INSTALL SAFETY CLOSURES AT ABANDONED MINES TO PROTECT VISITORS AND PRESERVE RESOURCES

VARIOUS NATIONAL PARKS IN THE INTERMOUNTAIN AND PACIFIC WEST REGIONS

INDEX OF DRAWINGS		
SHEET #	SHEET TITLE	SUB SHEET
1	COVER SHEET	C00
2	ADIT BACKFILL	C01
3	SHAFT BACKFILL	C02
4	ADIT DRY LAID STONE WALL WITH BACKFILL	C03
5	ADIT MORTARED STONE WALL	C04
6	ADIT CONCRETE BLOCK WALL	C05
7	ADIT ANGLE IRON BAT GATE	C06
8	ADIT ANGLE IRON BAT GATE MOUNTED ON PERIMETER RING OPTION	C06.1
9	SHAFT ANGLE IRON BAT CUPOLA	C07
10	MISCELLANEOUS DETAILS #1	C07.1
11	MISCELLANEOUS DETAILS #2	C07.2
12	ADIT ROUND BAR GATE WITH REMOVABLE BARS	C08
13	SHAFT REBAR CLOSURE	C09
14	SHAFT REBAR CLOSURE ANCHOR OPTIONS	C09.1
15	SHAFT STEEL GRATE WITH I-BEAM SUPPORT	C10
16	ADIT SQUARE BAR BAT GATE	C11
17	SHAFT SQUARE TUBING BAT CUPOLA	C12
18	ADIT PUF CLOSURE WITH BACKFILL	C13
19	SHAFT PUF CLOSURE WITH BACKFILL	C14
20	ADIT CORRUGATED METAL PIPE WITH BAT GATE	C15
21	SHAFT CORRUGATED METAL PIPE IN PUF WITH CUPOLA	C16
22	WIRE NETTING	C17
23	CHAIN LINK/BARBED WIRE PERIMETER FENCE	C18
24	CHAIN LINK/BARBED WIRE PERIMETER FENCE	C18.1

NO SCALE

A/E FIRM
The Louis Berger Group, Inc.
Washington, DC, 20037

Mark	Sheet	REVISION	Date	Initial

QUALITY DESIGN CERTIFICATION
- ☐ Prepared in Accordance with Design Development (Title I) ____ Drawing No.
  OR
- ☐ Variance from Design Development (Title I) Approved by Superintendent on ____ Date
  OR
- ☐ Construction Drawing Not Preceded by Design Development (Title I)

Project Manager ____ Date

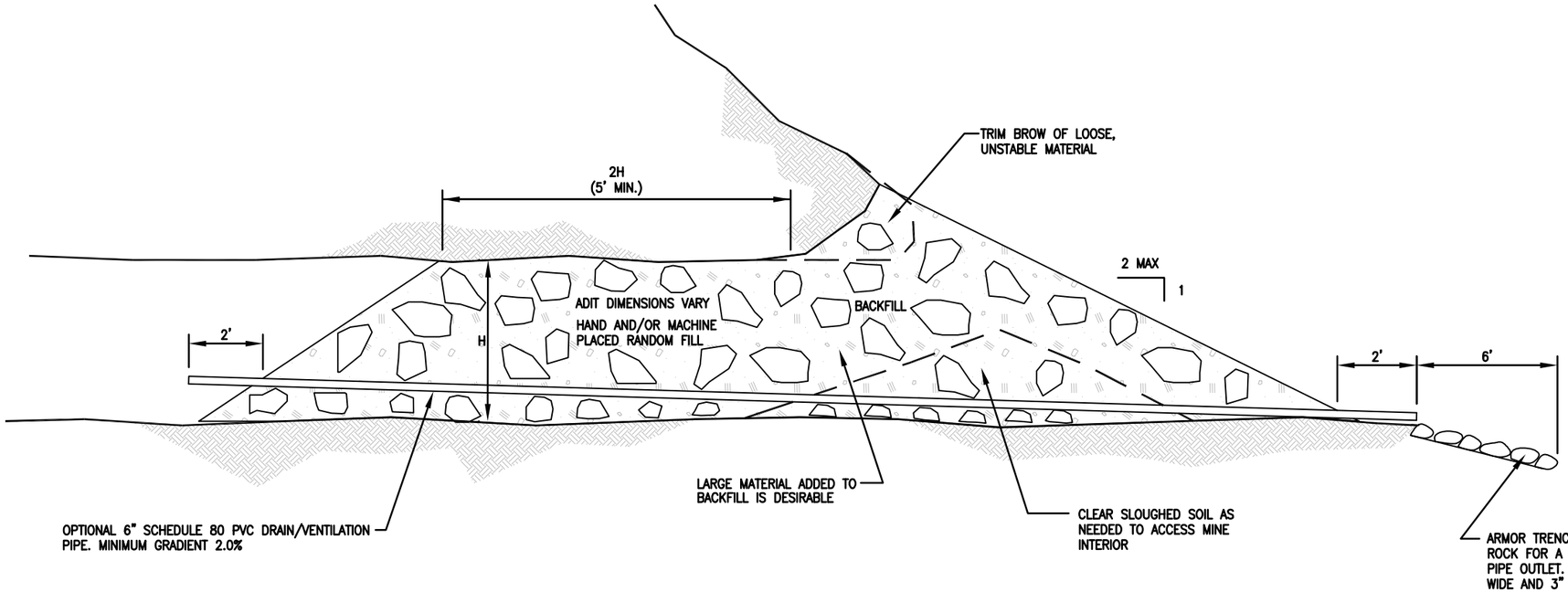
CONSTRUCTION DOCUMENTS

UNITED STATES
DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE
DENVER SERVICE CENTER

TITLE OF PROJECT
INSTALL SAFETY CLOSURES AT ABANDONED MINES TO PROTECT VISITORS AND PRESERVE RESOURCES
VARIOUS NATIONAL PARKS
INTERMOUNTAIN AND PACIFIC WEST REGIONS

DRAWING NO. 999 100486
PMIS/PKG NO. VARIOUS
SHEET 1 OF 24



1 ADIT BACKFILL
NO SCALE

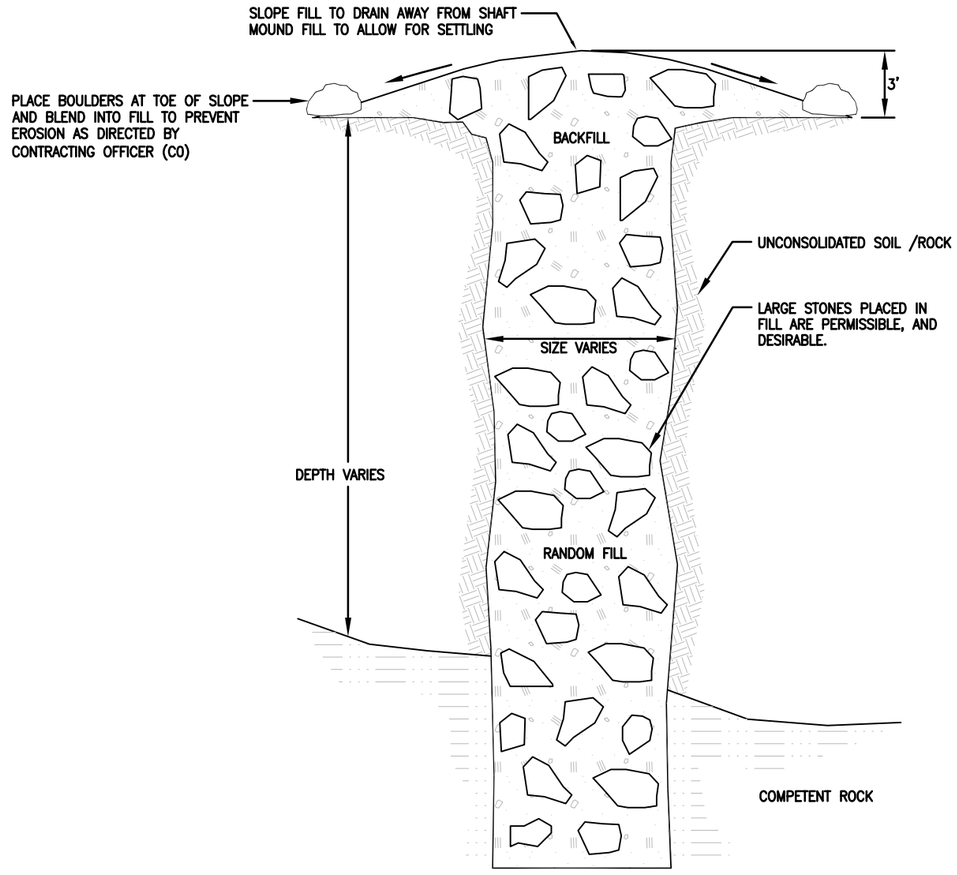
NOTES:

1. PLACE BOULDERS OR ROCK AT THE TOE OF THE SLOPE AND BLEND INTO GROUND AS DIRECTED BY THE CONTRACTING OFFICER TO PROTECT FROM EROSION.
2. RANDOM FILL SHALL CONSIST OF ON-SITE MATERIALS SUCH AS MINE WASTE ROCK, SOIL OR SUB-SOIL. RANDOM FILL SHALL BE FREE OR ORGANIC DEBRIS AND SHALL BE OF A GRADATION PERMITTING COMPACTION.
3. OPTIONAL PVC PIPE LENGTHS SHALL BE JOINED USING SLIP COUPLINGS AND PVC CEMENT.

NO SCALE

DESIGN COURTESY OF THE UTAH DEPARTMENT OF NATURAL RESOURCES

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN	C01	ADIT BACKFILL	999 100486
CADD: CRS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	PKG. NO. — — —
TECH. REVIEW: LSS			SHEET 2 OF 24
DATE: 01/27/2010			



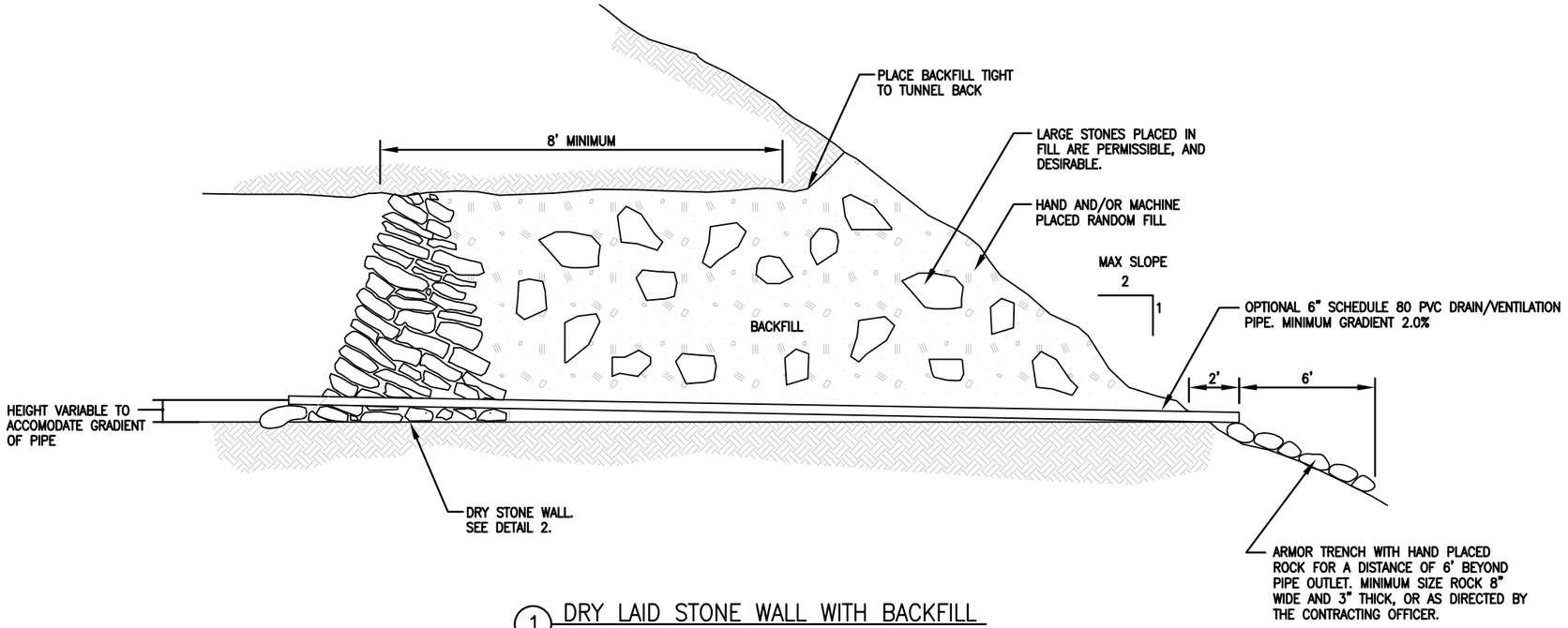
NOTE:
RANDOM FILL SHALL CONSIST OF ON-SITE MATERIALS SUCH AS MINE WASTE ROCK, SOIL OR SUB SOIL. RANDOM FILL SHALL BE FREE OF ORGANIC DEBRIS AND SHALL BE OF A GRADATION PERMITTING COMPACTION.

1 SHAFT BACKFILL
NO SCALE

NO SCALE

DESIGN COURTESY OF THE UTAH DEPARTMENT OF NATURAL RESOURCES

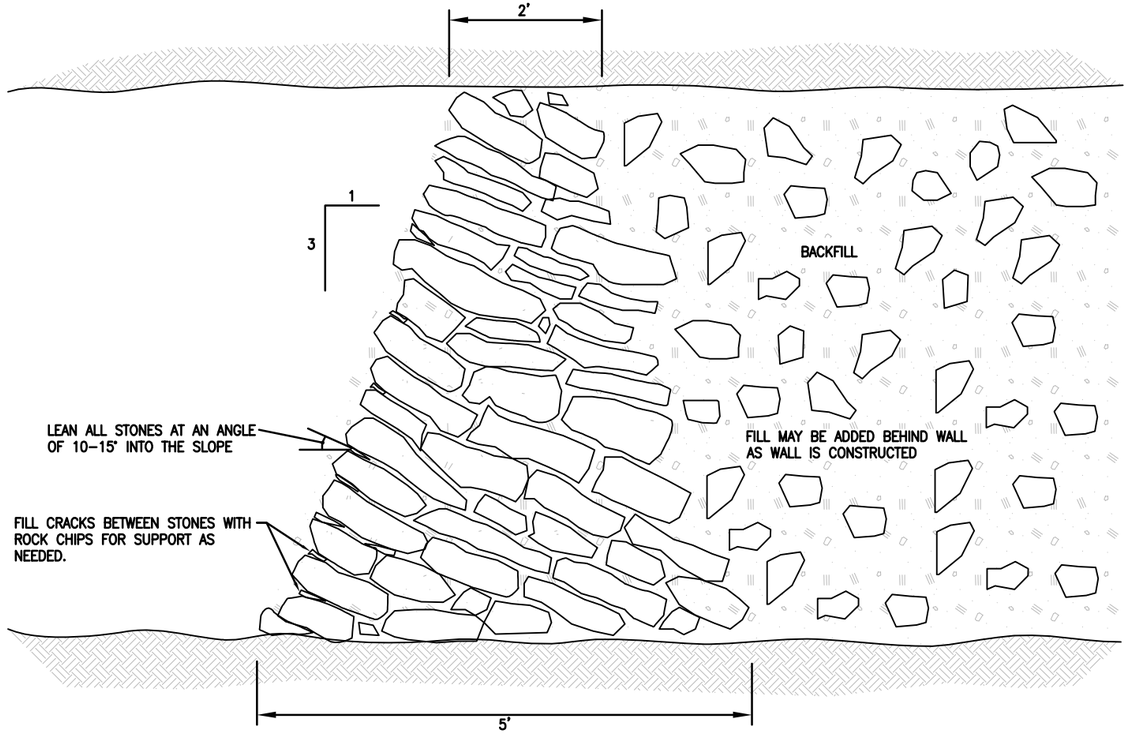
DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN DRAFTED: CRS TECH. REVIEW: LSS DATE: 01/27/2010	C02	SHAFT BACKFILL VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. ___ ___ ___ SHEET 3 OF 24



1 DRY LAID STONE WALL WITH BACKFILL
NO SCALE

NOTES:

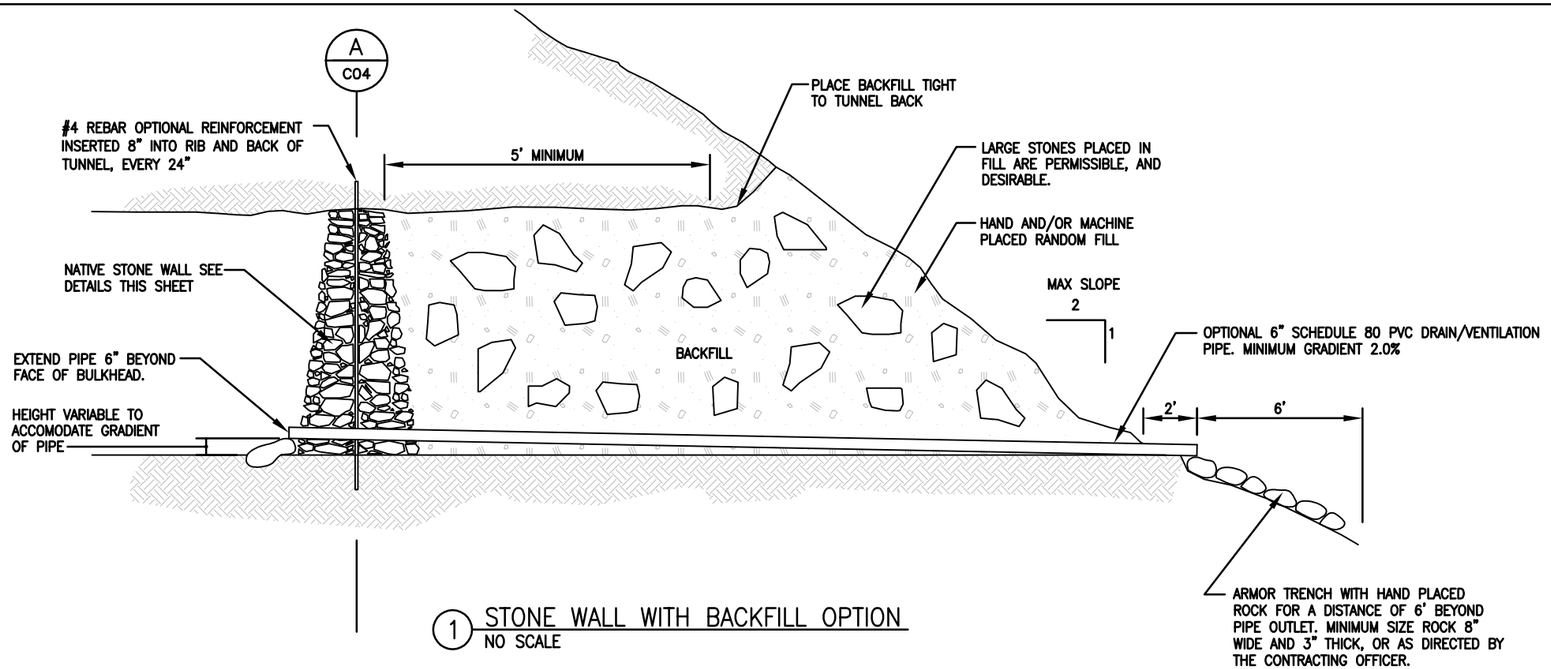
1. RANDOM FILL SHALL CONSIST OF ON-SITE MATERIALS SUCH AS MINE WASTE ROCK, SOIL OR SUB-SOIL. RANDOM FILL SHALL BE FREE OR ORGANIC DEBRIS AND SHALL BE OF A GRADATION PERMITTING COMPACTION.
2. OPTIONAL PVC PIPE LENGTHS SHALL BE JOINED USING SLIP COUPLINGS AND PVC CEMENT
3. FOR STABILITY STONE SHOULD BE SELECTED THAT IS TABULAR IN SHAPE AND NOT ROUND.
4. STONES SHALL BE STACKED IN A STAGGERED MANNER OVERLAPPING JOINTS IN PREVIOUS COURSES. JOINTS BETWEEN COURSES SHALL NOT BE ALLOWED TO OVERLAP.
5. STONES SHALL BE LEANED INTO THE SLOPE AT AN ANGLE OF 10-15 DEGREES TO PROVIDE STABILITY. JOINTS BETWEEN COURSES SHALL BE CHINKED WITH ROCK CHIPS FOR STABILITY AS NEEDED.



2 DRY LAID STONE WALL WITH BACKFILL DETAIL
NO SCALE

NO SCALE

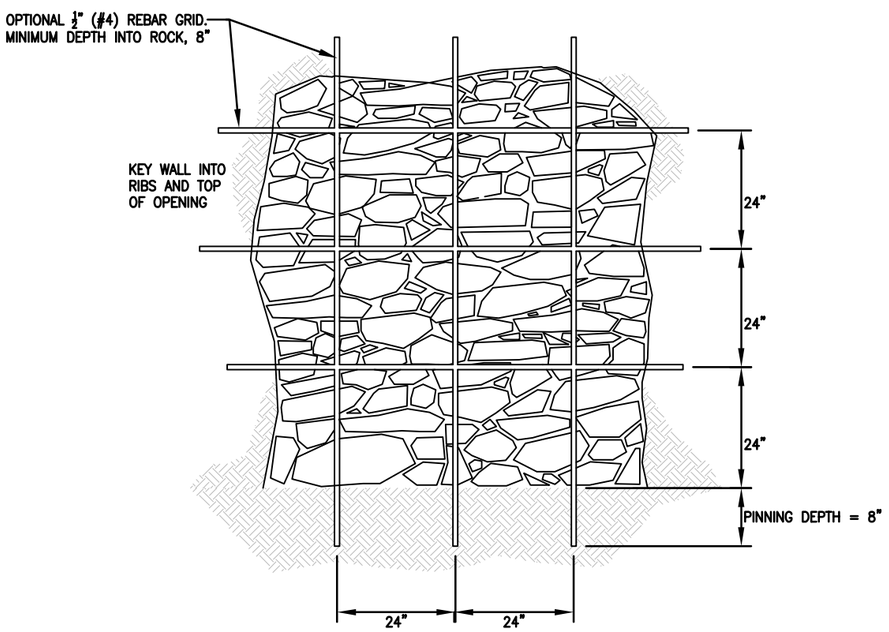
DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	C03	ADIT DRY LAID STONE WALL WITH BACKFILL VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. SHEET 4 OF 24



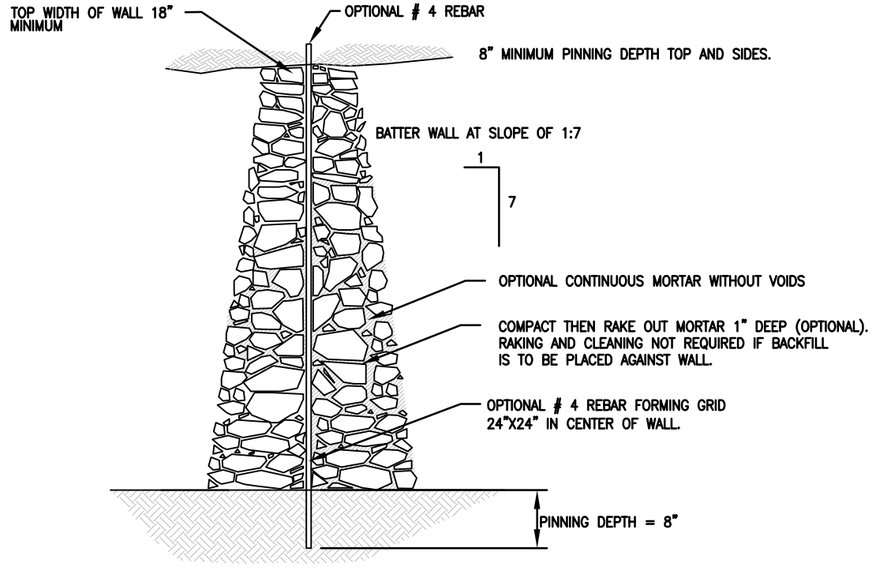
1 STONE WALL WITH BACKFILL OPTION
NO SCALE

NOTES:

1. NATIVE STONE SHALL BE COLLECTED ON SITE FOR CONSTRUCTION OF THE NATIVE STONE WALL. STONE QUALITY AND SIZE SHALL BE APPROVED BY THE CO.
2. OPTIONAL RANDOM FILL SHALL CONSIST OF ON-SITE MATERIALS SUCH AS MINE WASTE ROCK, SOIL OR SUB-SOIL. RANDOM FILL SHALL BE FREE OR ORGANIC DEBRIS AND SHALL BE OF A GRADATION PERMITTING COMPACTION.
3. REBAR IN WALL IS OPTIONAL AND SHOULD BE USED AT THE CONTRACTING OFFICER'S DISCRETION.
4. OPTIONAL PVC PIPE LENGTHS SHALL BE JOINED USING SLIP COUPLINGS AND PVC CEMENT
5. IF STONE WALL WILL BE EXPOSED TO THE ELEMENTS OR VIEWED BY VISITORS, COMPACT EXPOSED MORTAR JOINTS THEN WIRE BRUSH WITH WATER ONLY. NO ACID WASH.
6. MORTAR ON ALL FACE JOINTS TO BE COMPACTED. CONTINUOUS MORTAR MUST FILL ALL INTERNAL JOINTS, WITHOUT VOIDS.
7. ROCK ATTACHMENT: OPTIONAL REBAR PINS (BARS) SHALL BE INSERTED INTO HOLES DRILLED A MINIMUM OF 8" INTO ROCK WALLS AND FLOOR. PINS SHALL BE SECURED USING AN INTERFERENCE FIT CREATED BY DISTORTING THE BAR WITH A SIDE HAMMER BLOW THEN DRIVING THE BAR INTO THE HOLE. HOLES SHALL BE DRILLED ⅛" LARGER IN DIAMETER THAN THE PINS. GROUTING OF PINS IS NOT REQUIRED.



2 STONE WALL ELEVATION
NO SCALE

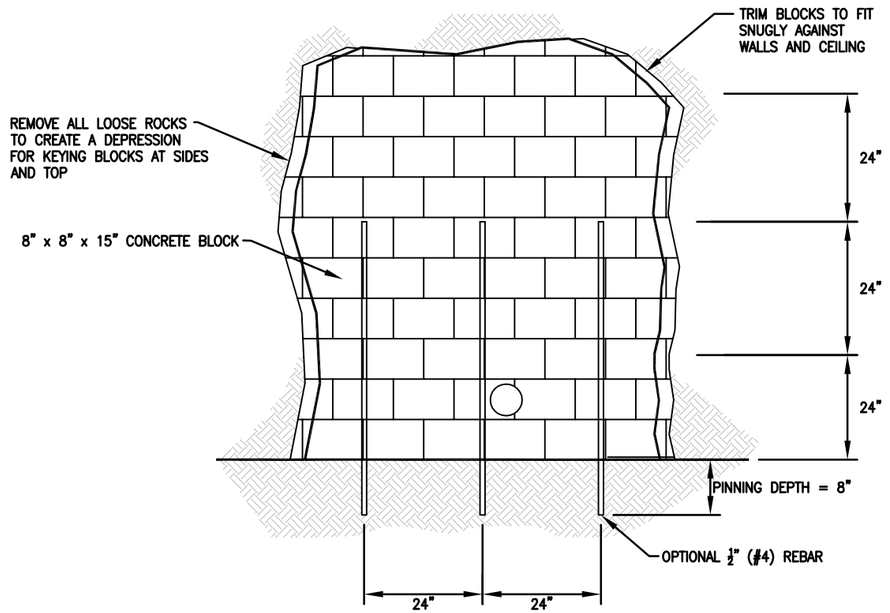


A C04 STONE WALL SECTION
NO SCALE

NO SCALE

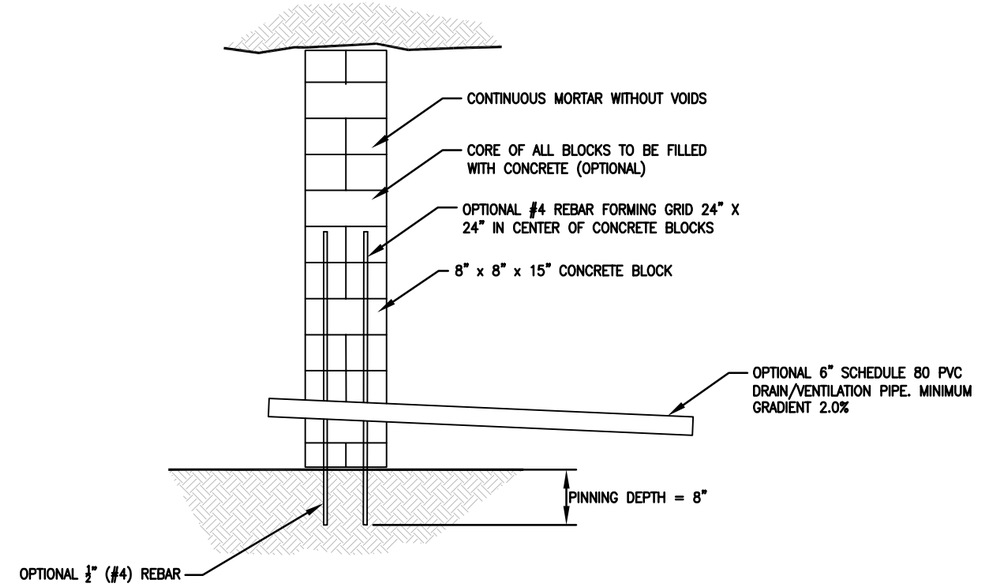
DESIGNED: JRN; CADD: CRS; TECH. REVIEW: LSS; DATE: 01/27/2010	SUB SHEET NO. C04	TITLE OF SHEET: ADIT MORTARED STONE WALL; VARIOUS NATIONAL PARKS; INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486; PKG. NO. ___; SHEET 5 OF 24

TYPICAL ELEVATION



1 CONCRETE BLOCK WALL ELEVATION
NO SCALE

TYPICAL SECTION



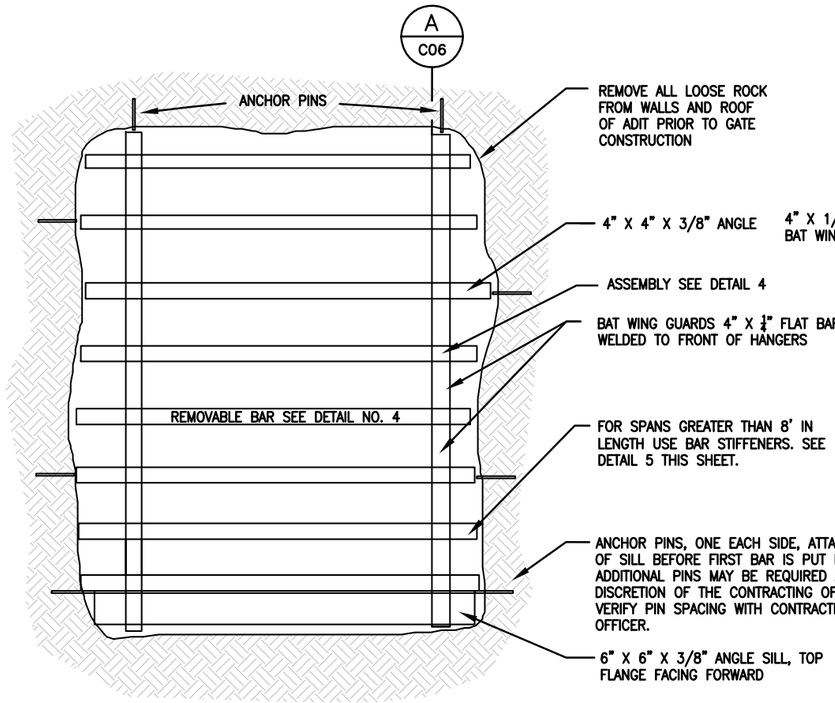
2 CONCRETE BLOCK WALL SECTION
NO SCALE

NOTES:

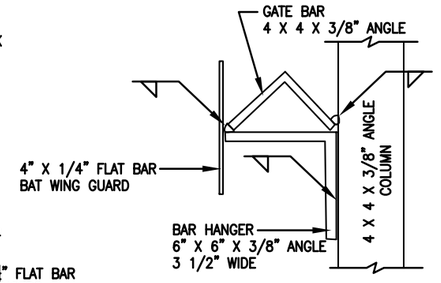
1. OPTIONAL REBAR REINFORCEMENT.
2. ROCK ATTACHMENT:
   OPTIONAL REBAR PINS (BARS) SHALL BE INSERTED INTO HOLES DRILLED A MINIMUM OF 8" INTO ROCK WALLS AND FLOOR. PINS SHALL BE SECURED USING AN INTERFERENCE FIT CREATED BY DISTORTING THE BAR WITH A SIDE HAMMER BLOW THEN DRIVING THE BAR INTO THE HOLE. HOLES SHALL BE DRILLED ⅛" LARGER IN DIAMETER THAN THE PINS. GROUTING OF PINS IS NOT REQUIRED.

NO SCALE

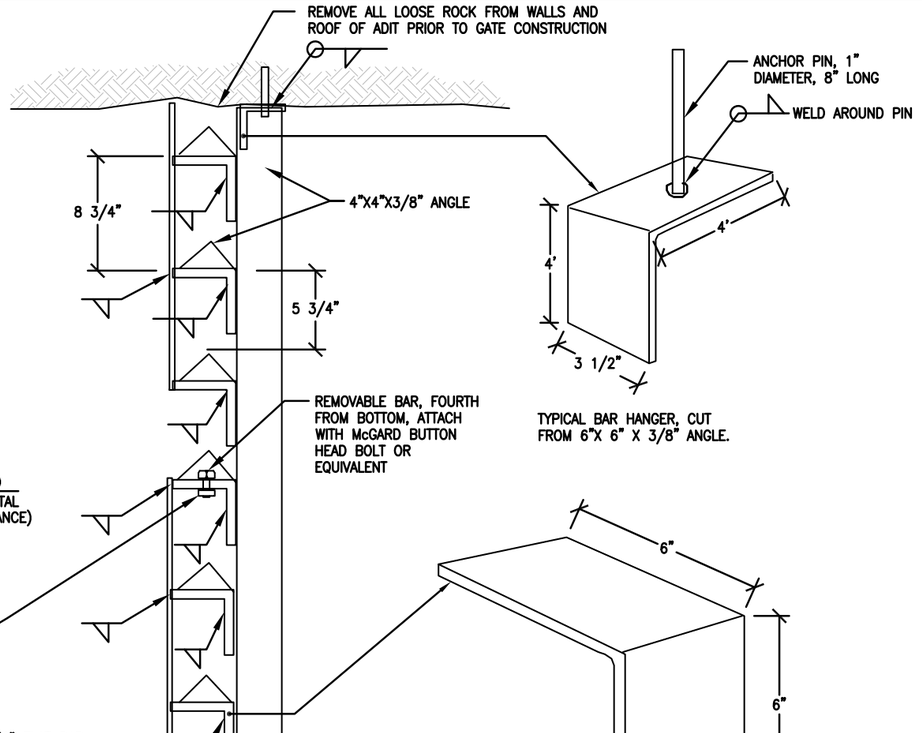
DESIGNED: JRN DRAWN: CRS TECH. REVIEW: LSS DATE: 01/27/2010	SUB SHEET NO. C05	TITLE OF SHEET ADIT CONCRETE BLOCK WALL VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 PKG. NO. ___ ___ ___ SHEET 6 OF 24



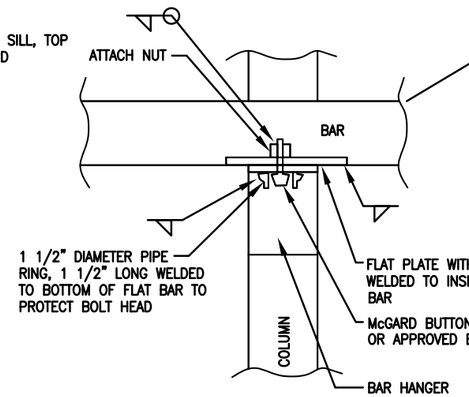
1 TYPICAL ANGLE IRON BAT GATE FRONT PROFILE
NO SCALE



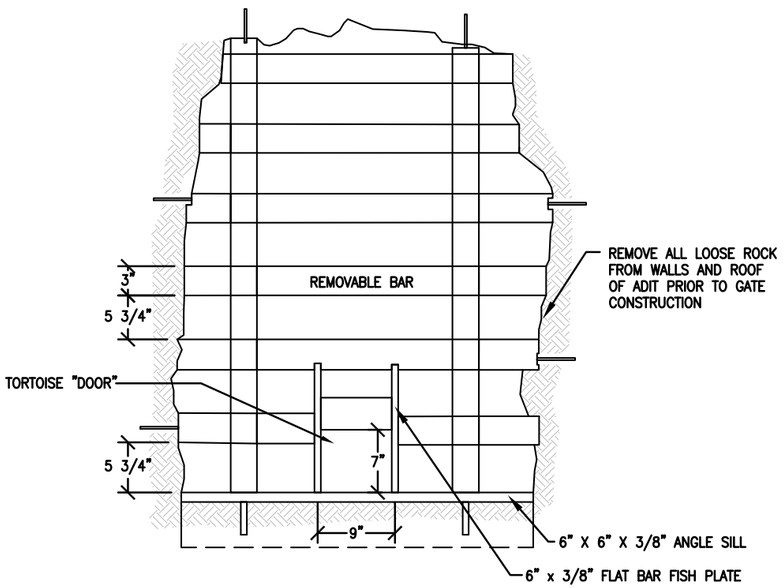
3 GATE BAR WELDING DETAIL SECTION
NO SCALE



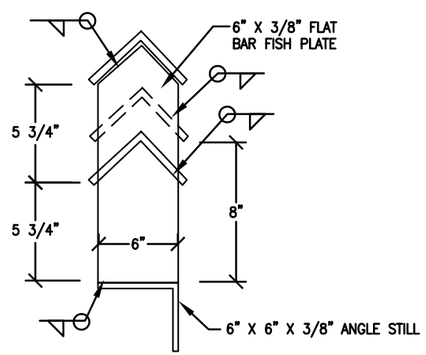
A C06 ANGLE IRON GATE SECTION
NO SCALE



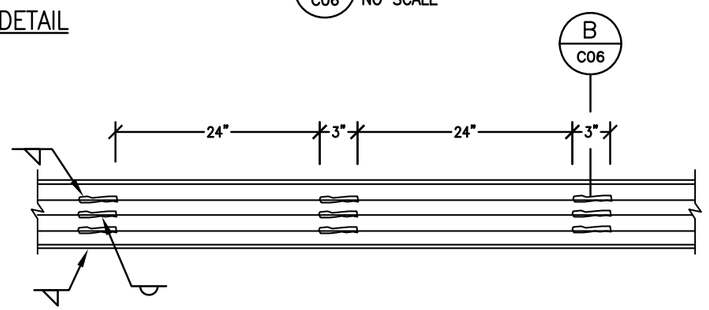
4 REMOVABLE BAR DETAIL
NO SCALE



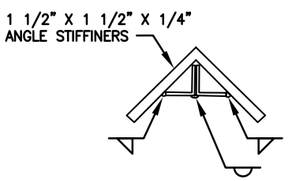
ANGLE IRON GATE SHOWING TORTOISE ACCESS OPTION
2 NO SCALE



5 TORTOISE DOOR WELDING DETAIL
NO SCALE



6 OPTIONAL WELDING PATTERN ON BOTTOM SIDE OF BAR
NO SCALE

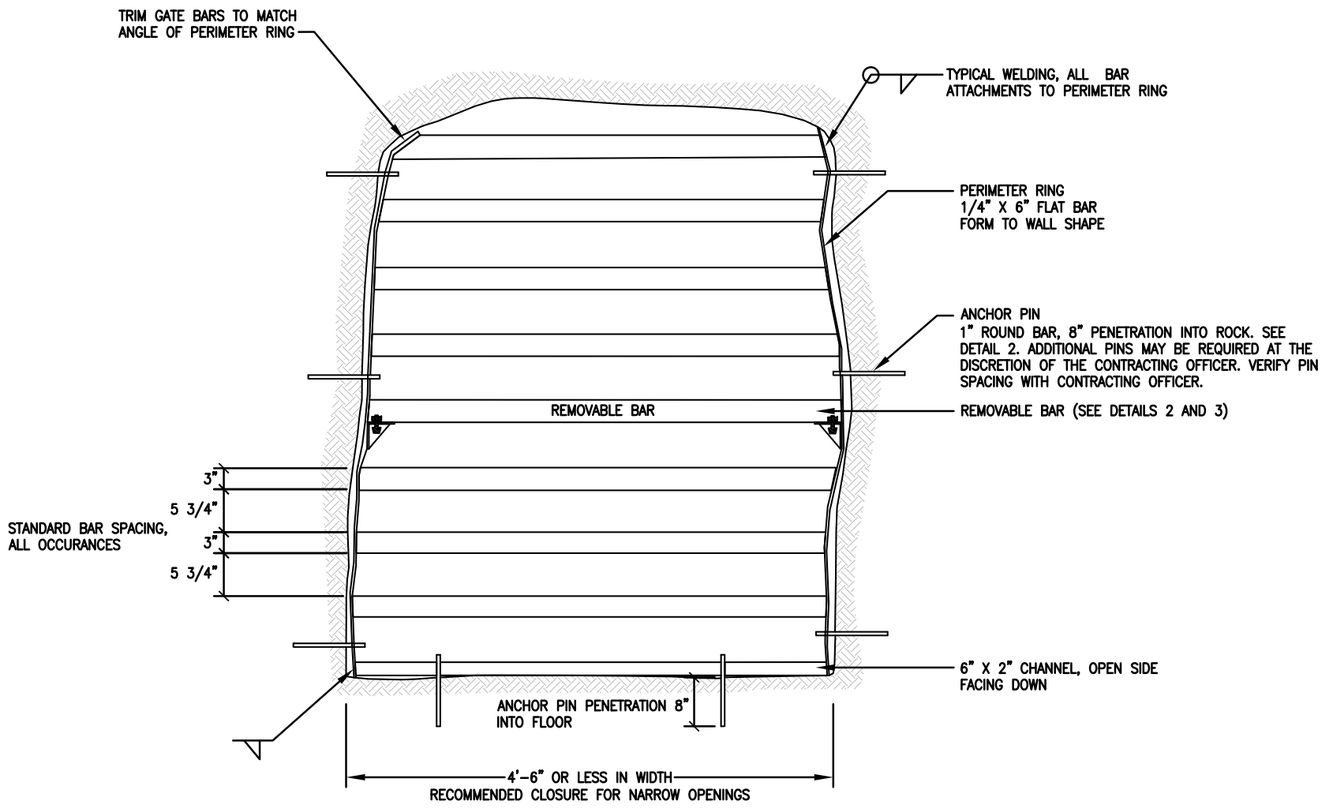


B C06 CROSS SECTION OF GATE BAR
NO SCALE

NO SCALE

DESIGNS COURTESY OF THE AMERICAN CAVE CONSERVATION ASSOCIATION

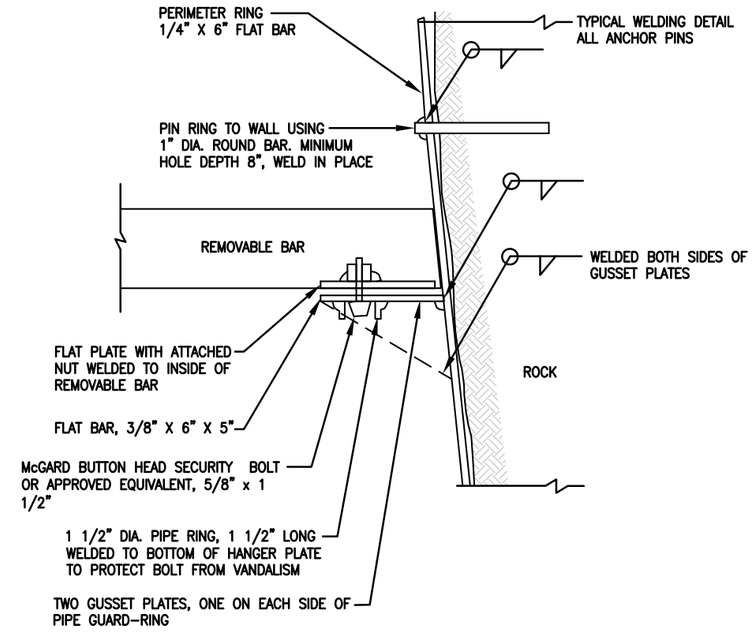
DESIGNED: JRN	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO. 999 100486
DRAFTED: CRS	C06	ADIT ANGLE IRON BAT GATE	PKG. NO. — — —
TECH. REVIEW: LSS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	SHEET 7 OF 24
DATE: 01/27/2010			



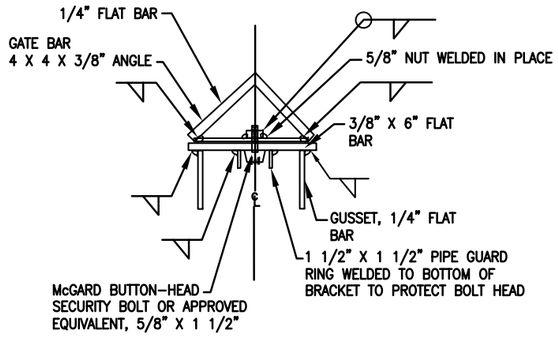
1 ANGLE IRON BAT GATE WITH PERIMETER RING OPTION
NO SCALE

NOTES:

1. THIS IS AN OPTIONAL GATE FOR OPENINGS LESS THAN 4'–6" WIDE, OR IN CASES WHERE UNINTERRUPTED BAT FLIGHT SPACE IS REQUIRED.
2. ALL WELDS OF GATE BARS TO PERIMETER RING SHALL BE FILLET, WELDED ON BOTH TOP AND BOTTOM SIDES OF BAR.
3. ALL GATE BARS SHALL BE SPACED 5¾" APART AS SHOWN IN DETAIL NO. 1.
4. ALLOWABLE SPANS (GATE BARS):
   4" X4 " X ⅜" ANGLE WITHOUT STIFFENERS.....8'–0"
   4" X 4" X ⅜" ANGLE WITH STIFFENERS.....15'–0"
   (SEE DRAWING C06 (6) FOR STIFFENER DETAIL
   3" X 3" X ⅜" SQUARE TUBING (OPTIONAL).....8'–0"



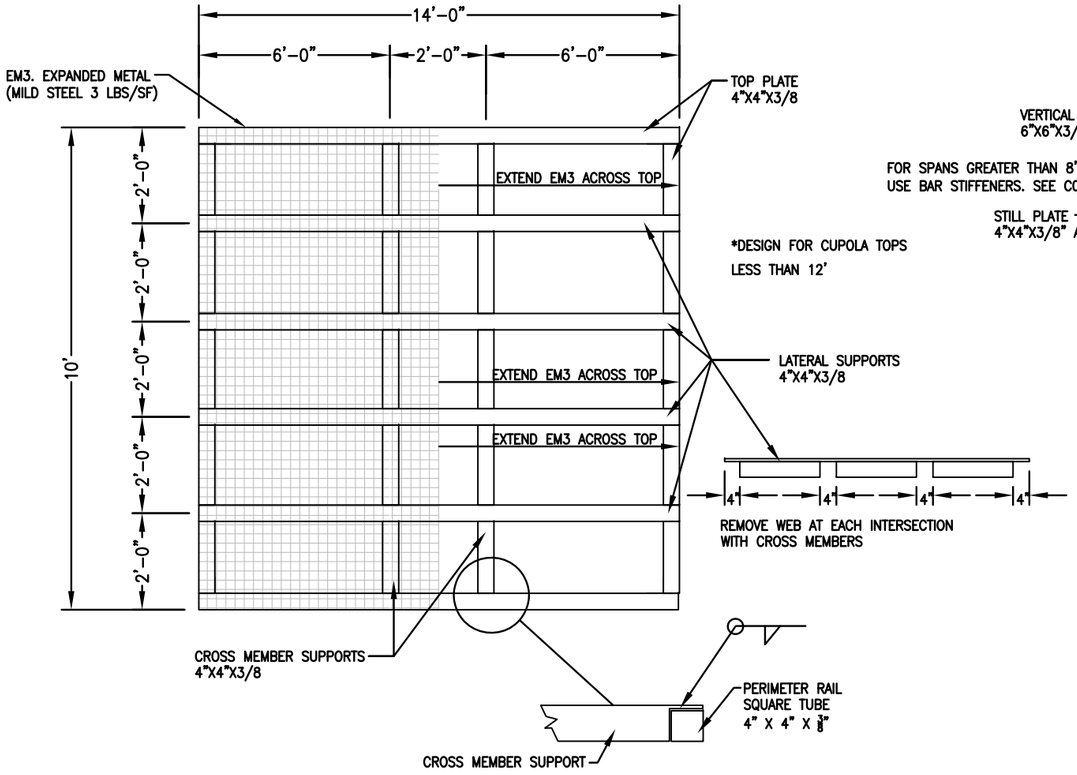
2 LONGITUDINAL SECTION BAR LOCKING MECHANISM
NO SCALE



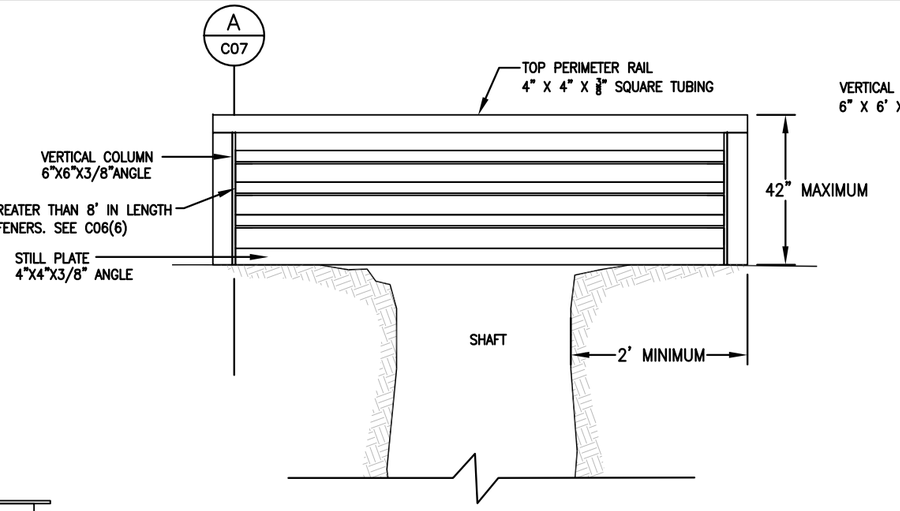
3 CROSS SECTION LOCKING BAR MECHANISM AND WELDING DETAIL
NO SCALE

NO SCALE

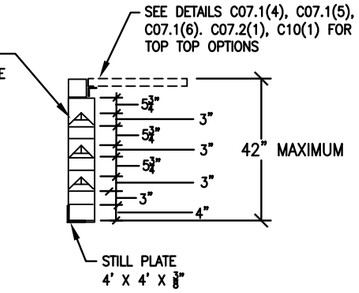
DESIGNED: JRN; CADD CRS; TECH. REVIEW: LSS; DATE: 01/27/2010	SUB SHEET NO. C06.1	TITLE OF SHEET: ADIT ANGLE IRON BAT GATE MOUNTED ON PERIMETER RING OPTION; VARIOUS NATIONAL PARKS; INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486; PKG. NO. ___; SHEET 8 OF 24



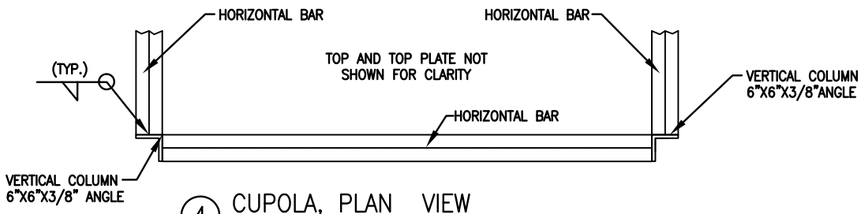
1 TOP VIEW, EM3 TOP COVER
NO SCALE



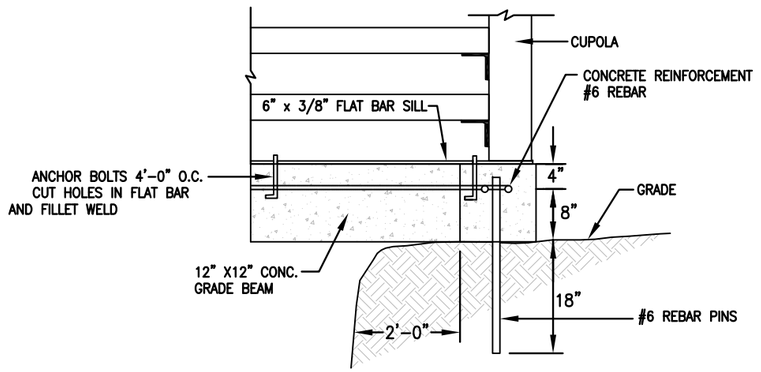
3 CUPOLA FRONT SECTION
NO SCALE



A C07 COLUMN SECTION
NO SCALE

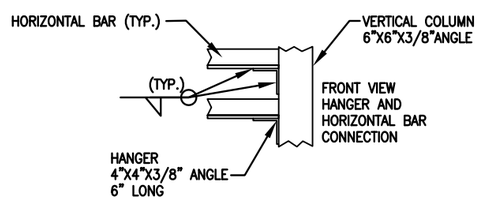


4 CUPOLA, PLAN VIEW
NO SCALE

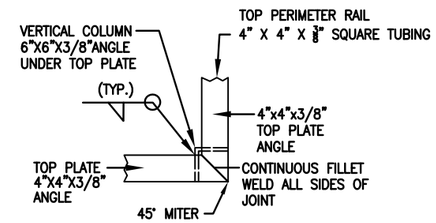


NOTE: GRADE BEAM TO BE USED WHEN SHAFT COLLAR IS IRREGULAR, OR COMPOSED OF INCOMPETENT MATERIAL. TOP SURFACE TO BE LEVEL AND SQUARE.

2 GRADE BEAM DETAIL OPTION
NOT TO SCALE



5 BAR ATTACHMENT TO COLUMN
NO SCALE

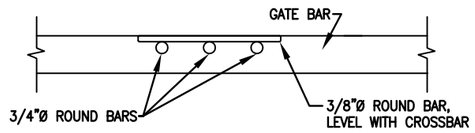


6 TOP VIEW, PERIMETER RAIL
NO SCALE

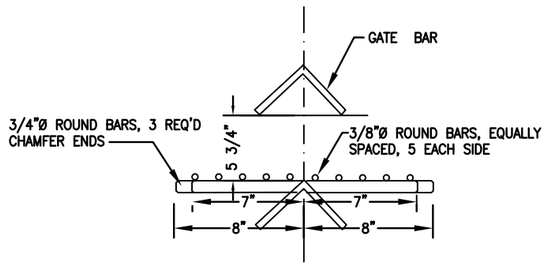
NO SCALE

DESIGN COURTESY OF THE AMERICAN CAVE CONSERVATION ASSOCIATION

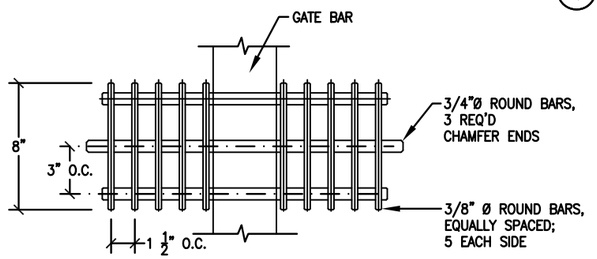
DESIGNED: JRN / CADD: CRS / TECH. REVIEW: LSS / DATE: 01/27/2010	SUB SHEET NO. C07	TITLE OF SHEET: SHAFT ANGLE IRON BAT CUPOLA — VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 / PKG. NO. / SHEET 9 OF 24



1 OWL PERCH–FRONT ELEVATION
NO SCALE



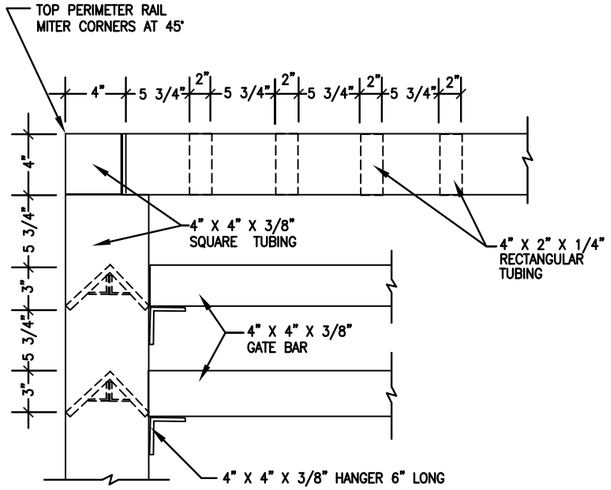
2 OWL PERCH–SECTION
NO SCALE



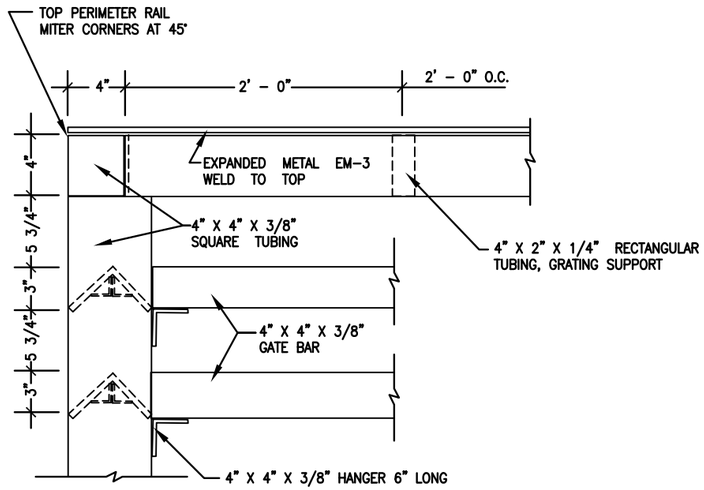
3 OWL PERCH– PLAN VIEW
NO SCALE

NOTES:

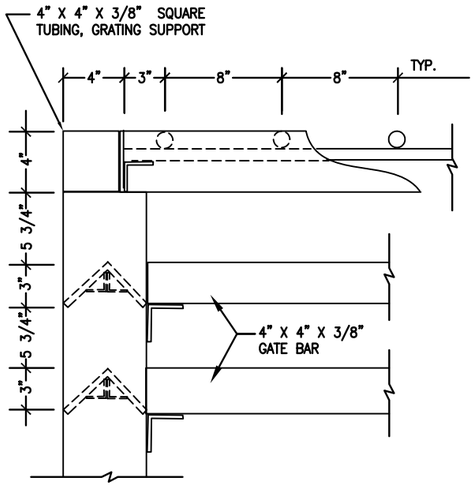
1. OPTIONAL OWL PERCH MAY BE PLACED IN CUPOLA WALLS OR WALL GATES TO PERMIT OWLS TO ROOST AND/OR ENTER MINE. THE PERCH SHALL NOT BE MOUNTED TO REMOVABLE BARS.
2. OPTIONAL CUPOLA TOPS (4, 5, 6) MAY BE USED TO ROOF ANY SHAFT CLOSURE STRUCTURES 10' X 10' IN MAXIMUM SIZE. LARGER SIZES REQUIRE ADDITIONAL CENTER SPAN SUPPORT AND CUSTOM DESIGN.



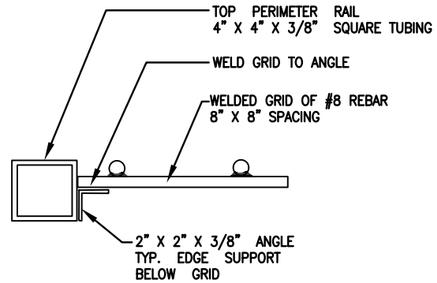
4 OPTIONAL CUPOLA TOP – SECTION
4" x 2" RECTANGULAR TUBING
NO SCALE



5 CUPOLA TOP – SECTION
EM–3 EXPANDED METAL MESH
NO SCALE



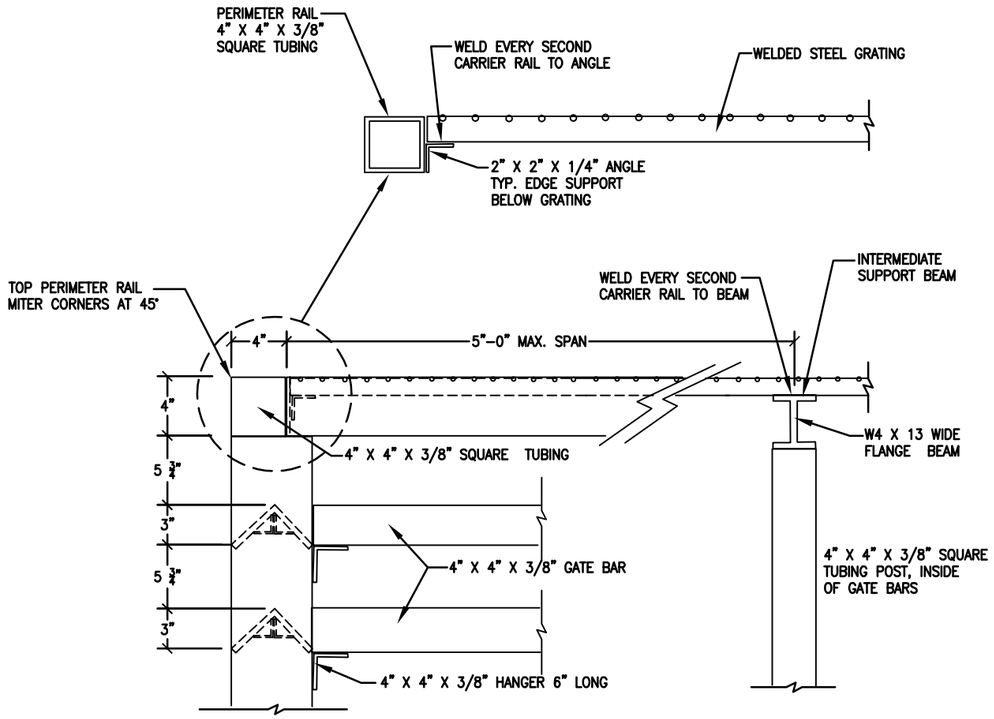
6 OPTIONAL CUPOLA TOP – SECTION
8 REBAR GRATE 8" x 8" GRID
NO SCALE



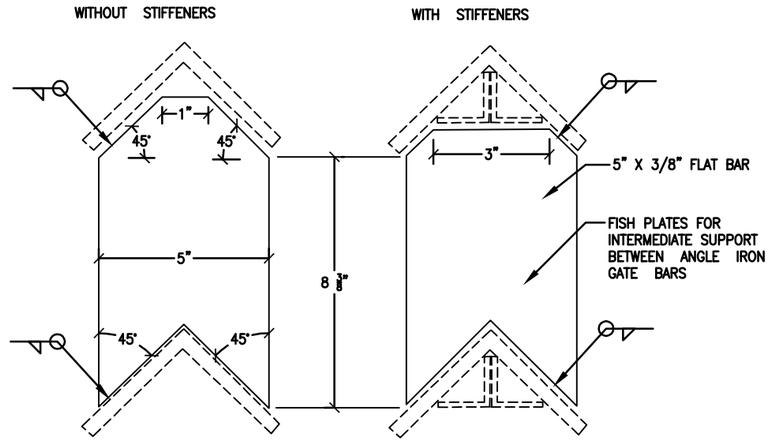
7 EDGE DETAIL PERIMETER RAIL
NO SCALE

NO SCALE

DESIGNED: JRN DRAWN: CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	SUB SHEET NO. C07.1	TITLE OF SHEET MISCELLANEOUS DETAILS #1 VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 PKG. NO. ___ ___ ___ SHEET 10 OF 24



OPTIONAL CUPOLA TOP – SECTION
WELDED STEEL GRATING
(1) NOT TO SCALE



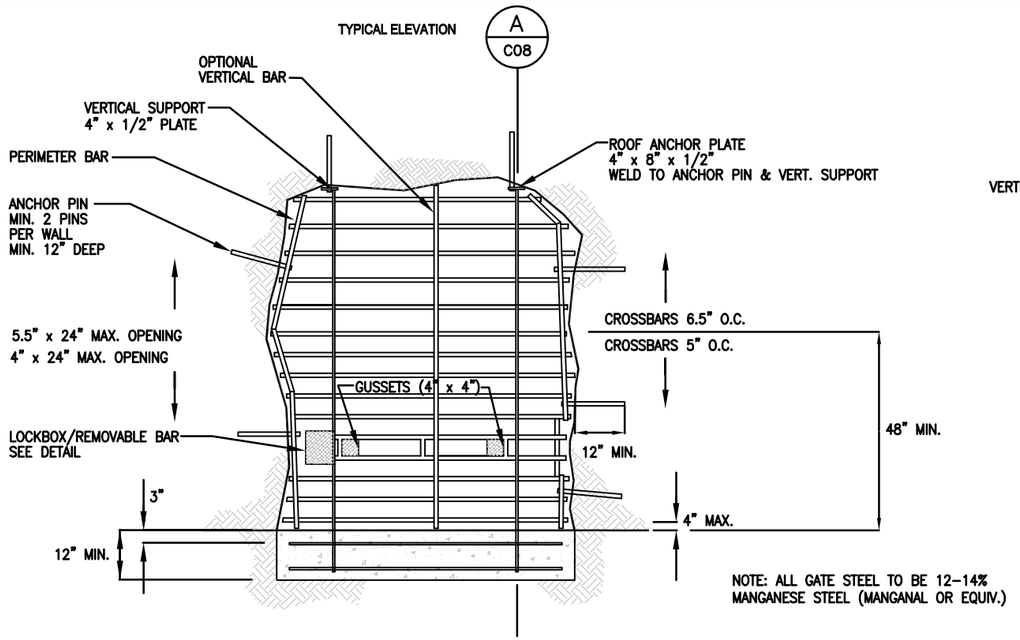
OPTIONAL FISH PLATES
SUPPORT BETWEEN GATE BARS
(2) NOT TO SCALE

NOTES:

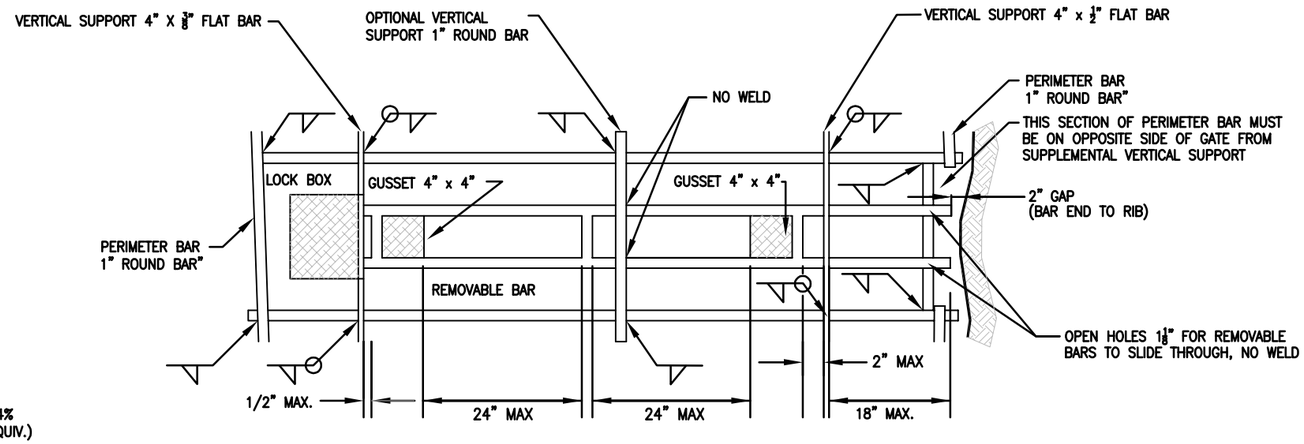
1. WELDED STEEL GRATING CREATES A SECURE TOP FOR CUPOLAS AND LOW PROFILE BAT ACCESSIBLE GRATES. THE STRONG CONSTRUCTION AND SPAN CAPABILITIES MAKE THIS TOP CLOSURE MATERIAL FAST TO INSTALL AND ATTRACTIVE. WELDED GRATING IS AVAILABLE PAINTED, HOT DIP GALVANIZED AND UNFINISHED.
2. FISH PLATES SHALL BE USED ANYWHERE ADDITIONAL SUPPORT BETWEEN ANGLE IRON GATE BARS IS REQUIRED. FISH PLATES ARE USED TO CONNECT BARS VERTICALLY, AND TO MAINTAIN BAR SPACING. FISH PLATES SHALL BE CONTINUOUSLY WELDED TO THE GATE BARS, ON BOTH SIDES, AT ALL CONTACT POINTS.

NO SCALE

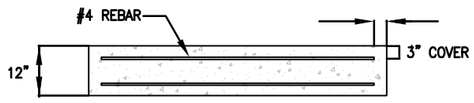
DESIGNED: JRN	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
CADD: CRS	C07.2	MISCELLANEOUS DETAILS #2	999 100486
TECH. REVIEW: LSS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	PKG. NO. — — —
DATE: 01/27/2010			SHEET 11 OF 24



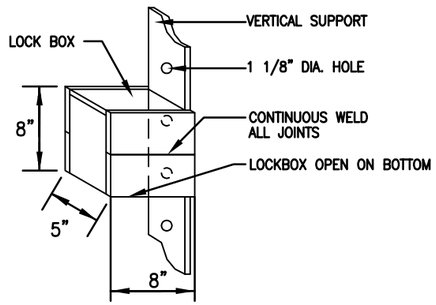
1 ADIT ROUND BAR GATE WITH REMOVEABLE BAR
NO SCALE



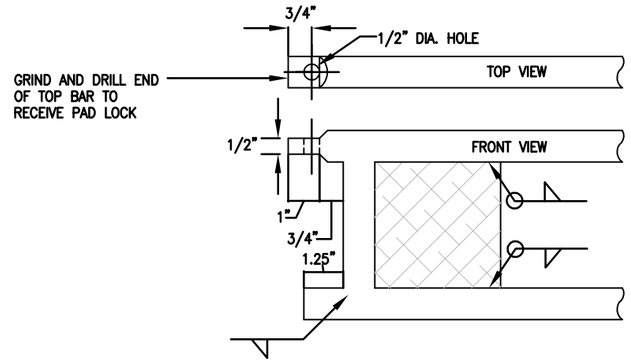
3 REMOVABLE BAR ASSEMBLY
NO SCALE



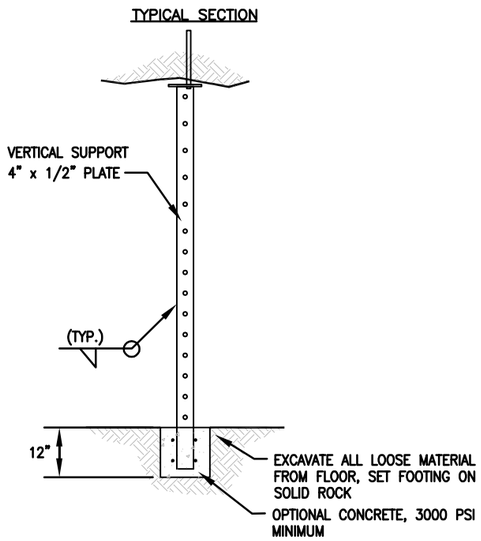
2 FOOTING DETAIL, PLAN VIEW
NO SCALE



4 LOCK BOX, OBLIQUE VIEW
NO SCALE



5 REMOVABLE BAR DETAIL
NO SCALE

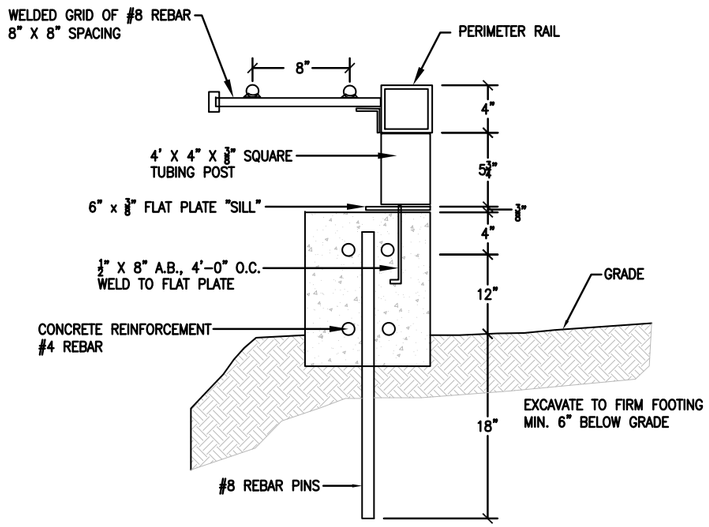


A C08 GATE CROSS SECTION
NO SCALE

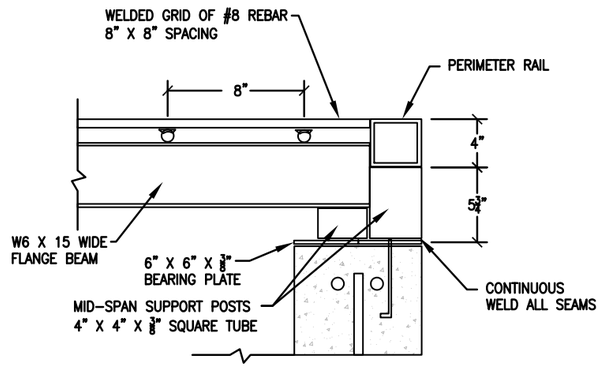
DESIGN COURTESY OF THE UTAH DEPARTMENT OF NATURAL RESOURCES

NO SCALE

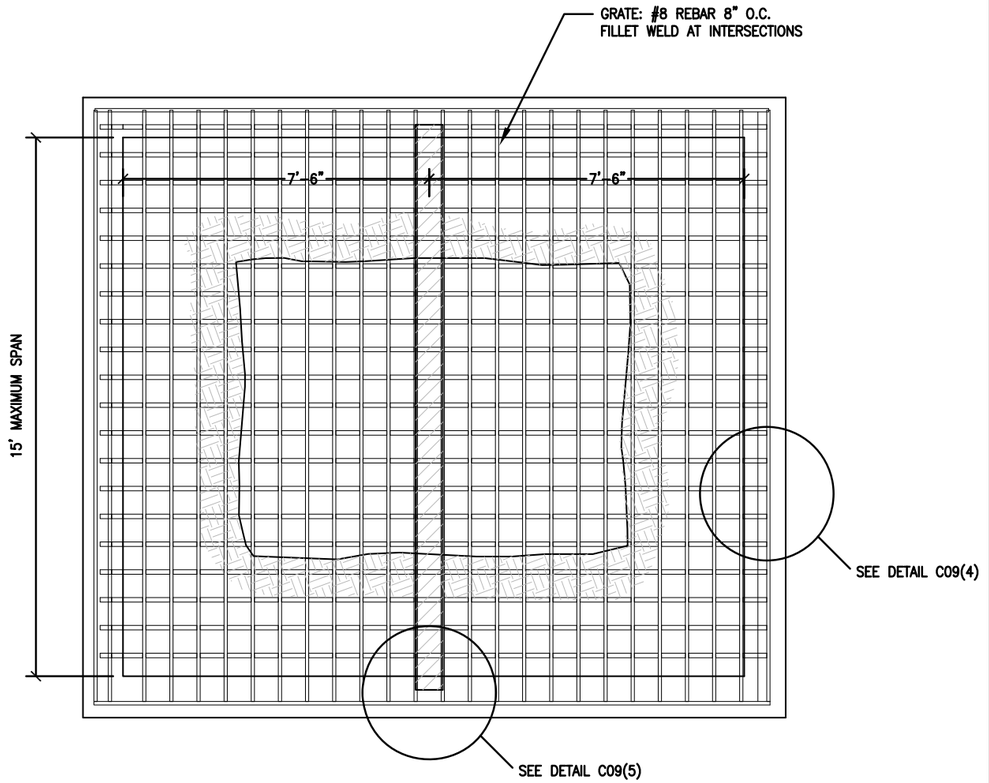
DESIGNED: JRN	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO. 999 100486
CADD: CRS	C08	ADIT ROUND BAR GATE WITH REMOVABLE BARS	PKG. NO. — — —
TECH. REVIEW: LSS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	SHEET 12 OF 24
DATE: 01/27/2010			



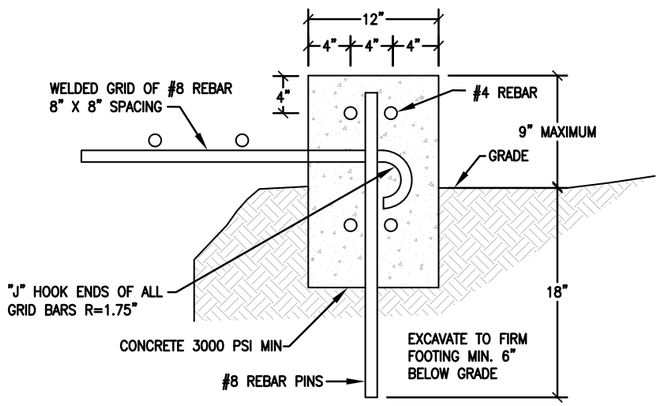
4 ELEVATED SHAFT GRATE WITH OPTIONAL BAT FLYAWAY
NO SCALE



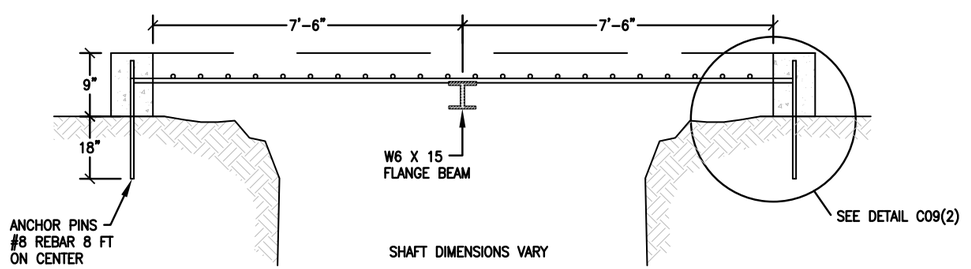
5 MID-SPAN POST AND BEAM DETAIL
NO SCALE



2 GRADE BEAM, TYPICAL PLAN
NO SCALE



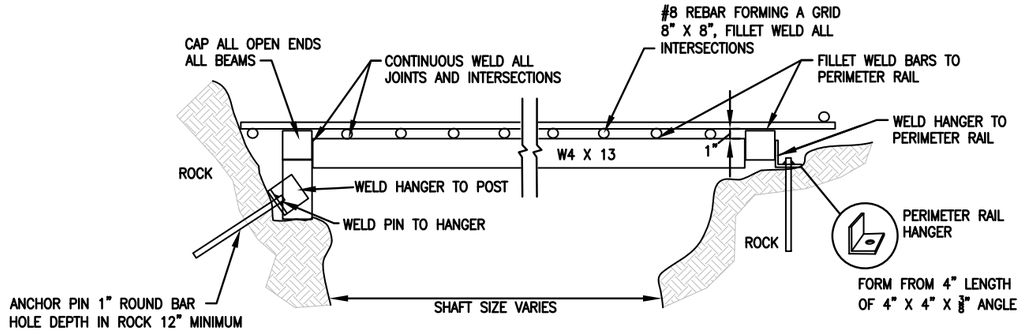
3 ELEVATED REBAR GRATE DETAIL
NO SCALE



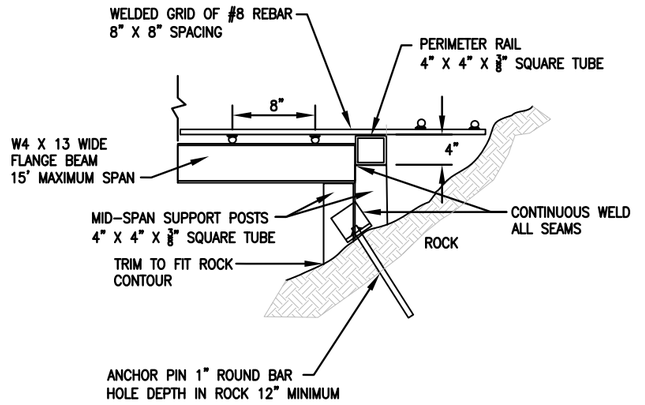
1 GRADE BEAM, TYPICAL SECTION
NO SCALE

NO SCALE

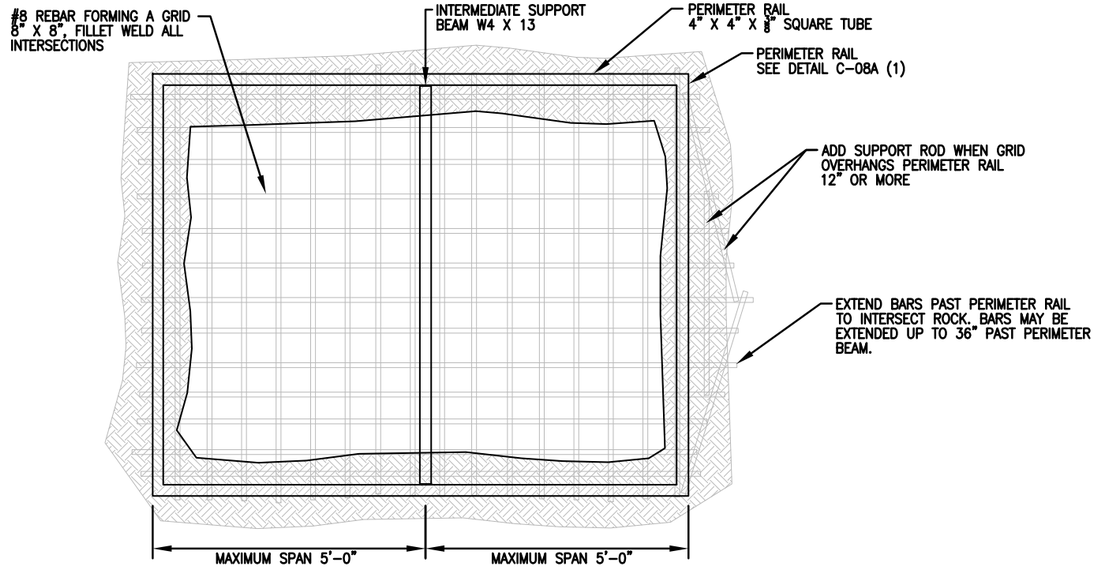
DESIGNED: JRN; CADD CRS; TECH. REVIEW: LSS; DATE: 01/27/2010	SUB SHEET NO. C09	TITLE OF SHEET: SHAFT REBAR CLOSURE — VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486; PKG. NO. ___; SHEET 13 OF 24



1 CROSS SECTION AND ASSEMBLY BEAM OPTION
NO SCALE



3 MID-SPAN POST AND BEAM DETAIL OPTION
NO SCALE



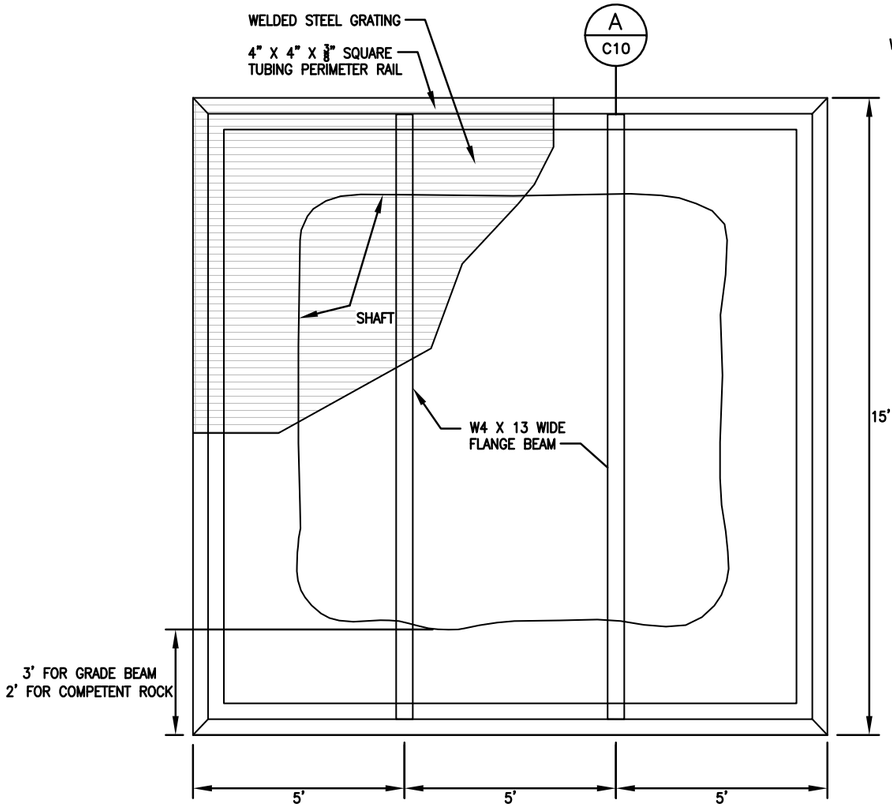
2 ROCK ANCHOR OPTIONS
NO SCALE

NOTES:

1. REBAR GRATING MAXIMUM CLEAR SPAN BETWEEN SUPPORT BEAMS 5'-0".
2. THIS CLOSURE IS SUITABLE TO MAINTAIN MINE VENTILATION. IF BAT PASSAGE IS NEEDED, REFER TO DRAWING C-08.
3. THIS CLOSURE SHOULD ONLY BE USED IN LOCATIONS WHERE VEHICLES WILL NOT BE OPERATING. THE DESIGN IS NOT INTENDED TO SUPPORT THE WEIGHT OF VEHICLES.
4. MOST REBAR IS PRODUCED WITH UNCONTROLLED CHEMISTRY, PHOSPHOROUS AND CARBON CONTENT WHICH MAKES IT UNSUITABLE FOR WELDING. FOR WELDING GRADE OBTAIN A MILL STATEMENT THAT IS SUITABLE FOR WELDING. GRADE ASTM A706 IS SUITABLE.

NO SCALE

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	C09.1	SHAFT REBAR CLOSURE ANCHOR OPTIONS VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. ___ SHEET 14 OF 24

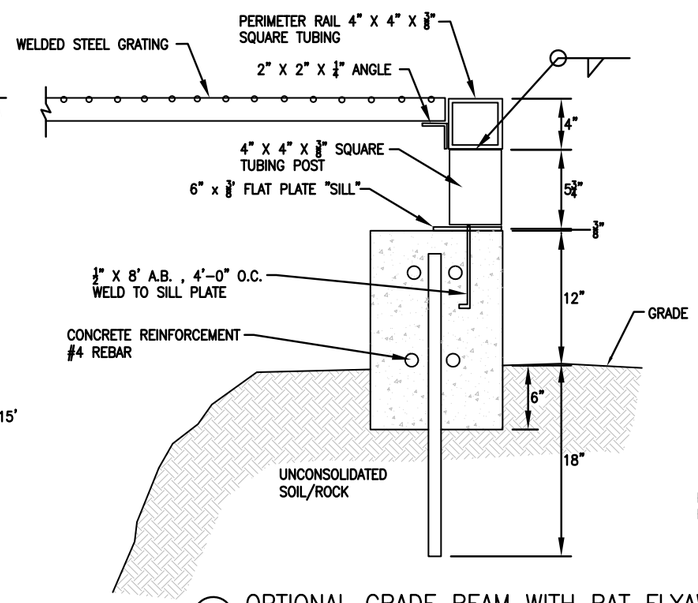


1 PLAN VIEW OF SHAFT GRATING
NO SCALE

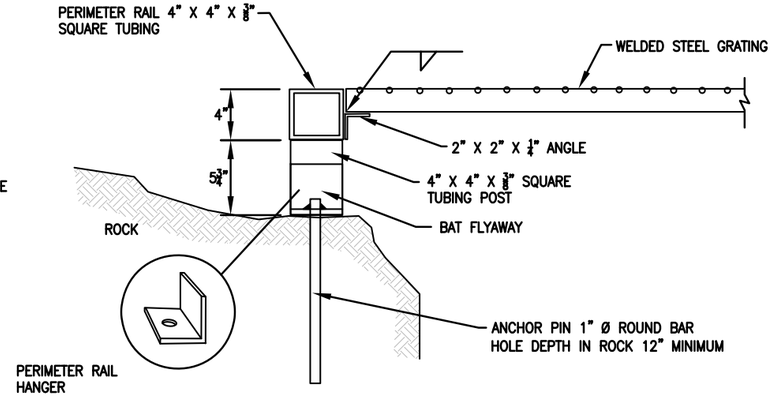
BEARING BAR SIZE	BEARING BAR SPACING	CROSS BAR SPACING	MAX. GRATING SPAN ft.
1– 1/4" x 1/8"	1– 3/16"	4"	3.5
1– 1/4" x 1/8"	15/16"	2"	4.0
1– 1/4' x 3/16"	1– 3/16"	4"	4.0
1– 1/4" x 1/8"	15/16"	2"	4.5
1– 1/2" x 1/8"	1– 3/16"	4"	4.5
1– 1/2" x 1/8"	15/16"	2"	5.0
1– 1/2" x 3/16"	1– 3/16"	4"	5.0
1– 1/2" x 3/16"	15/16"	2"	5.5
1– 3/4" x 3/16"	1– 3/16"	4"	5.5
1– 3/4" x 3/16"	15/16"	2"	6.0
2" x 3/16"	1– 3/16"	4"	6.0
2" x 3/16"	15/16"	2"	6.5
2 – 1/4" x 3/16"	1– 3/16"	4"	6.5
2 – 1/4" x 3/16"	15/16"	2"	6.5
2 – 1/2" x 3/16"	1– 3/16"	4"	6.5
2 – 1/2" x 3/16"	15/16"	2"	7.0

STEEL BEAMS WILL BE USED TO REDUCE ALL GRATING SPANS TO A MAXIMUM AS SHOWN ABOVE. FOR SHAFT SPANS OF TWELVE FEET (12'), OR LESS, W4 X 13 STEEL BEAMS WILL BE USED. FOR SHAFT SPANS BETWEEN TWELVE FEET (12') AND TWENTY FEET (20'), W6 X 20 STEEL BEAMS SHALL BE USED.

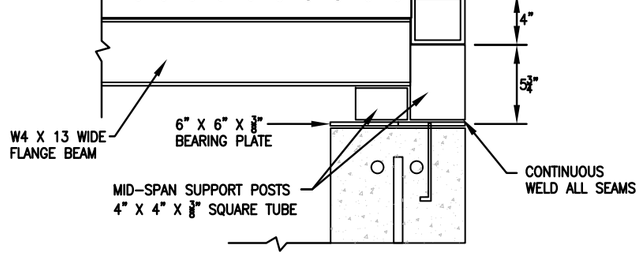
2 TABLE OF GRATING SPANS
NO SCALE



3 OPTIONAL GRADE BEAM WITH BAT FLYAWAY
NO SCALE

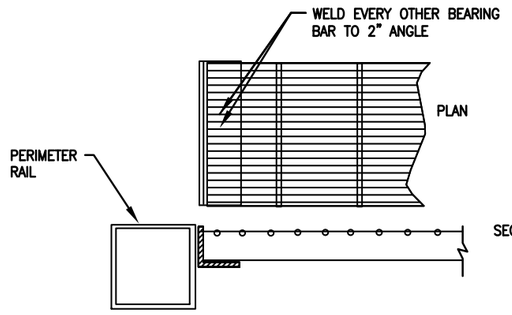


5 OPTIONAL ELEVATED WELDED STEEL GRATING WITH A BAT FLYAWAY
NO SCALE



A C10 MID–SPAN POST AND BEAM
NO SCALE

6 PERIMETER RAIL WITH CONCRETE SUPPORT
NO SCALE



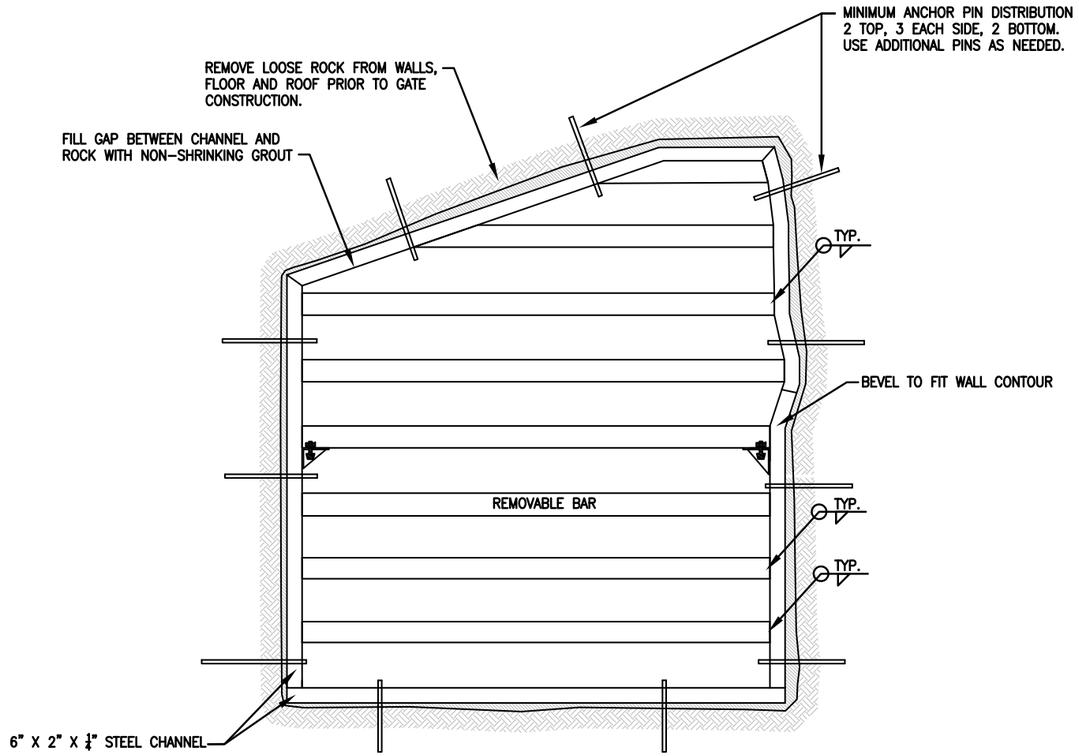
4 EDGE DETAIL, PLAN AND SECTION VIEWS
NO SCALE

NOTES:

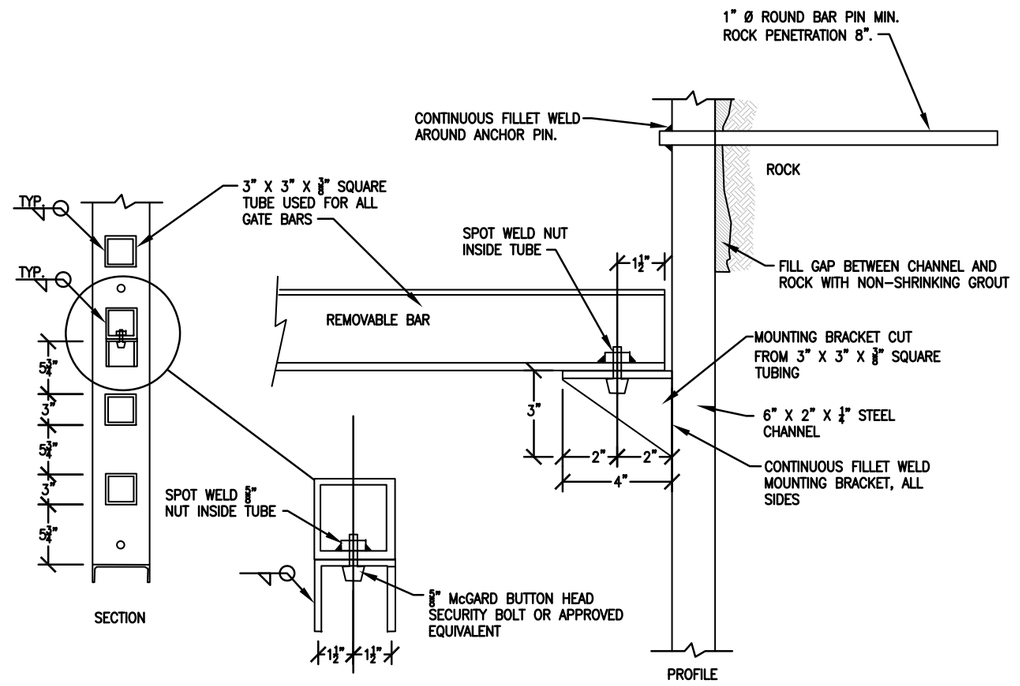
1. A GRADE BEAM IF REQUIRED SHALL BE INSTALLED AROUND THE ENTIRE PERIMETER OF THE STEEL GRATE.

NO SCALE

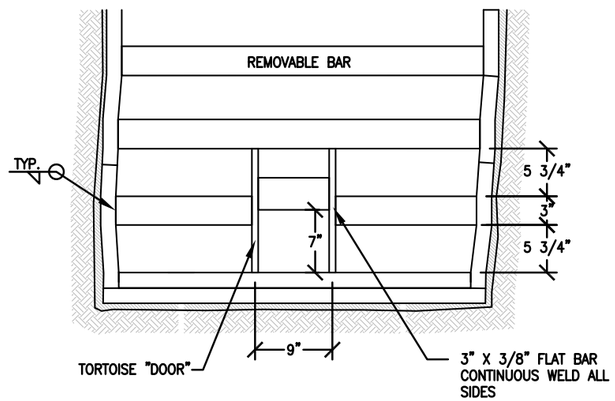
DESIGNED: JRN; DRAWN: CRS; TECH. REVIEW: LSS; DATE: 01/27/2010	SUB SHEET NO. C10	TITLE OF SHEET: SHAFT STEEL GRATE WITH I–BEAM SUPPORT — VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486; PKG. NO.; SHEET 15 OF 24



1 SQUARE TUBE BAT GATE PROFILE
NO SCALE



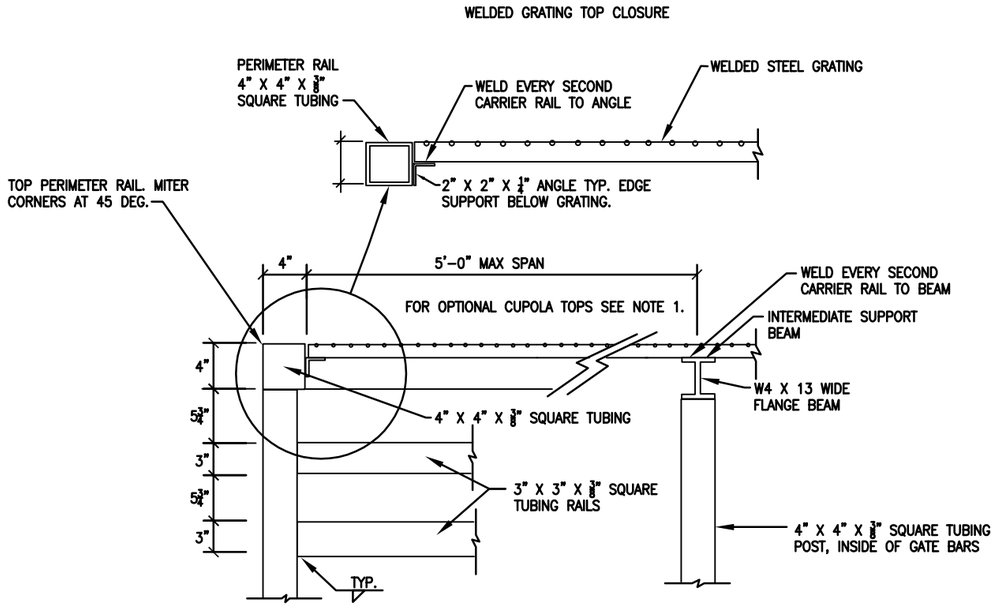
2 LOCKING BAR DETAIL
NO SCALE



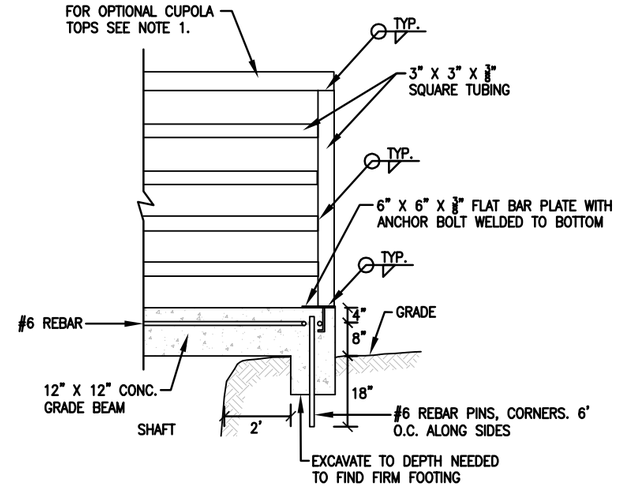
3 LOWER HALF OF GATE OPTIONAL TORTOISE ACCESS
NO SCALE

NO SCALE

DESIGNED: JRN DRAWN: CRS TECH. REVIEW: LSS DATE: 01/27/2010	SUB SHEET NO. C11	TITLE OF SHEET ADIT SQUARE BAR BAT GATE VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 PKG. NO. ___ ___ ___ SHEET 16 OF 24



1 SHAFT CLOSURE SQUARE TUBING CUPOLA
NO SCALE



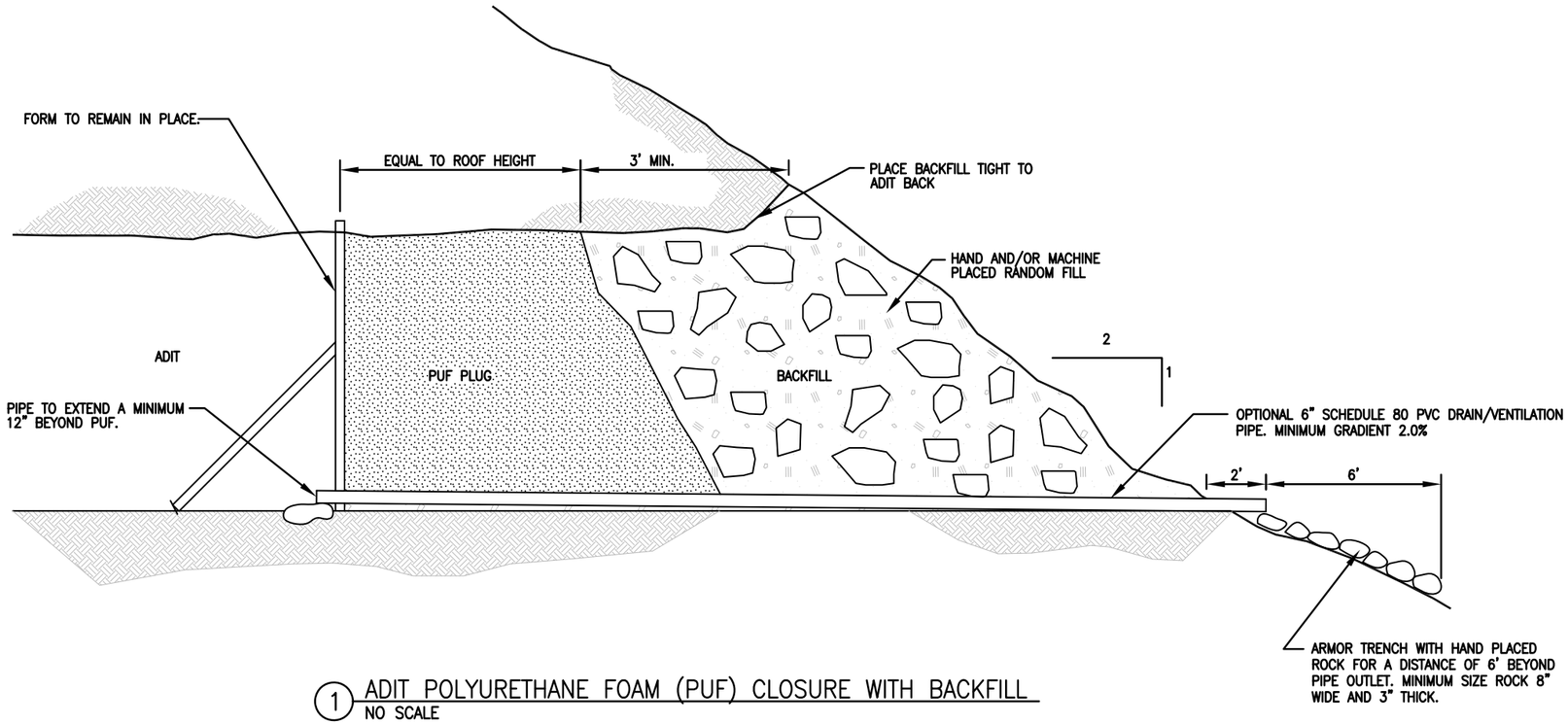
2 SHAFT SQUARE TUBING CUPOLA FOOTING SECTION
NO SCALE

NOTES:

1. A VARIETY OF TOP CLOSURES ARE POSSIBLE FOR ALL CUPOLAS. ILLUSTRATED IS WELDED STEEL GRATING, BUT ADDITIONAL OPTIONS MAY BE USED. REFER TO DETAILS C07 (1) AND C07.1 (4) (5) (6) FOR ADDITIONAL TOP CLOSURE METHODS.
2. A GRADE BEAM SHALL BE USED WHEN SHAFT COLLAR IS IRREGULAR, OR COMPOSED OF INCOMPETENT MATERIAL. THE TOP SHALL BE LEVEL AND SQUARE.

NO SCALE

DESIGNED: JRN DRAWN: CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	SUB SHEET NO. C12	TITLE OF SHEET SHAFT SQUARE TUBING BAT CUPOLA VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 PKG. NO. ___ SHEET 17 OF 24



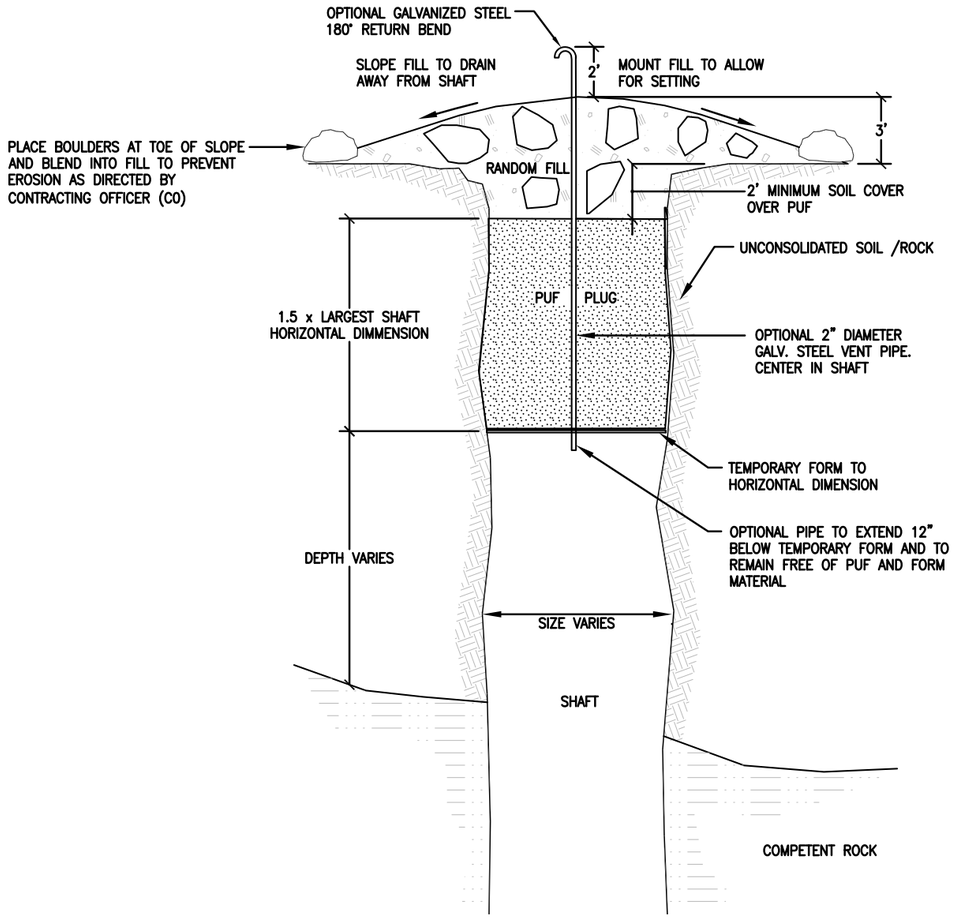
1 ADIT POLYURETHANE FOAM (PUF) CLOSURE WITH BACKFILL
NO SCALE

NOTES:

1. THICKNESS OF PUF FILL SHALL EQUAL THE PASSAGE HEIGHT AS MEASURED ALONG THE CEILING (ADIT BACK).
2. TEMPORARY FORMS MAY BE CONSTRUCTED OF ANY MATERIAL CAPABLE OF SUSTAINING AN INITIAL LIFT OF FOAM. MATERIALS COMMONLY USED INCLUDE PLYWOOD, PLASTIC SHEETING, DIMENSION LUMBER, REBAR, EXPANDED METAL, FOAM BOARD, AND FENCE MATERIALS.
3. OPTIONAL PVC PIPE LENGTHS SHALL BE JOINED USING SLIP COUPLINGS AND PVC CEMENT.

NO SCALE

DESIGNED: JRN DRAWN: CRS TECH. REVIEW: LSS DATE: 01/27/2010	SUB SHEET NO. C13	TITLE OF SHEET ADIT PUF CLOSURE WITH BACKFILL VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486 PKG. NO. ___ ___ ___ SHEET 18 OF 24



(2) SHAFT POLYURETHANE (PUF) CLOSURE WITH BACKFILL
NO SCALE

NOTES:

1. THE OPTIONAL VENTILATION/DRAIN PIPE SHALL BE PLACED THROUGH THE BOTTOM FORM UNOBSTRUCTED BY CROSS–MEMBERS. THE VENTILATION/DRAIN PIPE SHALL BE OPEN TO THE SHAFT AFTER INSTALLATION OF THE FOAM. THE VENTILATION PIPE SHALL BE SUPPORTED BY A TRIPOD OR OTHER LOAD–BEARING DEVICE SUCH THAT THE LOAD IS NOT PLACED ON THE BOTTOM FORM.

2. THE OPTIONAL 2–INCH STEEL VENTILATION/DRAIN PIPE SHALL BE INSTALLED IN THE APPROXIMATE CENTER OF THE PUF INSTALLATION AND SHALL EXTEND VERTICALLY TO THE LINES AND GRADES AS SHOWN ON THE IN THE DRAWING.

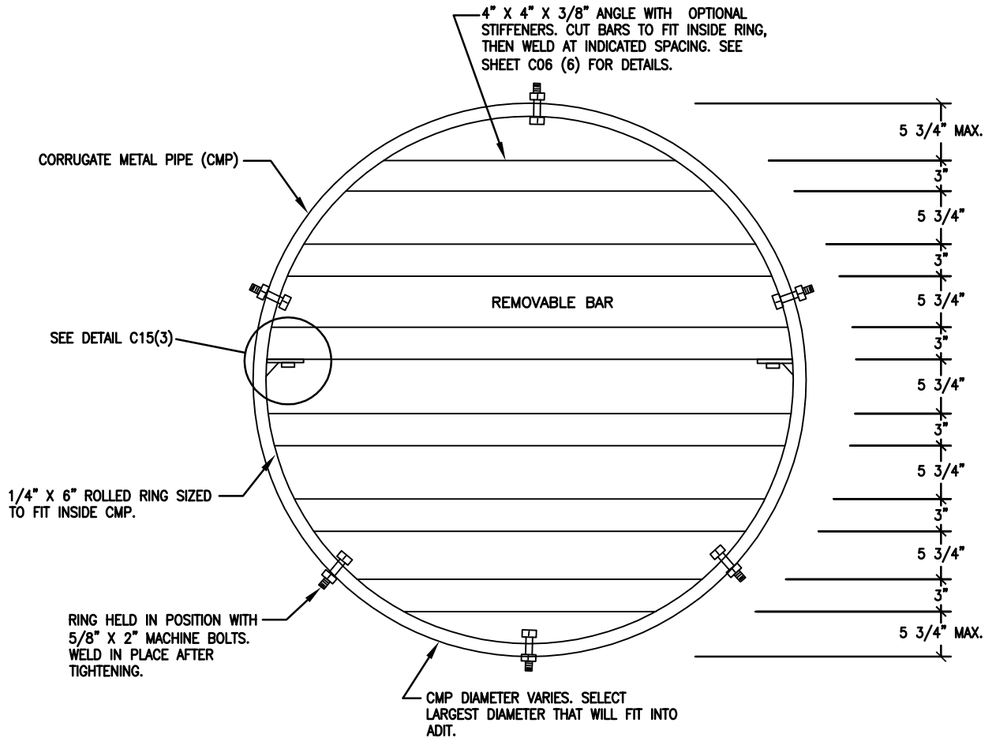
3. THE OPTIONAL STEEL VENTILATION/DRAIN PIPE SHALL EXTEND UP THROUGH THE ENTIRE PUF AND BACKFILL MATERIAL TO PROVIDE VENTILATION AND THROUGH THE ENTIRE STRUCTURE. THE 2–INCH STEEL PIPE SHALL 2 FEET ABOVE GROUND LEVEL AND A 180° TURN BEND INSTALLED.

4. CLEAR DEBRIS OTHER THAN FIXED, ATTACHED OR PERMANENT STRUCTURES FROM THE SHAFT BEFORE PUF IS INSTALLED AS DIRECTED BY THE CONTRACTING OFFICER. HISTORIC STRUCTURAL FEATURES SHALL BE PRESERVED AND MAINTAINED. ANY HISTORIC DEBRIS REMOVED SHALL BE PLACED NEATLY TO THE SIDE OF THE OPENING.

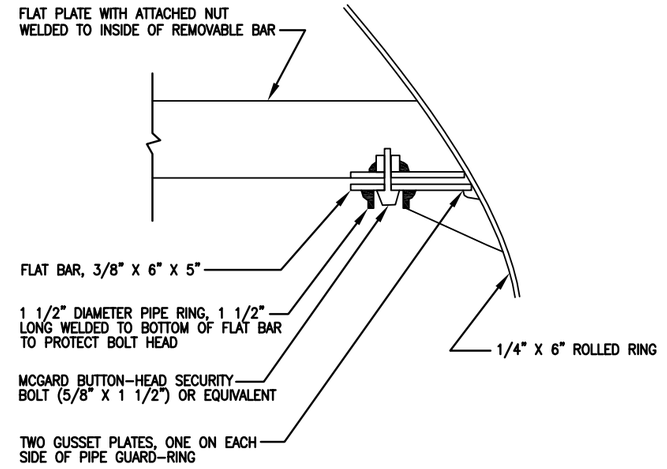
5. THE FORMWORK SHALL BE INSTALLED BELOW THE SURFACE OF THE SHAFT AT THE BOTTOM OF THE FOAM DEPTH LEVEL. THE DEPTH OF FOAM REQUIRED TO PLUG A SHAFT SHALL BE DETERMINED BY THE FOLLOWING FORMULA: THE DEPTH OF PUF IN VERTICAL OPENINGS SHALL BE AT LEAST 1.5 TIMES THE LARGEST DIMENSION OF THE OPENING. IN CIRCULAR OR NEAR CIRCULAR FEATURES, THE MINIMUM DEPTH WILL BE 1.5 TIMES THE DIAMETER (OR AVERAGE DIAMETER) OF THE FEATURE. CROSS–MEMBER SUPPORTS MAY BE PLACED AT AN ANGLE NOT MORE THAN 20 DEGREES FROM HORIZONTAL AS LONG AS BOTH ENDS ARE SEATED IN THE SHAFT. THE BOTTOM FORM SHALL BE SET OVER THE CROSS–MEMBERS. FORMWORK MAY BE SUSPENDED BY ROPES TO AVOID PLACING PERSONNEL INSIDE THE SHAFT.

NO SCALE

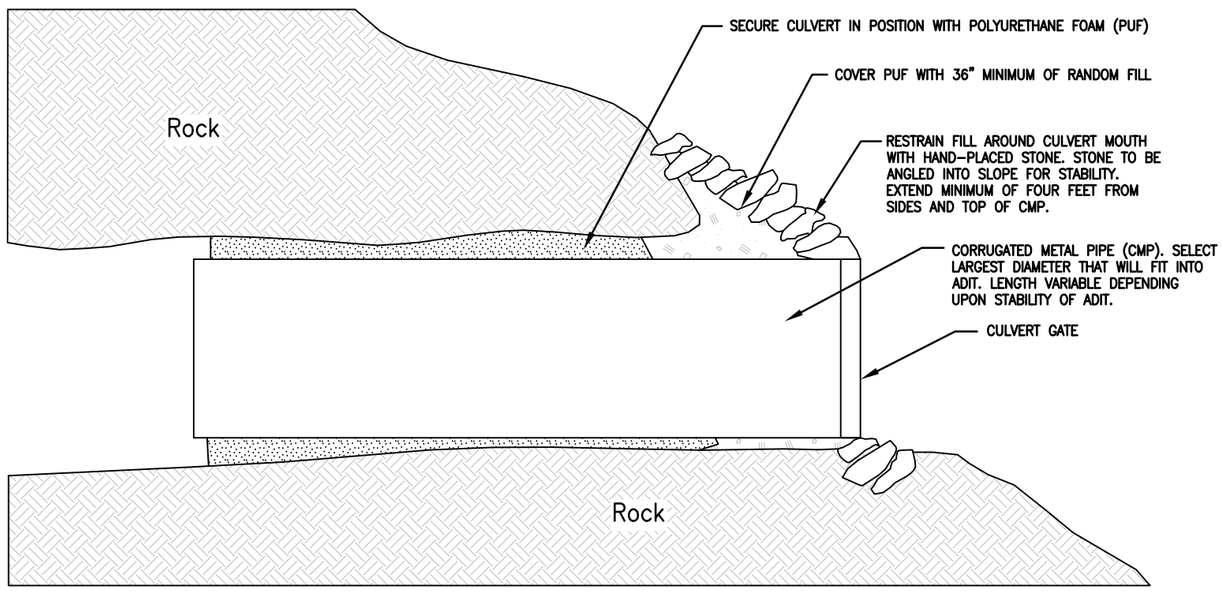
DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN	C14	SHAFT PUF CLOSURE WITH BACKFILL	999 100486
DRAWN: CRS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	PKG. NO. — — —
TECH. REVIEW: LSS			SHEET 19 OF 24
DATE: 01/27/2010			



1 CULVERT GATE – SECTION
NO SCALE



3 REMOVABLE BAR DETAIL
NO SCALE



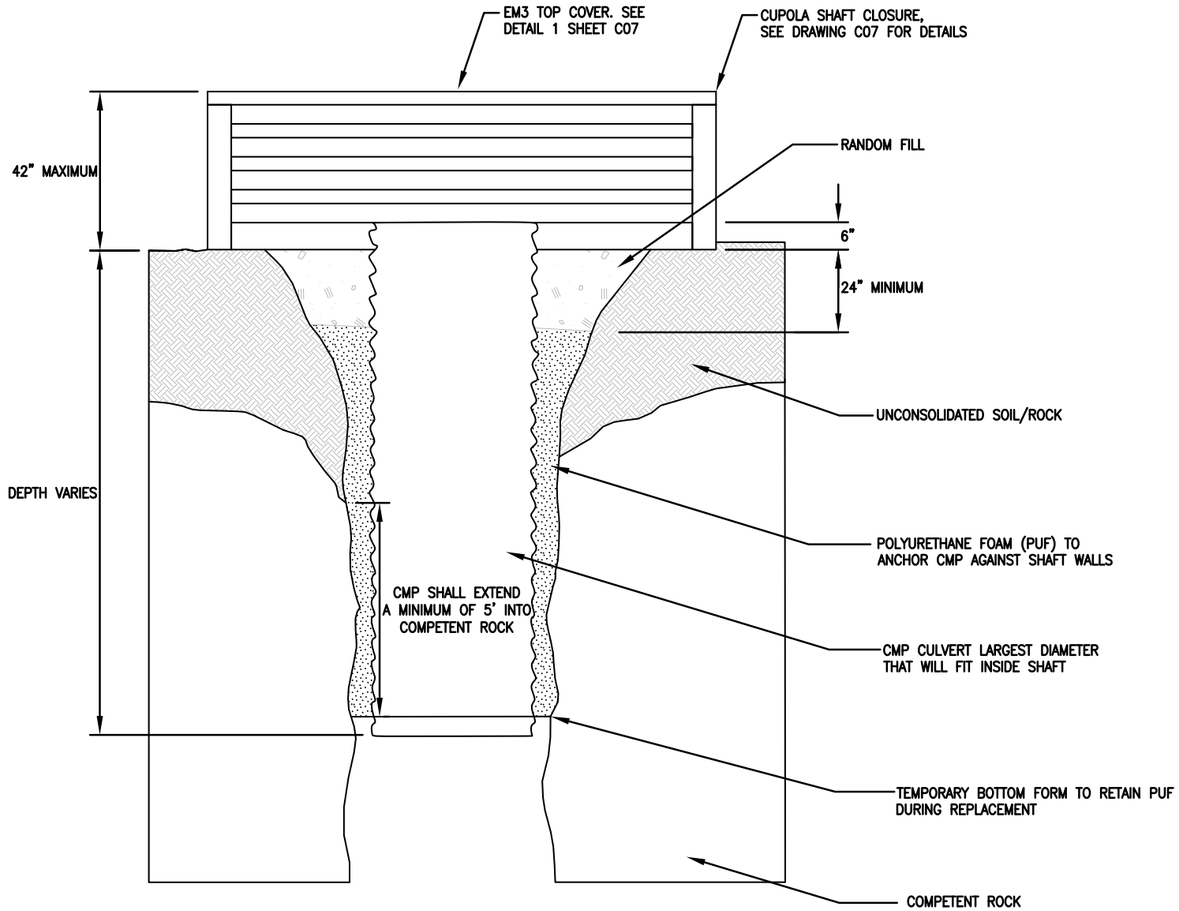
2 CULVERT GATE – PROFILE
NO SCALE

NOTES:

1. THIS GATE IS INTENDED FOR STABILIZATION OF COLLAPSING PORTALS.
2. AN OPTIONAL COLLAR OF CONCRETE MAY BE PLACED AROUND THE CULVERT MOUTH ON THE SURFACE. THE CONCRETE SHALL BE A MINIMUM OF 6" THICK AND EXTEND A MINIMUM OF 4 FEET ABOVE AND TO THE SIDES. THE CONCRETE SHALL BE REINFORCED USING A CROSS GRID OF #4 REBAR, TIED WITH WIRE, LAID IN A 12" X 12" PATTERN. THE REBAR SHALL BE PLACED IN THE CENTER OF THE CONCRETE WITH 3" OF COVER, TOP AND BOTTOM.
3. ONLY THE LARGEST DIAMETER CULVERT (CMP) THAT WILL FIT INSIDE THE PORTAL SHALL BE USED.
4. DETAILS ON PUF APPLICATION AND STANDARDS MAY BE FOUND IN THE SPECIFICATIONS

NO SCALE

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	C15	ADIT CORRUGATED METAL PIPE WITH BAT GATE VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. SHEET 20 OF 24



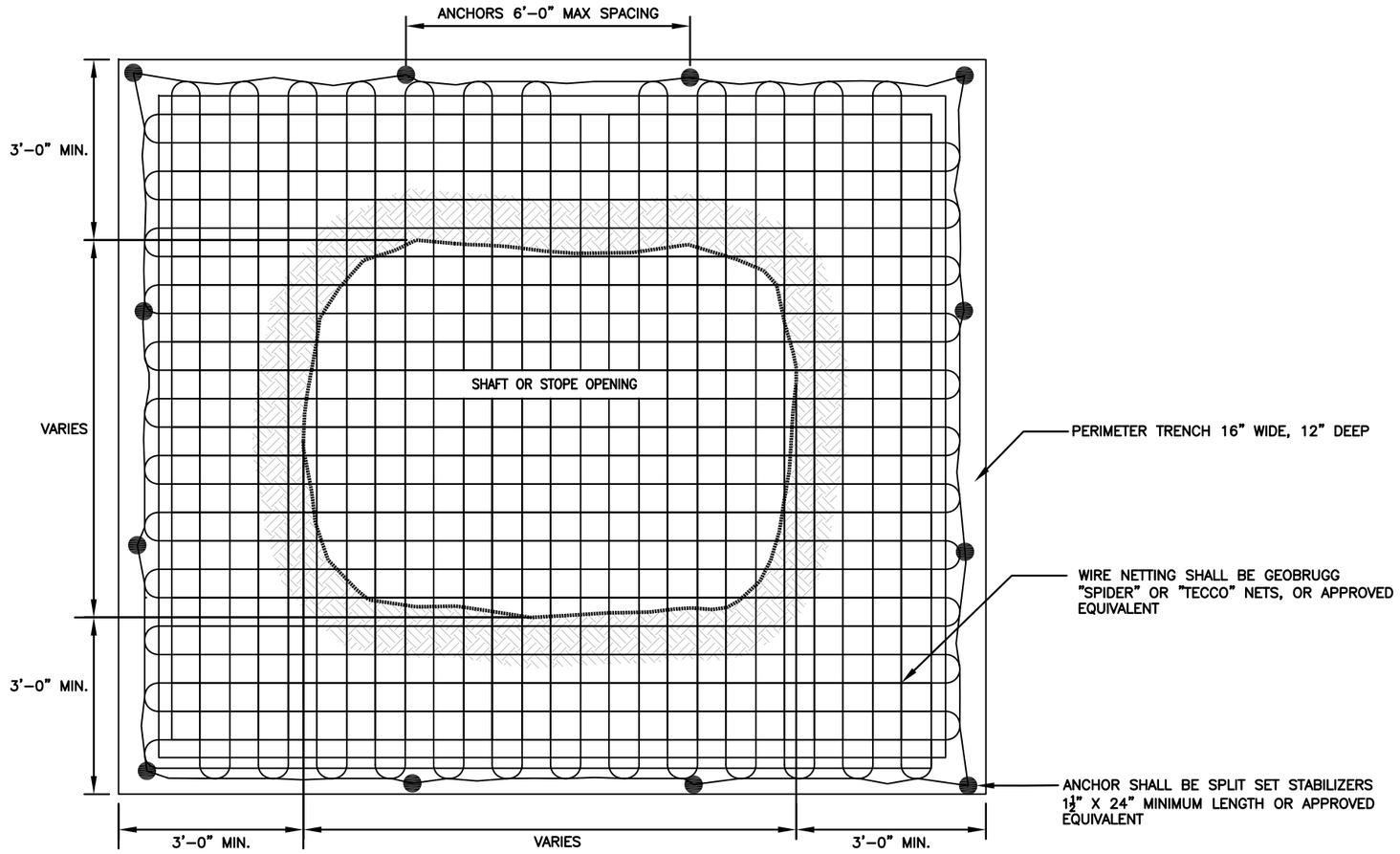
1 CMP SHAFT REINFORCEMENT–PROFILE
NOT TO SCALE

NOTES:

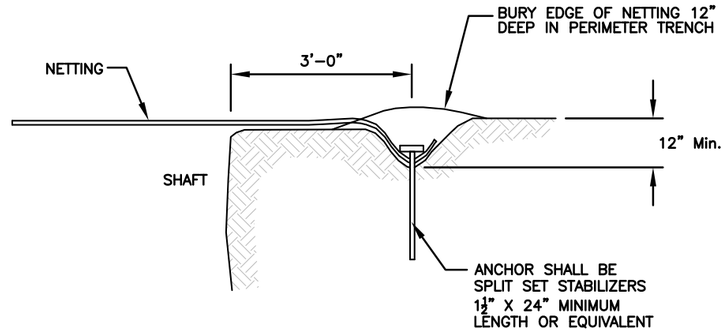
1. CMP SHALL BE EXTENDED 6" ABOVE GRADE TO PREVENT SURFACE WATER FROM ENTERING THE SHAFT.
2. RANDOM FILL 24" DEEP IS REQUIRED OVER PUF TO PROVIDE PROTECTION FROM UV RADIATION.
3. AN OPTIONAL CONCRETE CAP 12" THICK CAN BE USED TO REPLACE THE RANDOM FILL COVER OVER THE PUF. CONCRETE MAY BE PLACED DIRECTLY ON PUF AND BURY DEPTH REDUCED TO 12".
4. THE TEMPORARY BOTTOM FORM MUST LEAVE THE CMP CLEAR OF OBSTRUCTIONS. FROM MATERIALS WHICH DO NOT CREATE AN OBSTRUCTION MAY BE LEFT IN PLACE.
5. DETAILS ON PUF APPLICATION AND STANDARDS MAY BE FOUND IN THE SPECIFICATIONS

NO SCALE

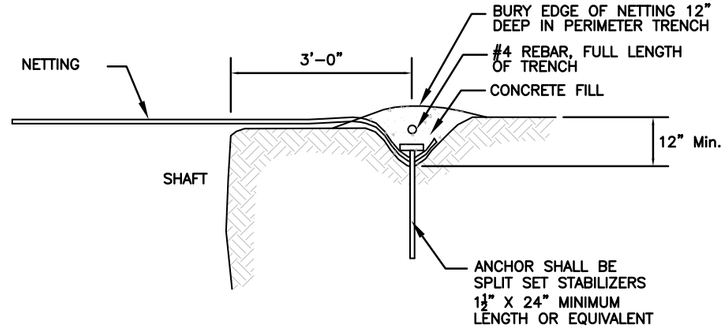
DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN CADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	C16	SHAFT CORRUGATED METAL PIPE IN PUF WITH CUPOLA VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. ___ SHEET 21 OF 24



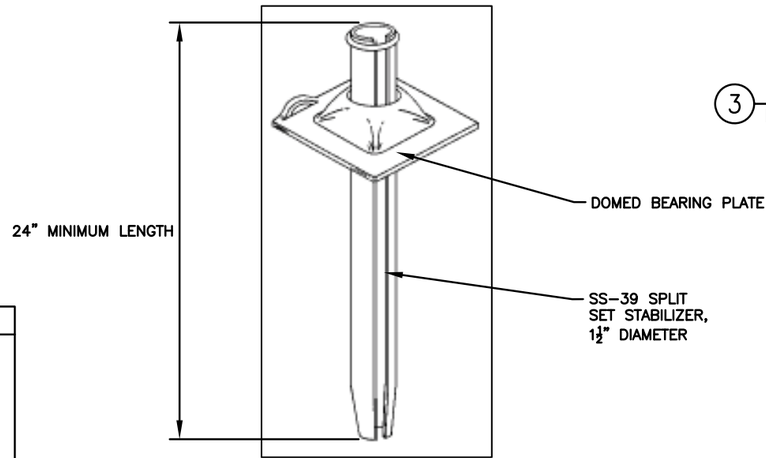
1 PLAN – WIRE NETTING SHAFT CLOSURE
NOT TO SCALE



2 PROFILE – DIRECT BURIAL NETTING ANCHOR
NO SCALE



3 PROFILE – NETTING ANCHOR CONCRETE OPTION
NO SCALE



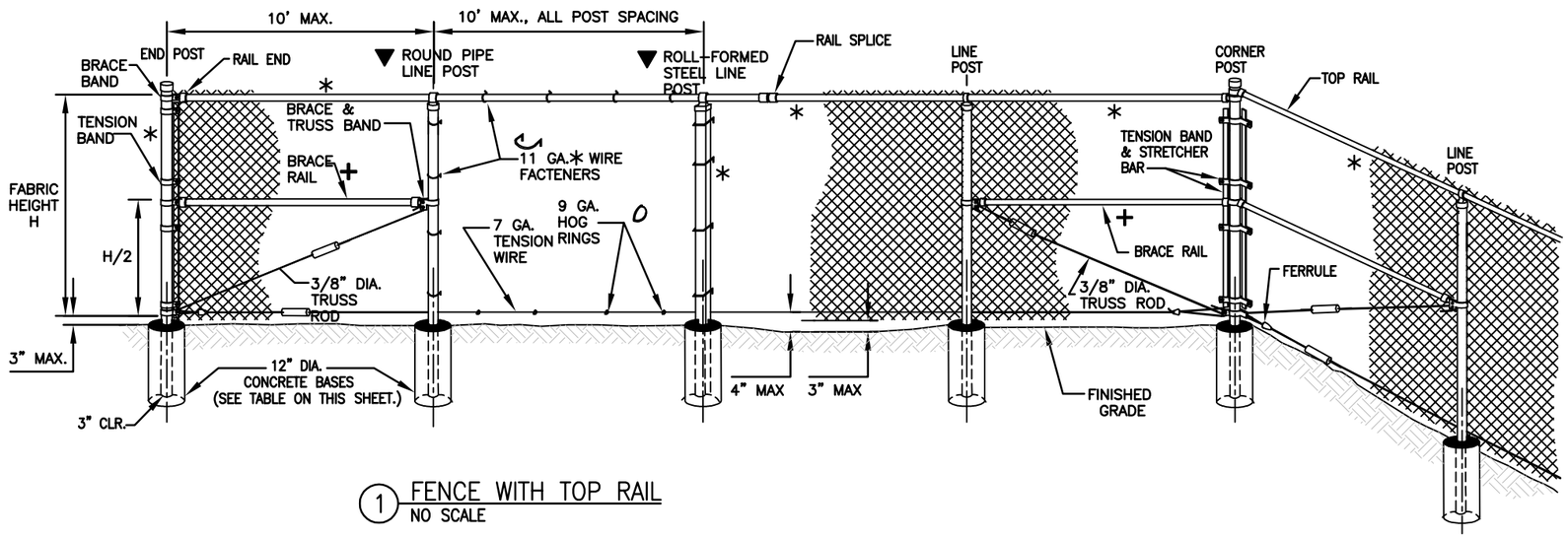
4 SPLIT SET STABILIZER DETAIL
NOT TO SCALE

NOTES:

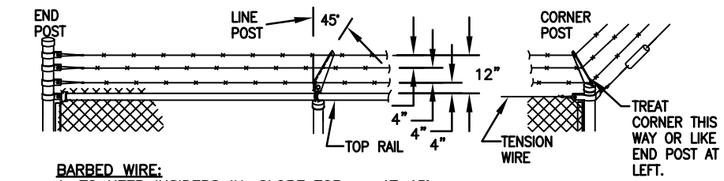
1. NETTING ANCHORS SHALL BE SPLIT SET STABILIZERS 1½" X 24" MINIMUM LENGTH, MANUFACTURED BY INTERNATIONAL ROLLERFORMS, OR APPROVED EQUIVALENT.
2. AS DIRECTED BY THE CONTRACTING OFFICER, CLEAR SOIL AND LOOSE ROCK BETWEEN EDGES OF THE SHAFT OR SLOPE OPENING AND EDGES OF THE NET PRIOR TO INSTALLATION.
3. BURY THE OUTER BOUNDARY OF THE NET, INCLUDING THE PERIMETER CABLE AND ANCHORS, TO A MINIMUM DEPTH OF 12 INCHES.
4. DEPTH AND PLACEMENT OF SPLIT SET STABILIZERS ARE INDICATED IN THE CONTRACT SPECIFICATIONS, AND SHALL BE INSTALLED AS PER MANUFACTURER'S RECOMMENDATIONS.
5. OPTIONAL CONCRETE PERIMETER ANCHOR. BACKFILL OF THE TRENCH WITH CONCRETE MAY BE SUBSTITUTED FOR SOIL BACKFILL. ONE PIECE OF #4 REBAR SHALL BE PLACED IN THE TRENCH, CENTERED IN THE CONCRETE.

NO SCALE

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN DADD CRS TECH. REVIEW: LSS DATE: 01/27/2010	C17	WIRE NETTING VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	999 100486 PKG. NO. ___ SHEET 22 OF 24



1 FENCE WITH TOP RAIL
NO SCALE



BARBED WIRE:
1. TO KEEP INSIDERS IN, SLOPE TOP AT 45°
2. TO KEEP OUTSIDERS OUT SLOPE OUT 45°
3. BARBED WIRE OVER GATES SHALL NOT BE SLOPED.

2 BARBED WIRE TOP
NO SCALE

CONCRETE BASES FOR FENCE POSTS	
HEIGHT OF FABRIC	DEPTH OF CONC. BASE
7'	3'
6'	3'
5'	3'
4'	2'
3'	2'

NOTES:

1. H (HEIGHT OF FABRIC). FABRIC IS AVAILABLE IN THE FOLLOWING HEIGHTS 36", 42", 48", 60", 72", 84", 96", 108", 120" AND 144"

2. CHAIN LINK FENCE SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 181.

3. CHAIN LINK FABRIC SHALL BE 2" MESH NO. 9 GAGE GALVANIZED OR ALUMINUM COATED WIRE SECURELY FASTENED TO TENSION WIRE, LINE POSTS, RAILS, BRACES AND STRETCHER BARS SPACED AS SHOWN HEREON. WIRE FASTENERS AND TIE CLIPS SHALL BE NO. 11 GAGE (W&M) GALVANIZED STEEL WIRE OR NO. 7 GAGE (B&S) ALUMINUM WIRE, AND HOG RINGS SHALL BE NO. 9 GAGE, ALL IN CONFORMANCE WITH ASTM F 626.

4. STEEL POSTS, RAILS AND GATE FRAMES SHALL CONFORM TO AASHTO M 181 TYPE 1, GRADE 1 OR GRADE 2.

5. AT THE CONTRACTORS OPTION, PIPE USED FOR FENCE CONSTRUCTION SHALL CONFORM TO THE DIMENSIONS AND WEIGHTS FOR EITHER "ORDINARY PIPE" OR ALTERNATIVE PIPE." "ALTERNATIVE PIPE" SHALL BE HIGH STRENGTH STEEL PIPE MEETING THE REQUIREMENTS OF FED. SPEC. RR-F-191/3C.

6. TENSION WIRE SHALL BE CONTINUOUS BETWEEN END OR CORNER POST AND LINE BRACE POST. A TURNBUCKLE OR OTHER APPROVED TIGHTENING DEVICE SHALL BE USED FOR EACH CONTINUOUS SPAN OF TENSION WIRE.

7. TENSION WIRE SHALL BE AS SPECIFIED IN AASHTO M 181.

8. CONCRETE FOOTINGS SHALL HAVE TOPS CROWNED AT GROUND LEVEL AND SHALL BE CLASS B. CONCRETE WITH LIGHTWEIGHT AGGREGATE CONFORMING TO AASHTO M 195, WILL BE PERMITTED.

9. TERMINATION OF FENCE AT BRIDGES OR OTHER STRUCTURES SHALL BE AS SHOWN ON PLANS.

10. CHAIN LINK FENCE UP TO 5 FEET HIGH SHALL BE KNUCKLED AT THE TOP AND BOTTOM SELVAGES. FABRIC OVER 5 FEET HIGH SHALL BE TWISTED AND BARBED ON THE TOP SELVAGE AND KNUCKLED ON THE BOTTOM SELVAGE.

11. FENCE MAY BE CONSTRUCTED WITH EITHER ROUND OR ROLL-FORMED STEEL COMPONENTS. THE CONTRACTOR SHALL STATE THE TYPE OF CONSTRUCTION AND TYPE OF LINE POST TO BE USED THROUGHOUT THE PROJECT AT THE PRE-CONSTRUCTION CONFERENCE.

12. CONTRACTOR MAY SUBSTITUTE SMOOTH WIRE FOR BARBED WIRE UPON APPROVAL FROM THE CONTRACTING OFFICER.

LEGEND

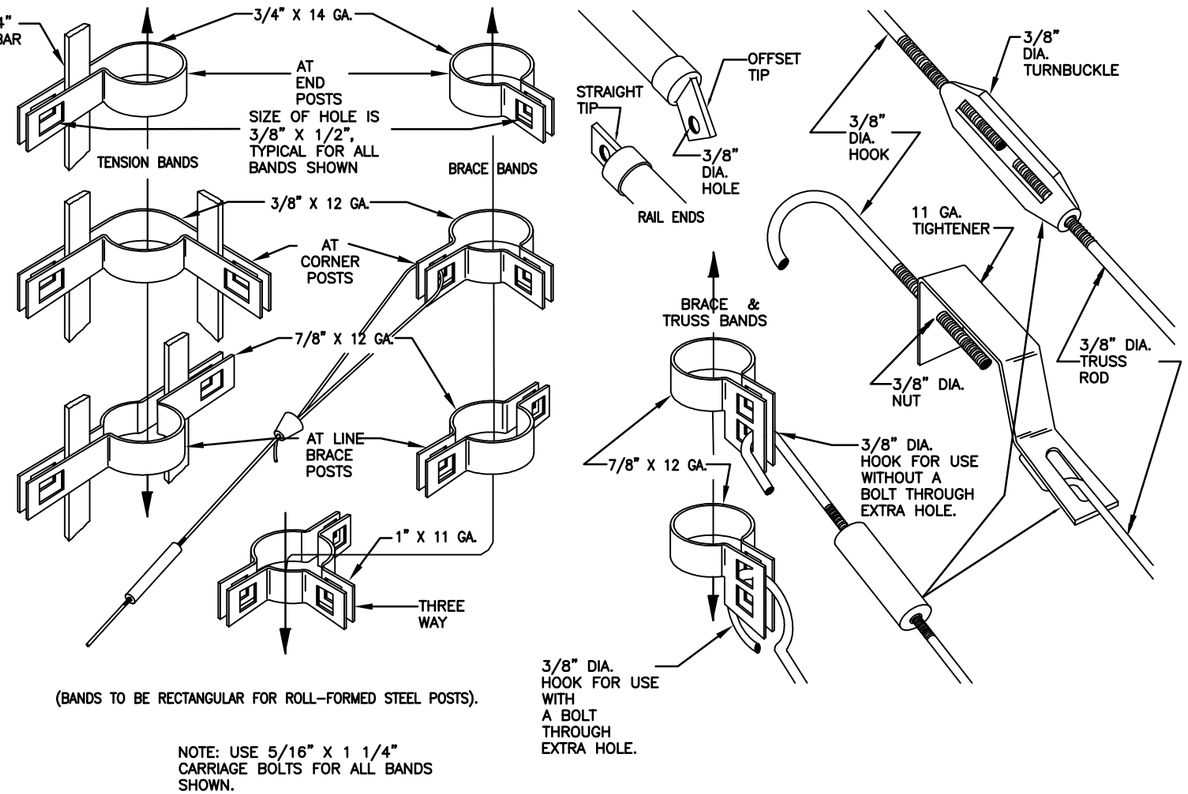
* ATTACH FABRIC TO ALL FENCE AND GATE STRUCTURES AT 12" INTERNALS VERTICALLY AND AT 20" HORIZONTALLY.

TIGHTENER OR TURNBUCKLE SYMBOL,

▼ TYPE OF LINE POST (ROUND PIPE ROLL-FORMED STEEL) SHALL BE AT THE OPTION OF THE CONTRACTOR UNLESS OTHERWISE SHOWN ON THE PLANS.

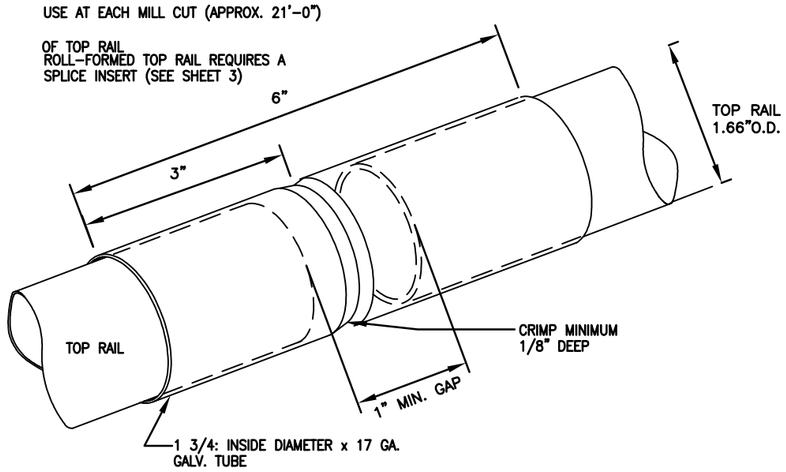
\+ BRACE RAIL WILL NOT BE REQUIRED FOR 36", 42" OR 48" FRABRIC HEIGHTS. BRACE RAIL FOR FENCE WITH ROLL-FORMED STEEL ELEMENTS IS 12" BELOW THE TOP RAIL.

NO SCALE

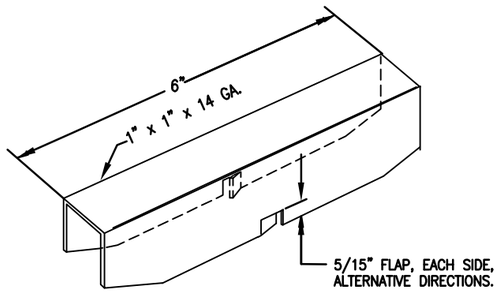


3 BANKS, RAIL ENDS & TIGHTENERS (DIMENSIONS SHOWN ARE MINIMUMS)
NO SCALE

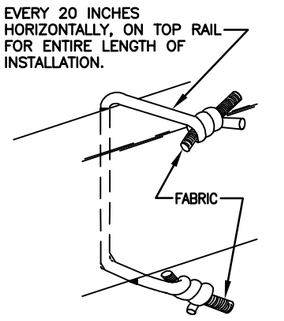
DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
JRN	C18	CHAIN LINK/BARBED WIRE PERIMETER FENCE	999 100486
DRAWN: CRS		VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	PKG. NO. — — —
TECH. REVIEW: LSS			SHEET 23 OF 24
DATE: 01/27/2010			



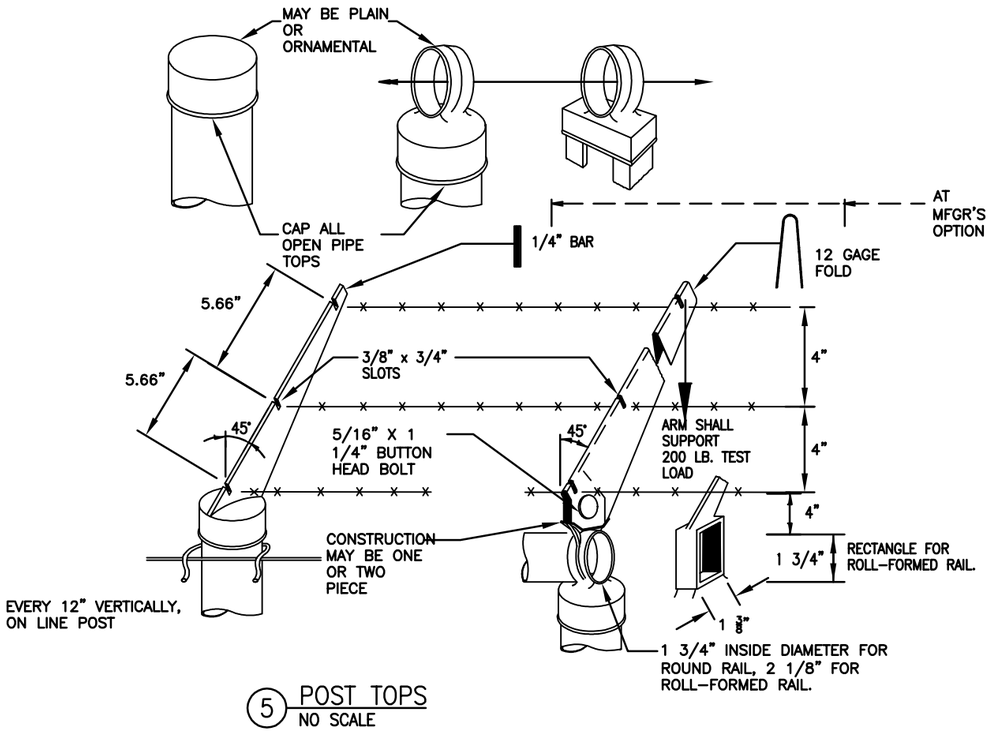
4 RAIL SPLICE
NO SCALE



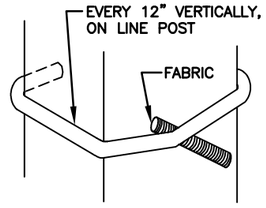
6 RAIL SPLICE INSERT
NO SCALE



7 WIRE FASTENER
NO SCALE



5 POST TOPS
NO SCALE



8 TIE CLIP
NO SCALE

NO SCALE

DESIGNED: JRN; CADD: CRS; TECH. REVIEW: LSS; DATE: 01/27/2010	SUB SHEET NO. C18.1	TITLE OF SHEET: CHAIN LINK/BARBED WIRE PERIMETER FENCE; VARIOUS NATIONAL PARKS INTERMOUNTAIN AND PACIFIC WEST REGIONS	DRAWING NO. 999 100486; PKG. NO. ___ ___ ___; SHEET 24 OF 24