Riprap Protection

Spillway set 2’ max above bottom of channel

Dimensions shown are typical but may vary from site to site.

3’ min. buried into ground

Groundline must extend above and beyond weir to prevent bypassing

Biaxial or tri-axial geo-grid base (not shown)
1. Excavate ditch to depth where water runs over rock on sides into ditch.
2. Ditches <10% are underlain with geo-grid unless on bedrock.
3. Ditches over acidic material will have 2’ earthen base and may have 3” limestone base.
4. Ditches >4’ depth should have side slopes on 3:1 covered with ECB instead of rock.

<table>
<thead>
<tr>
<th>&quot;A&quot; Flat Bottom Width (LF)</th>
<th>&quot;B&quot; (LF)</th>
<th>&quot;C&quot; (LF)</th>
<th>Class II/III (Ton/LF)</th>
<th>Geo-Grid (SQ YD/LF)</th>
<th>ECB (SQ YD/LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.6</td>
<td>10</td>
<td>0.76</td>
<td>1.55</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4.6</td>
<td>12</td>
<td>0.90</td>
<td>1.75</td>
<td>1</td>
</tr>
</tbody>
</table>

Use with AML 21-20-3
1. Excavate ditch to depth where water runs over rock on sides into ditch.
2. Ditches <10% are underlain with geo-grid unless on bedrock.
3. Ditches over acidic material will have 2’ earthen base and may have 3’ limestone base.
4. Ditches >4’ depth should have side slopes on 3:1 covered with ECB instead of rock.

**ANALOG INTO SOIL**

**PLACE ECB PRIOR TO CHANNEL LINING**

**BI-AXIAL GEO-GRID DO NOT USE ON >10% SLOPES.**

**CLASS III DITCH- FLAT BOTTOM (AML 21-20-2)**

<table>
<thead>
<tr>
<th>&quot;A&quot; Flat Bottom Size (LF)</th>
<th>&quot;B&quot; (LF)</th>
<th>&quot;C&quot; (LF)</th>
<th>C + Earth Base (LF)*</th>
<th>Class II/III (TON/LF)</th>
<th>Geo-Grid (SQ YD/LF)</th>
<th>ECB (SQ YD/LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4.9</td>
<td>10</td>
<td>15.9</td>
<td>1.65</td>
<td>2.40</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>6.9</td>
<td>12</td>
<td>19.9</td>
<td>1.88</td>
<td>2.60</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>8.9</td>
<td>14</td>
<td>23.9</td>
<td>2.10</td>
<td>2.80</td>
<td>1</td>
</tr>
</tbody>
</table>

*This is for ditches with earthen cover over acidic underlying materials.*
CONSTRUCTION NOTES:

1. GRADE CHANNEL SO THAT WATER IS CONTAINED AND FLOWS DOWN THE CENTER.
2. THE SUBGRADE SHALL BE SMOOTH, UNYIELDING, AND FREE OF ALL PROTRUSIONS AND/OR DEBRIS.
3. APPLY SEED PRIOR TO INSTALLATION.
4. ENGINEER MAY ELECT TO ADD ADDITIONAL "U" SHAPED REBAR ANCHORS SET MIN. 2' DEEP (INCIDENTAL).
5. ENGINEER MAY REQUIRE INTERMEDIATE CONCRETE/GROUT ANCHORS 2' WIDE X 1.5' DEEP WIDTH OF DITCH. ASSUME INCIDENTAL UNLESS STATED OTHERWISE IN BID ITEM DESCRIPTION. AN ALTERNATIVE IS TO BURY THE LEADING EDGE 18" VERTICALLY INTO COMPACTED DGA.
6. OVERLAP IS REQUIRED FOR SLOPES >10%.
7. NOT RECOMMENDED FOR SLOPES STeeper THAN 2:1.
• GEO–GRID SHALL ONLY BE PLACED UNDER ALL DITCHES WITH CHANNELS FLATTER THAN 10% AND NOT ON BEDROCK.
• INSTALL GABION ANCHORS (21–70–3) ON SLOPES >10%.

GABION = 0.22 CY/LF
GEO–GRID = 1.1 SY/LF

JOIN BASKETS AND LACE SECURELY DEFORMING BASKETS SLIGHTLY AS REQUIRED. OVERLAP LID OF ONE BASKET AS REQUIRED TO LACE SECURELY

FILL THIS AREA WITH ROCK

BI–AXIAL GEO–GRID DO NOT USE ON >10% SLOPES.

1’ X 3’ X LENGTH 2 BASKETS REQUIRED
- GEO-GRID SHALL ONLY BE PLACED UNDER ALL DITCHES WITH CHANNELS FLATTER THAN 10% AND NOT ON BEDROCK.
- INSTALL GABION ANCHORS (21-70-3) ON SLOPES >10%.

**EXCAVATION LIMITS**

- ECB (TYPE A)
- COMPACTED FILL
- GABION BASKET 1' X 3' X LENGTH

**QUANTITIES**

<table>
<thead>
<tr>
<th>Gabions</th>
<th>Geo-Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' WIDE= 0.35 CY/LF</td>
<td>1.00 SY/LF</td>
</tr>
<tr>
<td>6' WIDE= 0.48 CY/LF</td>
<td>1.33 SY/LF</td>
</tr>
<tr>
<td>9' WIDE= 0.61 CY/LF</td>
<td>1.67 SY/LF</td>
</tr>
</tbody>
</table>

ECB = 1.00 SY/LF

**JOIN BASKETS AND OVERLAP LID OF ONE BASKET, LACE SECURELY, DEFORMING BASKETS SLIGHTLY AS REQUIRED**

GABION DITCH- TRAPEZOIDAL 3',6',9' WIDTH (AML 21-40-2)
GABION DITCH- RECTANGULAR 4' FLAT BOTTOM EVEN SIDE HEIGHTS (AML 21-40-3)

- Geo-grid shall only be placed under all ditches with channels flatter than 10% and not on bedrock.
- Install gabion anchors (21-70-3) on all slopes >10%.
- Place filter fabric between rock and soil contact on sides.
- Use concrete headwall when gabion ditches tie into a pipe. Base of headwall extends 1' below base of gabion.

**Quantities**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gabion</td>
<td>1.00 CY/LF</td>
</tr>
<tr>
<td>Geo-grid</td>
<td>1.11 SY/LF</td>
</tr>
<tr>
<td>Class II Backfill</td>
<td>0.84 TON/LF</td>
</tr>
<tr>
<td>ECB (Type A)</td>
<td>1.00 SY/LF</td>
</tr>
<tr>
<td>Filter Fabric</td>
<td>1.5 SY/LF</td>
</tr>
</tbody>
</table>

Use with AML 21-70-3 & 70-30-1
- **GEO-GRID** SHALL ONLY BE PLACED UNDER ALL DITCHES WITH CHANNELS FLATTER THAN 10% AND NOT ON BEDROCK.
- INSTALL GABION ANCHORS (21-70-3) ON ALL SLOPES >10%.
- PLACE FILTER FABRIC BETWEEN ROCK AND SOIL CONTACT ON SIDES.
- USE CONCRETE HEADWALL WHEN GABION DITCHES TIE INTO A PIPE. BASE OF HEADWALL EXTENDS 1’ BELOW BASE OF GABION.

<table>
<thead>
<tr>
<th>QUANTITIES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GABION</td>
<td>1.33 CY/LF</td>
</tr>
<tr>
<td>GEO-GRID</td>
<td>1.1 SY/LF</td>
</tr>
<tr>
<td>CLASS II BACKFILL</td>
<td>1.11 TON/LF</td>
</tr>
<tr>
<td>ECB</td>
<td>1.00 SY/LF</td>
</tr>
<tr>
<td>FILTER FABRIC</td>
<td>VARIES</td>
</tr>
</tbody>
</table>

**GABION DITCH- RECTANGULAR 4' FLAT BOTTOM UNEVEN SIDE HEIGHTS (AML 21-40-4)**
- GEO-GRID SHALL ONLY BE PLACED UNDER ALL DITCHES WITH CHANNELS FLATTER THAN 10% AND NOT ON BEDROCK.
- INSTALL GABION ANCHORS (21-70-3) ON ALL SLOPES >10%.
- PLACE FILTER FABRIC BETWEEN ROCK AND SOIL CONTACT ON SIDES.
- USE CONCRETE HEADWALL WHEN GABION DITCHES TIE INTO A PIPE. BASE OF HEADWALL EXTENDS 1' BELOW BASE OF GABION.

**EXISTING GROUNDLINE**

**MEDIUM WEIGHT NON-WOVEN FILTER FABRIC**

**CLASS II BACKFILL (AS REQUIRED BY THE ENGINEER)**

**BI-AXIAL GEO-GRID**

**9’ X 1’ GABION BASKET**

**6’ FB DITCH**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GABION</td>
<td>1.70 CY/LF</td>
</tr>
<tr>
<td>GEO-GRID</td>
<td>2.70 SY/LF</td>
</tr>
<tr>
<td>CLASS II BACKFILL</td>
<td>1.80 TON/LF</td>
</tr>
<tr>
<td>ECB</td>
<td>1.00 SY/LF</td>
</tr>
<tr>
<td>FILTER FABRIC</td>
<td>2.5 SY/LF</td>
</tr>
</tbody>
</table>

**8’ FB DITCH**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GABION</td>
<td>1.80 CY/LF</td>
</tr>
<tr>
<td>GEO-GRID</td>
<td>3.50 SY/LF</td>
</tr>
<tr>
<td>CLASS II BACKFILL</td>
<td>1.80 TON/LF</td>
</tr>
<tr>
<td>ECB</td>
<td>1.00 SY/LF</td>
</tr>
<tr>
<td>FILTER FABRIC</td>
<td>2.5 SY/LF</td>
</tr>
</tbody>
</table>

**USE WITH AML 21-70-3 & 70-30-1**

**GABION DITCH- RECTANGULAR 6' & 8' FLAT BOTTOM (AML 21-40-5)**
CONCRETE DITCH- RECTANGULAR w/ GRATE (AML 21-50-3)

CONSTRUCTION JOINTS SHALL BE PLACED A MINIMUM OF 10’ & A MAXIMUM OF 20’. SEE "STEEL" SECTION OF AML TECHNICAL SPECIFICATION FOR BAR SPlices & Embedment INFORMATION. INSERT WEEP HOLES AT CONSTRUCTION JOINTS.

ALL STEEL REINFORCEMENT SHALL BE 60 KSI. ALL CONCRETE IS 4,000 PSI WITH FIBER REINFORCEMENT. SECURITY ANCHORS ARE INCIDENTAL. DON’T WELD GRATES CLOSED. ALL REBAR SHALL HAVE 2” MIN CLEARANCE.

INSTALL SIDEWALLS COMPLETELY BELOW GROUNDLINE. UNITS MAY BE PRE-CAST WITH ENGINEER’S PRIOR APPROVAL.

VEHICLE GRATE IS EQUIVALENT OF JR HOE "STANDARD" OR NEENAH R-499- TYPE A. ALL GRATES USE EMBEDDED FRAME RAIL TO SECURE GRATE TO THE TENCH.

NON-VEHICULAR GRATE IS 1” X 3/16” BEARING BAR SIZE PLAIN BLACK PAINTED, WELDED STEEL BAR GRATING.

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>&quot;T&quot; DIMENSION</th>
<th>&quot;U&quot; BAR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0’ – 3’</td>
<td>6”</td>
<td>#4 REBAR</td>
</tr>
<tr>
<td>3.1’ – 6”</td>
<td>10”</td>
<td>#5 REBAR</td>
</tr>
</tbody>
</table>

"U" SHAPE BARS SET 18” CENTERS SEE CHART FOR SIZE

CREATE NOTCH TO ALLOW FOR GRATE AND ANCHOR RAIL.

FLOwABLE FILL

INSERT BOLT TO ATTACH GRATE SECURITY WIre

HORIZONTAL #5 REBAR 12” CC (MAX)

10” THICK ANCHOR AT INLET, OUTLET AND EVERY 50’ ALONG CHANNEL

NO. 4 BARS SET IN ANCHORS TIED TO THE "U" BAR RUNNING FROM THE DITCH TOP TO ANCHOR BOTTOM (W/ 2” CLEARANCES FROM EDGES)

USE WITH AML 24-50-1
CONCRETE DITCH-RECTANGULAR NO GRATE

CONSTRUCTION JOINTS SHALL BE PLACED A MINIMUM OF 10’ & A MAXIMUM OF 20’. SEE "STEEL" SECTION OF AML TECHNICAL SPECIFICATION FOR BAR SPLICES & EMBEDMENT INFORMATION. INSERT WEEP HOLES AT CONSTRUCTION JOINTS.

ALL STEEL REINFORCEMENT SHALL BE 60 KSI. ALL CONCRETE IS 4,000 PSI WITH FIBER REINFORCEMENT. SEE "STEEL" SECTION OF AML TECHNICAL SPECIFICATION FOR BAR SPLICES & EMBEDMENT INFORMATION. ALL REBAR SHALL HAVE 2” MIN CLEARANCE.

INSTALL SIDEWALLS COMPLETELY BELOW GROUNDLINE.

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>&quot;T&quot; DIMENSION</th>
<th>&quot;U&quot; BAR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0’ – 3’</td>
<td>6”</td>
<td>#4 REBAR</td>
</tr>
<tr>
<td>3.1’ – 6’</td>
<td>10”</td>
<td>#5 REBAR</td>
</tr>
</tbody>
</table>

10” THICK ANCHOR AT INLET, OUTLET AND EVERY 50’ ALONG CHANNEL.

NO. 4 BARS SET IN ANCHORS TIED TO THE "U" BAR RUNNING FROM THE DITCH TOP TO ANCHOR BOTTOM (W/ 2” CLEARANCES FROM EDGES).
CLASS III BACKFILL

BASE SLOPED ON 2–3% DOWN ANGLE TO BACK

1:1 ROCK CUT
1:5:1 SOIL CUT

12–15'

MEDIUM WEIGHT NON-WOVEN FILTER FABRIC ON SOIL–ROCK INTERFACE

ROCK TOE BUTTRESS (AML 22-10-1)
EXISTING GROUNDLINE

FINISHED GRADELINE

2' COMPACTED EARTHEN BACKFILL ENGINEER MAY REQUEST ROCK TO SURFACE INSTEAD OF EARTH CAP

MEDIUM WEIGHT NON-WOVEN FILTER FABRIC BETWEEN AGGREGATE AND SOIL INTERFACE

VARIES

10:1

CLASS II

8" DUAL WALL HDPE PIPE MAY BE INCLUDED

KEY INTO SOLID ROCK

INTERPOLATED ROCKLINE

SHEAR KEY (AML 22-10-2)
ROCK CORE DRAIN (AML 22-20-1)

<table>
<thead>
<tr>
<th>SIDE SLOPE</th>
<th>CLASS II/III</th>
<th>FILTER FABRIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1</td>
<td>3.1 TON/LF</td>
<td>4.7 SY/LF</td>
</tr>
<tr>
<td>2:1</td>
<td>4.0 TON/LF</td>
<td>7.2 CY/LF</td>
</tr>
</tbody>
</table>

EXISTING GROUNDLINE

MEDIUM WEIGHT ON-WOVEN FILTER FABRIC WITH 2’ MIN. OVERLAP

FILL MATERIAL

CLASS II/III CHANNEL LINING

EXCAVATED TRENCH

4’

10’
NOTES:

1. EXCAVATION SHALL BE CONSIDERED INCIDENTAL FOR SUBDRAINS INSTALLED TO 3 FT DEEP. FOR SUBDRAINS DEEPER THAN 3 FT, EXCAVATION SHALL BE INCLUDED FOR PAYMENT AS EARTHWORK.

2. USE SOCK PIPE FOR ALL DEPTHS.

3. WHEN SWITCHING FROM PERFORATED TO NON-PERFORATED PIPE USE A SUBDRAIN COLLAR (AML 21–30–2)

4. SET PIPE ON MINIMUM OF 1% GRADE. RAISE THE PIPE IF NECESSARY TO MAINTAIN GRADE. THE ROCK CORE OF THE SUBDRAIN IS STILL TIED INTO BEDROCK.

5. THE CONSTRUCTION DRAWINGS, NOTES, SPECIAL CONDITIONS MAY REQUIRE A LARGE DIAMETER PIPE THAN SHOWN, THE LARGER PIPE IS STILL INCIDENTAL TO THE SUBDRAIN.

SEE THE DITCH AND SUBDRAIN DETAILS FOR SPECIFIC INFORMATION. SEPARATE BID ITEMS.

COMBINATION ECB DITCH-DRAIN (AML 22-30-3)
SEE THE DITCH OR SUBDRAIN DETAIL FOR SPECIFIC INFORMATION. SEPARATE BID ITEMS.

COMBINATION ROCK DITCH-DRAIN (AML 22-30-4)
SEE THE DITCH AND SUBDRAIN DETAILS FOR SPECIFIC INFORMATION.

SEPARATE BID ITEMS.

COMBINATION CONCRETE BLOCK- TIED MAT & DRAIN (AML 22-30-5)
1. UNCOMPACTED DENSE GRADE AGGREGATE (DGA) TO WIDTH AND ELEVATION SHOWN
2. 95% COMPACTED DGA IN LAYERS 6” OR LESS TO WIDTH AND ELEVATION AS SHOWN W/ MECHANICAL TAMPERSPS OR COMPACTORS
3. 85% COMPACTED DGA IN LAYERS 6” OR LESS TO WIDTH AND ELEVATION AS SHOWN W/ MECHANICAL TAMPERPS OR COMPACTORS
4. ANCHORED HDPE & RHDPE WITH GUY WIRE ANCHORS AND STRAPS OR EQUIVALENT IF FLOWABLE WILL IS USED INSTEAD OF DGA. ANCHOR PRIOR TO PLACING FLOWABLE FILL.
5. USE FLOWABLE FILL ALL PAVED ROADS WITH REINFORCED CONCRETE PIPE (SEE DETAIL 50-10-4).
**Holes must be large enough to accommodate pile and 2” minimum concrete on all sides.**

**Steel Pile**

**Concrete**

**Rockline**

**Groundline**

<table>
<thead>
<tr>
<th>Depth to Rock</th>
<th>Use</th>
<th>Type</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5’ - 19’</td>
<td>Temporary Support Only</td>
<td>130 LBS/YD Rail Steel or W8 X 40</td>
<td>Single Row, 36” OC, 15” Dia. Min</td>
</tr>
<tr>
<td></td>
<td>Independent Permanent Stabilization</td>
<td>W8 X 40</td>
<td>Double Row, 48” OC, 18” Dia. Min, Reinforced Concrete Cap</td>
</tr>
<tr>
<td>20’ +</td>
<td>Engineer Special Design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Beams shall be oriented with flanges perpendicular to possible slide movement.
2. Beams shall be encased with concrete a minimum 2” concrete on all sides for the entire depth of the hole.
3. Beams shall be straight and structurally sound. Engineer must authorize splicing. No splicing shall be allowed in railroad rails.
4. The engineer may specify the size or type of steel (including use of railroad steel rails) on drawings, in the special conditions, or in writing during construction.

See AML 30-30-2 for cap details.

**Steel Piles - Temporary and Independent Support (AML 30-30-1)**
STEEL PILES WITH REINFORCED CONCRETE CAP (AML 30-30-2)

- 4.0' length
- 2.0' length
- 3.0' length
- 0.7' length
- Ø1.5' diameter
- 3/4" chamfer
- #9 rebar on top & bottom
- #5 rebar on side middle
- #4 hoops on 18" centers
- 6" minimum
- Staggered steel piles

Use with AML 30-30-1
1. Bury only 1/2 basket for walls shorter than 9 ft.
2. Gabion walls must be constructed in a stagger pattern as shown. This must be done for both directions of the wall.

Chain-link fence required for walls 9' or higher

3' x 3' gabion baskets

Class II backfill

Use medium weight non-woven filter fabric over soil, not over bedrock

Construction slope

Depending on rock lines encountered, the shaded baskets may be omitted by engineer

No. 57 stone surrounded by light weight non-woven filter fabric (1' overlap)

8" HDPE dual wall perforated sock pipe wrapped in light weight filter fabric or sock pipe

Class II leveling pad as needed

Steel piles foundation (if required use AML 30-30-1)

The drawings may require gabions with tails (not shown). Tails extend horizontally into the backfill at length specified on drawings.
**EMBEDMENT**

1. MINIMUM EMBEDMENT VALUE FOR FIRM EARTH IS 2'-0".
2. CASE III REQUIRES AN EMBEDMENT OF 1/4 H FOR A WALL OVER 8'.
3. FOR FOOTER SET ON ROCK 1/2 FOOTER DEPTH WILL BE SET IN ROCK.

WALLS TERMINATE INTO HILLSIDE WINGED OR AT 90' ANGLE.

**BATTER**

CASE I AND CASE II
\[ H = 3'-0" \text{ TO LESS THAN 5'-0" (VERTICAL)} \]
\[ H = 5'-0" \text{ TO LESS THAN 10'-0" (12:1)} \]
\[ H = 10'-0" \text{ TO LESS THAN 12'-0" (6:1)} \]

CASE III
\[ H = 3'-0" \text{ TO LESS THAN 5'-0" (12:1)} \]
\[ H = 5'-0" \text{ TO LESS THAN 12'-0" (6:1)} \]

USE WITH AML 30-50-2

**CONCRETE GRAVITY WALL (AML 30-50-1)**
REINFORCED CONCRETE WALL (HEIGHTS FROM 5' TO 20') (AML 30-60-1)

**WALL DIMENSIONS (FEET)**

<table>
<thead>
<tr>
<th>WALL HT</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
<th>&quot;T&quot;</th>
<th>&quot;W&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-7&quot;</td>
<td>2.00</td>
<td>3.00</td>
<td>1.00</td>
<td>6.00</td>
</tr>
<tr>
<td>8'-10'</td>
<td>2.25</td>
<td>3.50</td>
<td>1.25</td>
<td>7.00</td>
</tr>
<tr>
<td>11'-13'</td>
<td>2.75</td>
<td>4.00</td>
<td>1.25</td>
<td>8.00</td>
</tr>
<tr>
<td>14'-16'</td>
<td>3.50</td>
<td>5.00</td>
<td>1.50</td>
<td>10.00</td>
</tr>
<tr>
<td>17'-20'</td>
<td>4.00</td>
<td>6.25</td>
<td>2.25</td>
<td>12.50</td>
</tr>
</tbody>
</table>

**ALL REINFORCEMENT IS TO BE SPACED AT 12 INCH CENTERS**

**REINFORCEMENT REQUIREMENTS**

<table>
<thead>
<tr>
<th>WALL HT</th>
<th>B BAR</th>
<th>F BAR</th>
<th>H BAR</th>
<th>P BAR</th>
<th>T BAR</th>
<th>K BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-7&quot;</td>
<td>#5</td>
<td>#5</td>
<td>#4</td>
<td>#5</td>
<td>#5</td>
<td>#4</td>
</tr>
<tr>
<td>8'-10'</td>
<td>#6</td>
<td>#5</td>
<td>#5</td>
<td>#5</td>
<td>#6</td>
<td>#4</td>
</tr>
<tr>
<td>11'-13'</td>
<td>#7</td>
<td>#5</td>
<td>#5</td>
<td>#5</td>
<td>#7</td>
<td>#4</td>
</tr>
<tr>
<td>14'-16'</td>
<td>#8</td>
<td>#5</td>
<td>#6</td>
<td>#5</td>
<td>#8</td>
<td>#4</td>
</tr>
<tr>
<td>17'-20'</td>
<td>#9</td>
<td>#5</td>
<td>#5</td>
<td>#5</td>
<td>#9</td>
<td>#4</td>
</tr>
</tbody>
</table>

* B1 BAR IS TO BE ONE BAR SIZE SMALLER THAN "B" BAR
* F1 BAR IS TO BE ONE BAR SIZE SMALLER THAN "F" BAR

Number of H bars to use is equal to wall height x 2
Number of P bars to use is equal to "W" (footing width) x 2

**BAR DIMENSIONS (FEET)**

<table>
<thead>
<tr>
<th>WALL HT</th>
<th>B BAR</th>
<th>F BAR</th>
<th>K BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-7&quot;</td>
<td>L= 3.00', M= 2.75'</td>
<td>L= 2.75', N= 1.75'</td>
<td>L= 2.75', N= 0.50'</td>
</tr>
<tr>
<td>8'-10'</td>
<td>L= 3.33', M= 3.25'</td>
<td>L= 2.75', N= 2.0'</td>
<td>L= 3.0', N= 0.75'</td>
</tr>
<tr>
<td>11'-13'</td>
<td>L= 4.00', M= 3.75'</td>
<td>L= 3.50', N= 2.50'</td>
<td>L= 3.0', N= 0.75'</td>
</tr>
<tr>
<td>14'-16'</td>
<td>L= 5.00', M= 4.75'</td>
<td>L= 3.75', N= 3.25'</td>
<td>L= 3.25', N= 1.00'</td>
</tr>
<tr>
<td>17'-20'</td>
<td>L= 7.25', M= 6.00'</td>
<td>L= 4.25', N= 3.75'</td>
<td>L= 4.0', N= 1.50'</td>
</tr>
</tbody>
</table>

**FOOTING**

-WALL-

FOOTING

-WALL-

"K" BAR (ONLY WHEN KEY IS USED)
SPACE WITH "B" BAR

THE BASE OF THE FOOTER MUST BE SET MIN. 24" DEPTH.
WALLS TERMINATE INTO HILLSIDE WINGED OR AT 90° ANGLE.
CONSTRUCTION NOTES:

ALL FOUNDATION EXCAVATION AREA SHALL BE APPROVED BY THE ENGINEER, PRIOR TO THE PLACEMENT OF FORMWORK AND REBAR PLACEMENT. IN THE OPINION OF THE ENGINEER, ANY AREA NOT SUITABLE FOR FOOTING PLACEMENT (I.E. SOFT, SATURATED, ETC.) SHALL BE OVER EXCAVATED AND BACKFILLED WITH MECHANICALLY COMPACTED DENSE GRADE AGGREGATE AS DIRECTED BY THE ENGINEER.

ALL REINFORCING BARS ARE 2" FROM EDGE UNLESS OTHERWISE NOTED.

SAFETY FENCE MAY BE BOLTED TO THE WALL OR SET IN PLACE WITH CONCRETE BEHIND THE WALL. DO NOT PLACE FENCE IN THE WALL.

CONSTRUCTION JOINTS SHALL BE PLACED A MINIMUM OF 10’ & A MAXIMUM OF 20’.

ALL STEEL REINFORCEMENT SHALL BE 60 KSI.

ALL CONCRETE SHALL BE 4,000 PSI WITH FIBER REINFORCEMENT.

FINAL SLOPE SHALL BE MAX 2:1 FROM THE TOP EDGE OF THE WALL, MAX. 1.5:1 IF ROCK FROM WALL IS LEVEL FOR 10’ THEN SLOPED UP.

AT THE CONTRACTOR’S REQUEST, THE LENGTHS OF THE LONGITUDINAL REINFORCEMENT MAY BE CHANGED WITH PRIOR APPROVAL OF THE ENGINEER. LONGER OR SHORTER LONGITUDINAL BARS MAY BE USED TO ACCOMMODATE CONSTRUCTION OR FOR ECONOMY. ALL WORK AND/OR MATERIALS REQUIRED FOR CHANGES IN THE LENGTHS OF LONGITUDINAL REINFORCEMENT SHALL BE AT NO COST TO AML. SPLICES MUST BE IN ACCORDANCE WITH THE “STEEL” SECTION OF THE TECHNICAL SPECIFICATIONS.

<table>
<thead>
<tr>
<th>REINFORCEMENT QUANTITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL HEIGHT</td>
</tr>
<tr>
<td>5'-7&quot;</td>
</tr>
<tr>
<td>8'-10&quot;</td>
</tr>
<tr>
<td>11'-13&quot;</td>
</tr>
<tr>
<td>14'-16&quot;</td>
</tr>
<tr>
<td>17'-20&quot;</td>
</tr>
</tbody>
</table>

* PER FOOT OF WALL LENGTH
** PER FOOT OF WALL HEIGHT AND PER FOOT OF WALL LENGTH

Example: 12’ Wall Height, 100’ Long, with Key
V = (4.26 x 12) + 54.63 + 3.85 x 100 = 10,960 LBS. REINFORCEMENT
WALL HEIGHT + "K" BAR BECAUSE USING KEY

CONCRETE VOLUMES

<table>
<thead>
<tr>
<th>WALL HEIGHT</th>
<th>VOLUME (PER FOOT OF WALL LENGTH)</th>
<th>Key Volume (PER FOOT OF WALL LENGTH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-7&quot;</td>
<td>V = 0.23 + (.04 x H)</td>
<td>0.074 Cu. Yds.</td>
</tr>
<tr>
<td>8'-10&quot;</td>
<td>V = 0.32 + (.05 x H)</td>
<td>0.093 Cu. Yds.</td>
</tr>
<tr>
<td>11'-13&quot;</td>
<td>V = 0.37 + (.05 x H)</td>
<td>0.093 Cu. Yds.</td>
</tr>
<tr>
<td>14'-16&quot;</td>
<td>V = 0.56 + (.06 x H)</td>
<td>0.111 Cu. Yds.</td>
</tr>
<tr>
<td>17'-20&quot;</td>
<td>V = 1.04 + (.09 x H)</td>
<td>0.167 Cu. Yds.</td>
</tr>
</tbody>
</table>

V = Cu. Yds. PER FOOT OF WALL LENGTH
H = ACTUAL WALL HEIGHT USED FOR DESIGN

Example: 12’ Wall Height, 100’ Long, with Key
V = 0.37 + (.05 x 12) + 0.093 = 1.063
Total V = 1.063 x 100’ = 106.3 Cu. Yds.
ALL loose or unsupported roof rock on highwall or portal face—ups shall be backfilled for support or removed.

Class II or native sandstone pushed into opening

Filter fabric

Class II rock

Cover pipe with No. 2 stone and filter fabric. Install pest screen over end of pipe

Provide positive drainage to existing constructed ditch. The engineer may elect to install subdrain (not shown, separate bid item).

8" dual wall smooth interior HDPE (perforated or non—perforated as directed by engineer) slope to drain

All rock, excavation, pipe, screens are incidental to each portal closure.

If pneumatically backstowed gravel, rock ditches, subdrain are used they are separate bid item.

All pipe is incidental regardless of length or number of sections required.

See AML 40–20–11 for additional notes.

Standard non-wildlife accessible closure (AML 40-20-1)
ALL LOOSE OR UNSUPPORTED ROOF ROCK ON HIGHWALL OR PORTAL FACE-UPS SHALL BE BACKFILLED FOR SUPPORT OR REMOVED.

PNEUMATIC BACKSTOW MATERIAL OR CLASS II ROCK

ALL PIPE IS INCIDENTAL REGARDLESS OF LENGTH OR NUMBER OF SECTIONS REQUIRED.

36" HDPE WITH WILDLIFE ACCESS GRATE. SEE SECTION "A-A"

PROVIDE POSITIVE DRAINAGE TO EXISTING NATURAL DRAINS OR CONSTRUCT DITCHES

NOTE:

#4 REBAR OR 1/2" ALL-THREAD

36" HDPE PIPE

6" +/- 1/4"

SECURE REBAR OR ALL-THREAD ON EXTERIOR OF PIPE WITH WELDED WASHERS, LOCK NUTS, OR OTHER APPROVED METHODS. DO NOT SET BARS VERTICALLY.

MAJOR INCIDENTALS: ALL ITEMS SHOWN.

SEE AML 40-20-11 FOR ADDITIONAL NOTES
GENERAL NOTES:

POLYURETHANE FOAM IS A SEPARATE BID ITEM. ALL OTHER MATERIALS, EQUIPMENT, AND LABOR ARE INCIDENTAL TO THE PORTAL CLOSURE BID ITEM.

POLYURETHANE FOAM NOTES:

1. REAR AND FRONT BARRIERS SHALL BE CONSTRUCTED FROM COMMON MATERIALS OR SHALL BE COMPRISED OF BAGGED FOAM PLACED IN LAYERS AND ALLOWED TO PARTIALLY HARDEN. THE ENGINEER MAY SUBSTITUTE CONSTRUCTED BULKHEADS WITH LOCAL OR COMMON MATERIALS.

2. THE VOID IN FRONT OF EACH SUCCESSIVE LAYER SHALL THEN BE FILLED WITH FOAM.

3. THE FOAM SEAL SHALL BE TIGHT ENOUGH TO SECURE THE ADIT, BUT IT DOES NOT HAVE TO BE AIR TIGHT.

4. THE ENGINEER WILL DETERMINE THE DEPTH OF FOAM REQUIRED IN THE FIELD.

5. THE FACE OF THE FINAL CLOSURE MUST BE COVERED WITH 2’ OF EARTH OR ROCK, OR 2” OF GROUT. THE GROUT MUST BE TIED TO THE FACE USING PINS SET IN THE FOAM AND A WIRE MESH OVER THE FOAM FACE.

6. ALL PIPE IS INCIDENTAL REGARDLESS OF LENGTH OR NUMBER OF SECTIONS REQUIRED.

SEE PLANS FOR WILDLIFE OR NON-WILDLIFE ACCESS DETAILS AND AML 40-20-1 OR 40-20-2 FOR PIPE NOTES

SEE AML 40-20-11 FOR ADDITIONAL DETAILS

STANDARD CLOSURES W/ POLYURETHANE FOAM (AML 40-20-3)
NOTES:

THE ENGINEER WILL DETERMINE THE EXACT HEIGHT OF THE GABION WALL IN THE FIELD.

THE ENGINEER WILL DETERMINE THE NEED FOR A SURFACE DITCH AND/OR SUBDRAIN.

THE SURFACE DITCH, SUBDRAIN, GABION WALL ARE SEPARATE BID ITEMS.

ALL PIPE IS INCIDENTAL REGARDLESS OF LENGTH OR NUMBER OF SECTIONS REQUIRED.

PORTAL CLOSURE W/ GABION RETAINING WALL (AML 40-20-4)
PIPE NOTE:
RCP OR RHDPE (DUAL WALL REINFORCED HIGH DENSITY POLYETHYLENE) FOR PIPE ≥30" DIA.
RCP OR DWPP (DUAL WALL POLYPROPYLENE) FOR PIPES ≤30" DIA.
HDPE (DUAL WALL HIGH DENSITY POLYETHYLENE) SHALL NOT BE USED UNDER PUBLIC ROADS

PROVIDE STEEL PLATING TO COVER TRENCH UNTIL PAVEMENT REPAIRED (INCIDENTAL TO PIPE INSTALLATION).
1. All final grade areas should have benches created with bench diversions to central drainage channels.

2. Line bench channels with Type A ECB (erosion control blanket). Bench spacing and grades may be adjusted at the engineer's direction in the field.

PROPOSED GRADELINEN

INSTALL ECB SWALE DITCHES ALONG DIVERSION BENCHES (SEE AML 21-10-3 & 70-10-3)

EXISTING GROUND

ROCKLINE

FILTER FABRIC

KEY INTO ROCK

2' OF #57 AGGREGATE (TOP LAYER)

3' OF #2 AGGREGATE

CLASS III ROCK TOE BUTRESS

10' APPROXIMATE DEPTH

SLOPE RECONSTRUCTION (AML 70-10-2)
BENCH SPACING = H

1 FT MIN.

6 FT MIN.

ECB SWALE DITCH TO DIVERT FLOW

2:1 SLOPE OR FLATTER

CONSTRUCT ECB SWALE DITCH ALONG BENCH 2 TO 3% LONGITUDINAL GRADE AND DRAIN TO A STABLE OUTLET

<table>
<thead>
<tr>
<th>SLOPE</th>
<th>H (MAX.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:1</td>
<td>20 FT</td>
</tr>
<tr>
<td>3:1</td>
<td>30 FT</td>
</tr>
<tr>
<td>4:1</td>
<td>40 FT</td>
</tr>
</tbody>
</table>

BENCHING (AML 70-10-3)