necessary, splice geotextile together only at a support post, with a minimum 6-inch overlap, and securely fasten both ends to support post.

C. Geotextile shall not extend more than 24 inches above the ground surface. Securely fasten to up slope side of each support post using ties or staples. Bottom portion of geotextile shall be securely backfilled in toe trench such that it is not easily pulled out by hand. Geotextile shall not be stapled to existing trees.

D. Fasten wire mesh material support fence securely to up slope side of post fasteners. Extend wire into the trench a minimum of 4 inches, and not more than 36 inches above the ground surface.

E. Take precaution not to puncture geotextile during installation. Repair or replace damaged area.

3.3 SEDIMENT CONTROL LOGS (SCL)

A. Excavate a small trench, 2 to 3 inches in depth on the slope contour and perpendicular to water flow. Soil from the excavation should be placed down slope next to the trench.

B. Install the SCL in the trench, ensuring that no gaps exist between the soil and the bottom of the SCL. The ends of adjacent SCLs should be tightly abutted so that no opening exists for water or sediment to pass through.

C. Wooden stakes should be used to fasten the SCL to the soil. Place stakes at 4 feet o.c.

D. Terminal ends of SCL should be doglegged upslope to ensure containment and prevent channeling of sedimentation.

3.4 RIPRAP

A. Place riprap for erosion control so that pieces of different sizes are intermixed to eliminate segregation.

3.5 REMOVAL OF TEMPORARY FACILITIES

A. Do not remove erosion control facilities without written approval from OWNER.

B. All erosion control facilities will be the property of CONTRACTOR, and shall be removed and disposed of offsite after all Work is complete.

C. Remove and dispose of sediments collected in the sediment control systems in accordance with Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

END OF SECTION

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SECTION 31 37 00
RIPRAP

PART 1 GENERAL

1.1 WORK INCLUDES

A. Placing riprap bedding and riprap.

B. Grouted riprap test section.

C. Placing drain material and grouted riprap.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a. C 94 – Standard Specification for Ready-Mixed Concrete.
b. C 117 – Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Sieving.
c. C 127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
d. C 136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
e. C 150 – Standard Specification for Portland Cement.
f. C 535 – Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
g. D 5519 – Standard Test Method for Particle Size Analysis of Natural and Man-Made Materials.
h. D 7012 – Standard Test method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens Under Varying States of Stress and Temperatures.

2. Colorado Department of Transportation (CDOT)

a. Standard Specifications - Section 506

3. Mile High Flood District (MHFD)

a. Specification Section 31 37 00

1.3 SUBMITTALS

A. Shop Drawings:

1. Grouted Riprap Test Section Plan:

a. Equipment and procedures for constructing the test section. The test section shall include field and laboratory testing to confirm placement properties and compressive strength.
b. Schedule for constructing the test section, obtaining samples, and performing laboratory tests.
c. Proposed personnel for the test section shall be the same that will be assigned to field production grouted riprap.

2. Grouted Riprap Placement Plan (GRPP): GRPP at least 14 days before start of production placement. The GRPP shall include, at a minimum, the following information:

   a. Facilities, products, and procedures for transporting, placing riprap, grouting riprap protection, and curing.
   b. Procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
   c. Planned sequence for construction.
   d. Narrative with figures to illustrate the plan.

B. Samples:

1. General:

   a. Notify ENGINEER at least 48 hours prior to the date of sampling to allow optional observation of sampling by ENGINEER.
   b. Deliver to site at location designated by ENGINEER.
   c. Incorporate samples into Work after material placement is nearly complete.

2. Imported Riprap:

   a. 10 tons of each type riprap used.
   b. Each sample shall be representative of material to be furnished for incorporation into Work. Include at least one piece of maximum size. Weigh individual pieces of riprap with scales that are certified accurate to within plus or minus 1 percent of actual weight.

3. Imported Riprap Bedding:

   a. 1,000 pounds
   b. Each sample shall be representative of material to be furnished for incorporation into Work.

4. Imported Drain Material:

   a. 1,000 pounds
   b. Each sample shall be representative of material to be furnished for incorporation into Work.

C. Administrative:

1. Submit the following:

   a. Description and location of proposed sources of riprap bedding and riprap.
   b. Description and location of three projects where proposed riprap has been successfully used for minimum 3 years duration under similar service conditions.
   c. Report of petrographic examination of the riprap, riprap bedding, and drain material by an ENGINEER-approved geologist to confirm absence of shale partings, laminations and other deleterious features.
   d. Certificates of Compliance, that the riprap, riprap bedding, and drain material meet the Specification requirements.

2. Trip tickets showing source, type, and weight of each load of material delivered to site.

D. Quality Control:

1. Certified Test Results:

a. Imported drain material: Provide test results prior to importing, and at least one test per 5,000 tons during production.

1) Gradation
2) Abrasion resistance

b. Imported Riprap Bedding: provide test results prior to importing, and at least one test per 5,000 tons during production.

1) Gradation
2) Abrasion resistance

c. Imported Riprap: provide test results prior to importing, and during production on request of ENGINEER.

1) Gradation
2) Abrasion resistance
3) Bulk density
4) Unconfined Compressive Strength

1.4 QUALITY ASSURANCE

A. Riprap Source: Quarry that has produced riprap and has performed satisfactorily on other projects for at least 5 years.

B. Grouted Riprap Test Section Pre-Construction Conference:

1. Meeting attendees:

a. CONTRACTOR resident superintendent and foreman for placing and grouting (attendance mandatory).
b. Testing and sampling personnel (attendance mandatory).
c. ENGINEER's representative, including field personnel (attendance mandatory).
d. OWNER's representative (attendance optional).
e. Schedule meeting at least 14 days prior to construction of grouted riprap.

2. Agenda shall include:

a. Proposed grout mix.
b. Procedures for placing, finishing, and curing grouted riprap.
c. Procedures for testing fresh grout.
d. Provisions for environmental protection of grout during placement and curing periods.
e. Other specified requirements requiring coordination.

1.5 SCHEDULING AND SEQUENCING

A. Complete subgrade preparation prior to placing drain material, riprap bedding, and riprap.

PART 2 PRODUCTS

2.1 DRAIN MATERIAL

A. Imported well-graded sand and gravel material that meet the following:

1. Gradation, as determined in accordance with ASTM C 117 and ASTM C 136.

Sieve Size	Percent Passing by Weigh
3/8-inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10
No. 200	0 – 3

B. Conform to the requirements of ASTM C 33 for soundness and deleterious substances.

2.2 RIPRAP BEDDING

A. Imported, well-graded crushed rock with cobble-sized pieces that generally meets the requirements of MHFD Type II Granular Bedding:

1. Gradation, as determined in accordance with ASTM C 117 and ASTM C 136:

Sieve Size	Percent Passing by Weight
3 1/2 inch	100
3 inch	90 – 100
1-1/2 inch	55 – 100
3/4-inch	20 – 80
3/8-inch	10 – 40
No. 4	0 – 15
No. 16	0 – 7
No. 200	0 – 3

2. Abrasion Resistance: Maximum 35 percent wear when tested in accordance with ASTM C 535.
3. Minimum specific gravity of 2.65 when tested in accordance with ASTM C 127.

B. Free from deleterious matter.

2.3 IMPORTED RIPRAP

A. Application: Grouted riprap and ungrouted riprap.

B. Imported, hard and durable quarry stone free from fractures, bedding planes, pronounced weathering, and earth or other adherent coatings.

C. Minimum Dimension of Individual Pieces: Not less than 1/3 maximum dimension.

D. Abrasion Resistance: Maximum 35 percent wear as determined in accordance with ASTM C 535.

E. Unconfined Compressive Strength: Minimum 2,500 psi measured in accordance with ASTM D 7012 on drilled core specimen.

F. Bulk Density: Minimum 165 pounds per dry cubic foot (minimum specific gravity of 2.65 when tested in accordance with ASTM C 127).

G. Gradation: Smaller pieces shall generally fill voids between larger pieces without either excess or deficiency of one or more sizes of stone. The gradations listed below generally meet the requirements of CDOT Standard Specifications except that the weights have

been adjusted to maintain the minimum specific gravity specified. Riprap shall have the following gradations:

Type	D_{50} Stone Size (Inches)	Stone Size (Inches)	Weight (Pounds)	% Smaller By Weight
Modified M	12	21 18 15 4 3	465 290 87 3 1	70-100 50-70 35-50 2-10 0
L	9	15 12 9 3	170 90 35 1	70-100 50-70 25-50 2-10

H. Free from dirt and deleterious materials.

I. Oversized pieces shall be broken to provide maximum stone sizes in accordance with the specified gradations.

2.4 GROUT

A. Grout for the grouted riprap shall conform to Class H concrete.

PART 3 EXECUTION

3.1 GROUTED RIPRAP TEST SECTION

A. Construct a grouted riprap test section to demonstrate placement procedures for size of grouted riprap required at the overflow channels. Demonstrate the grouting method used to adequately fill void spaces and cleaning methods to adequately clean grout from the riprap and do not adversely impact the grout strength. The test section shall be constructed outside the limits of the overflow channel modifications and shall be a minimum of 15 feet by 15 feet in area and to the required thickness shown on the Drawings.

B. Notify OWNER at least 7 days prior to the date of test section construction to allow observation of construction procedure by ENGINEER.

C. Break and separate the grouted riprap sample section after a minimum of 7 days following placement and at least 14 days before the start of production placement of the grouted riprap to allow visual inspection of the completed riprap section by ENGINEER. Break each test section into four to six pieces.

D. Test section construction requirements:

1. Use type of riprap specified.
2. For the test section use materials, equipment, and procedures proposed for production placements.
3. The test section dimensions shall be increased, if necessary, to adequately demonstrate all proposed construction features and proposed placement methods and equipment.
4. Demonstrate ability to fulfill the performance requirements of handling, placing, grouting, and protecting grouted riprap.
5. Simulate features of the production placement.
6. Cure test section.

E. Test section grout testing requirements:

1. Slump: ASTM C 143.
2. Air content: ASTM 231.
3. Temperature.
4. Standard compressive strength (ASTM C 39) tests: Six total cylinders that include testing two cylinders at 3 days, two cylinders at 7 days, two cylinders at 28 days.

F. During construction of the test section, allow for numerous stops and starts for evaluating and testing.

G. CONTRACTOR's performance shall be evaluated by ENGINEER to establish if the methods and procedure demonstrated in construction of the test section are satisfactory for production grouted riprap placement.

H. Break test section into at least four pieces by cracking and separating generally along two lines in each direction. Break after completion and acceptance of all field and laboratory testing. Dispose of demolished grouted riprap in accordance with Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS.

3.2 PLACING DRAIN MATERIAL

A. Maximum Lift Thickness: 9 inches.

B. Compaction: Three coverages of a steel drum roller.

C. Compaction Moisture: Compact at in-situ, stockpile, or saturated water content.

D. Use placement procedures to prevent contamination of drain materials by adjacent materials.

E. Do not over-compact drain material and cause breakdown of particles.

F. Protect from contamination and repair any damage.

G. Protect drain material against damage as soon as possible before work stoppages or periods of inactivity.

H. Provide thickness equal to or greater than the minimum neat line dimensions shown.

3.3 PLACING RIPRAP BEDDING

A. Place riprap bedding on prepared foundation to lines, grades and thickness shown.

B. No mechanical compaction of riprap bedding is required; however, work riprap bedding as necessary to distribute it and to eliminate detrimental voids. Avoid overworking or long pushes that result in segregation of particle sizes.

C. Grade surface of drain material and riprap bedding free from irregularities and to tolerances of 0.2 foot from established grade.

D. Place and grade drain material and riprap bedding in a manner that avoids subgrade disturbance. Do not push material down slope.

3.4 PLACING UNGROUTED RIPRAP

A. Place riprap over riprap bedding or geosynthetic to the lines, grades and thickness shown.

B. No mechanical compaction of riprap is required.

C. Intermix different sizes of riprap to eliminate segregation, to interlock pieces, and to fill voids between larger pieces with smaller pieces in such a manner as to form a smooth, uniform, well-graded layer.

D. Use placement and intermixing methods that avoid disturbing riprap bedding or damaging geosynthetic, existing facilities, completed work, or adjacent property.

E. Placement tolerance for riprap is 0.25 foot above established grade. No tolerance below established grade will be allowed.

3.5 PLACING GROUTED RIPRAP

A. General:

1. Place riprap as specified in Section 3.4.
2. Clean all surfaces of riprap against which the grout will be placed so that the surfaces are free from dirt or other objectionable material that would prevent a proper bond between the grout and riprap.
3. Moisten surface of riprap immediately prior to placement of the grout.
4. Do not displace riprap, drain material, or geotextiles during grout placement.
5. Do not grout when temperature is less than 40°F. Maintain temperature of grouted riprap between 50°F and 90°F for minimum 3 days.
6. Grout riprap to produce a uniformly grouted rock mass for its entire thickness. Use accepted procedures from the Grouted Riprap Placement Plan. Grout penetration may be accomplished by rodding, vibrating, or pumping grout into the voids between the stones or other methods accepted by ENGINEER. Use a “pencil” vibrator to fill all voids between and under stones.
7. Grout in one continuous lift from bottom to top. Slope grout between successive placements not flatter than 2H:1V.
8. Place grout at low points and force grout to move upslope or rise vertically through rock mass using rodding, vibration, or other means as accepted by ENGINEER. Grout must penetrate to the geotextile.
9. Leave grout recessed below the surface of the adjacent stones.
    a. Adjust final grout surface such that between 2 and 6 inches of the top of various riprap stones are exposed.
    b. Leave the top surface of the stones fully exposed.
    c. Immediately remove all excess grout with a stiff brush. Wash the exposed surface of the grouted riprap to expose the natural color of the riprap. Do not allow wash water to infiltrate or mix with grout or otherwise impact the strength of grout.
10. Do not use grout to cover the surface of the stone and increase thickness.
11. Do not place fresh grout over hardened grout to increase stone coverage. If final grout surface does not maintain the specified stone exposure, remove grout to at least 12 inches below the final surface and re-grout as required by ENGINEER.
12. Match the procedures and workmanship of the accepted test section.
13. Moist cure grouted riprap for minimum of 7 days or apply curing compound.

B. Sequence:

1. Prepare subgrade.
2. Place drain material and geotextile.
3. Place the riprap to the required lines, grades, and thickness.
4. Grout the riprap.
5. Perform finishing work and moist cure or curing compound.

END OF SECTION

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SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 WORK INCLUDES

A. Aggregate surfacing used for access roads and trail detour.

1.2 REFERENCES

A. A. The following is a list of standards which may be referenced in this Section:

1. American Society of Testing Materials (ASTM):

a. C 117, Standard Test Method for Materials finer than 75 microns (No. 200) Sieve in Mineral Aggregates by Washing
b. C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
c. C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
d. D 75, Standard Practice for Sampling Aggregates
e. D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
f. D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction (CDOT Standard Specifications).

a. Section 703.03 Aggregate for Bases

1.3 SUBMITTALS

A. Samples: Submit 100 pounds of material taken at source, collected in accordance with ASTM D 75, no less than 28 days prior to importing to the site.

B. Quality Control:

1. Certified test results documenting conformance with all Specification requirements.

1.4 QUALITY CONTROL

A. Furnished from single source throughout Work.

B. Perform gradation test and Atterberg limits test in accordance with ASTM C 117, ASTM C 136, and ASTM D 4318, respectively for each 200 tons delivered to the site.

C. Perform L.A. Abrasion testing in accordance with ASTM C 131 for each 3,000 tons delivered to the site.

D. Notify ENGINEER when embankment or prepared foundation is ready for placement of overlying aggregate surfacing.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Imported, hard, durable, natural crushed stone or crushed gravel with sand and sufficient finer material for proper compaction, well-graded, and free from deleterious materials.

B. Gradation as determined in accordance with ASTM C 117 and C 136:

Sieve Size	Percent Passing by Weight
3/4-inch	100
No. 4	30 - 65
No. 8	25 - 55
No. 200	3 - 12

C. Liquid Limit not exceeding 30 and Plasticity Index not exceeding 6 as determined in accordance with ASTM D 4318.

D. Percentage of wear by LA abrasion test less than 50 percent as determined in accordance with ASTM C 131.

E. Material meeting the requirements of Class 6 Aggregate Base Course Material as specified in CDOT Section 703.03 may meet the requirements specified herein except that crushed slag, crushed reclaimed concrete, and crushed reclaimed asphalt will not be allowed.

PART 3 EXECUTION

3.1 PREPARING SUBGRADE

A. Prepare previously placed fill or excavated surface to receive overlying aggregate surfacing. Moisture condition and compact the underlying material as specified in Section 31 23 13: SUBGRADE PREPARATION.

B. After compaction, trim subgrade to firm, moist compacted material, and to the cross-section shown.

C. Grade subgrade with uniform slope between points where elevations are given.

D. Protect surface until placement of overlying aggregate surfacing.

E. Do not place on wet or muddy subgrade.

F. Fill and compact any depressions and remove loose material to finish true to line and grade, presenting a smooth, compacted and unyielding surface, except where indicated otherwise.

3.2 PLACING AGGREGATE SURFACING

A. Do not haul over completed subgrade.

B. Spread base in an even distribution of material without segregation.

C. Place in maximum 12-inch-thick lifts. Compact with a vibratory steel drum or rubber-tired roller.

D. Compaction moisture: Compact at in-situ, stockpile, or saturated water content. Modify as requested by ENGINEER.

E. Compact to at least 95 percent relative compaction (ASTM D 698).

F. Grade final surface to provide a smooth, uniform surface that drains.

G. Correction of Surface Defects: Should irregularities develop in any surface during or after rolling, they shall be remedied by loosening the surface and correcting the defects, after which the entire area, including surrounding surfaces, shall be rerolled until thoroughly compacted. Finished surfaces shall be true to grade and crown before proceeding with surfacing. Grade final surface to provide a smooth, uniform surface that drains.

H. Final Lines and Grades: Plus or minus 0.1-foot unless dimensions or grades are shown or specified otherwise.

END OF SECTION

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SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.1 WORK INCLUDES

A. Reclaiming areas within the limits of site disturbance including:

1. Seedbed preparation
2. Seeding
3. Mulching
4. Reseeding as necessary during warranty period

1.2 DEFINITIONS

A. Satisfactory stand: Minimum of 200 viable live seedlings per square yard with 6 inches of growth and maximum crop and weed count of one per 3 square yards. The seedlings shall be of the variety and species found in the specified seed mix. No noxious weeds shall be allowed. No bare areas larger than 4 square feet shall be allowed.

B. Areas to be seeded: Areas disturbed during construction except areas below the maximum normal reservoir pool, or areas to be covered with riprap. Areas will be as directed by the OWNER or ENGINEER.

C. Seeding Period: Perform when ground is thawed.

1.3 SUBMITTALS

A. Shop Drawings:

1. Proposed methods and equipment for seeding.
2. Proposed source and materials for seed and mulch.
3. Manufacturer’s product data and installation instructions for erosion control blanket.

B. Quality Control:

1. Seed certifications including quantity of PLS/acre/variety.
2. Soil amendment certifications for Mycorrhizae and Biosol.

1.4 DELIVERY, STORAGE AND PROTECTION

A. General: Deliver in original, unopened containers. Protect materials from animals and moisture. Wet, moldy, open, or broken packages will not be accepted. Nonflowing materials will be rejected.

B. Seed:

1. Furnish in standard containers with name and address of supplier, test date; seed name and variety; lot number; net weight; percentages of purity; germination; crop seed percentage; inert matter percentage; weed seed percentage; and noxious weeds by species and number by pound, clearly marked on each container of seed.
2. Keep dry during storage.

1.5 MAINTENANCE

A. Operations: Perform after planting until Initial Acceptance, and during warranty period, to include:

1. Mulch: Replace wherever and whenever washed or blown away.
2. Reseed unsatisfactory areas or portions thereof during the next seeding period.

PART 2 PRODUCTS

2.1 SOIL AMENDMENT

A. Mycorrhizae product to be mixed into seed mix at seed supplier or incorporated into seed bed to a minimum depth of 8 inches. Biosol product to be broadcast on planted seed bed. Acceptable products are as follows:

1. 20 lbs/ac granular Mycorrhizae and 1,800 lbs/ac Biosol Mix 7-2-1 from Rocky Mountain BioProducts, Denver, CO 303-696-8964.
2. 60 lbs/ac of Mycorrhizal Inoculum AM 120 and Biosol at 1,500 lbs/ac from Pawnee Buttes Seed Company, Greeley, CO 970-356-7002.
3. Approved equal.

2.2 SEED

A. Seed shall be new crop delivered in original containers, unopened, bearing dealer's warranty analysis. Maximum crop and weed content shall be 0.10 percent each. Seed shall be free of all noxious weeds. Minimum germination shall be 85 percent and minimum purity shall be 95 percent. If seed on the market does not meet minimum purity and germination percentage, compensation is to be made for a lesser percentage of purity or germination by furnishing additional seed to equal specified mix. Product comparison shall be made on basis of pure live seed (P.L.S.) in pounds. Formula for determining quantity of P.L.S. shall be:

Pounds of Seed x Purity x Germination = Pounds P.L.S.

2.3 SEED MIX

Common Name	Scientific Name	Seeds/lb	Lbs PLS/Acre
Sheep Fescue (Durar)	Festuca ovina	680,000	1.3
Western Wheatgrass (Arriba)	Pascopyrum smithii	110,000	7.9
Alkali Sacaton	Spolobolus airoides	1,758,000	0.5
Slender Wheatgrass	Elymus trachycaulus	159,000	5.5
Canadian Bluegrass (Talons)	Poa comkpressa	2,500,000	0.3
Switchgrass (Blackwell)	Panicum vigratum	389,000	1.3

2.4 MULCH

A. Provide clean, fresh straw, free of weeds and weed seeds. Mulch material shall be seed-free or fumigated to prevent introduction of weeds. Mulch shall not contain more than 5 percent seed by weight and shall not be musty, moldy, decayed, or caked. At least 50 percent by weight shall be 10 inches or more in length.

B. Tackifier: Provide mulch tackifier that is 100 percent organic and biodegradable.

2.5 HYDROMULCH

A. Mulch may be replaced with Hydromulch at OWNER's discretion. Provide natural wood fiber free of weeks and grass seeds. The wood fibers must have the property of becoming evenly dispersed and suspended when agitated in water. Weight specifications from suppliers shall refer only to the air-dry weight of the fiber. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds. Water shall be free from substances or matter that could inhibit growth of grass.

PART 3 EXECUTION

3.1 GRASS SEEDING

A. Apply seed with grass drill equipped with satisfactory feeding mechanism including fluff seed box, agitator, double disc furrow openers, depth banks, and packer wheels. Place seed at 1/4-inch depth. Operate drill parallel to slope. Drill equal quantity of seed in two directions at right angles to each other.

B. Broadcast Biosol product over planted seedbed.

3.2 MULCHING

A. For drill seeded areas, uniformly apply mulch on all seeded areas at 4,000 pounds per acre air dry mulch within 24 hours after seeding. After applying mulch, immediately crimp with weighted discs or crimpers operated parallel to the contour. Set disc straight so minimum amount of soil is disturbed. Depth of cut shall be 3 to 4 inches.

3.3 HYDROMULCHING

A. For drill seeded areas, uniformly apply Hydromulch at a rate of 2,000 pounds per acre. Apply tackifier at a rate of 100 pounds per acre or at the manufacturer's recommendation; whichever is greater. Upon completion of the application, soil shall not be visible through the Hydromulch.

3.4 MAINTENANCE

A. Germination during growing season is expected to be within 3 to 6 weeks. Spot regrading, reseeding, and mulching may be needed until Initial Acceptance to repair areas damaged by erosion, wind, fire, or other causes.

B. Remove weeds by hand over 6 inches tall.

C. Remove all litter and debris larger than 2 inches in size.

3.5 FINAL INSPECTION

A. Perform final inspection 1 year after date of substantial completion. Final inspection shall confirm that an acceptable stand has been achieved and is acceptable to OWNER.

END OF SECTION

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SECTION 34 41 00
TRAFFIC SIGNS AND SIGNALS

PART 1 GENERAL

1.1 WORK INCLUDES

A. Furnishing and installing all signs needed for temporary and permanent traffic control along the Multi-Use Trail detours.

1.2 REFERENCES

A. 2024 Edition of the Manual on Uniform Traffic Control Devices (MUTCD)

1.3 SUBMITTALS:

A. Shop Drawings:

1. Sign Layout diagram.
2. Manufacture's Product Information (Cut Sheets):

a. Sign face material
b. Pedestal pole and base
c. Mounting hardware

PART 2 PRODUCTS

2.1 GENERAL

A. All equipment shall meet the requirements of the MUTCD (2024).

B. Signs:

1. Sizes and colors shall be in accordance with MUTCD and City of Brighton Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate selection of traffic control signs in accordance with accepted Traffic Control Plan.

B. All installations shall be in accordance with MUTCD and City of Brighton Standard Specifications.

C. Replace damaged or defective signs throughout the duration of construction.

END OF SECTION

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