

By virtue of this seal and signature, all supporting documents included in this package are accurate and support the design presented herein.



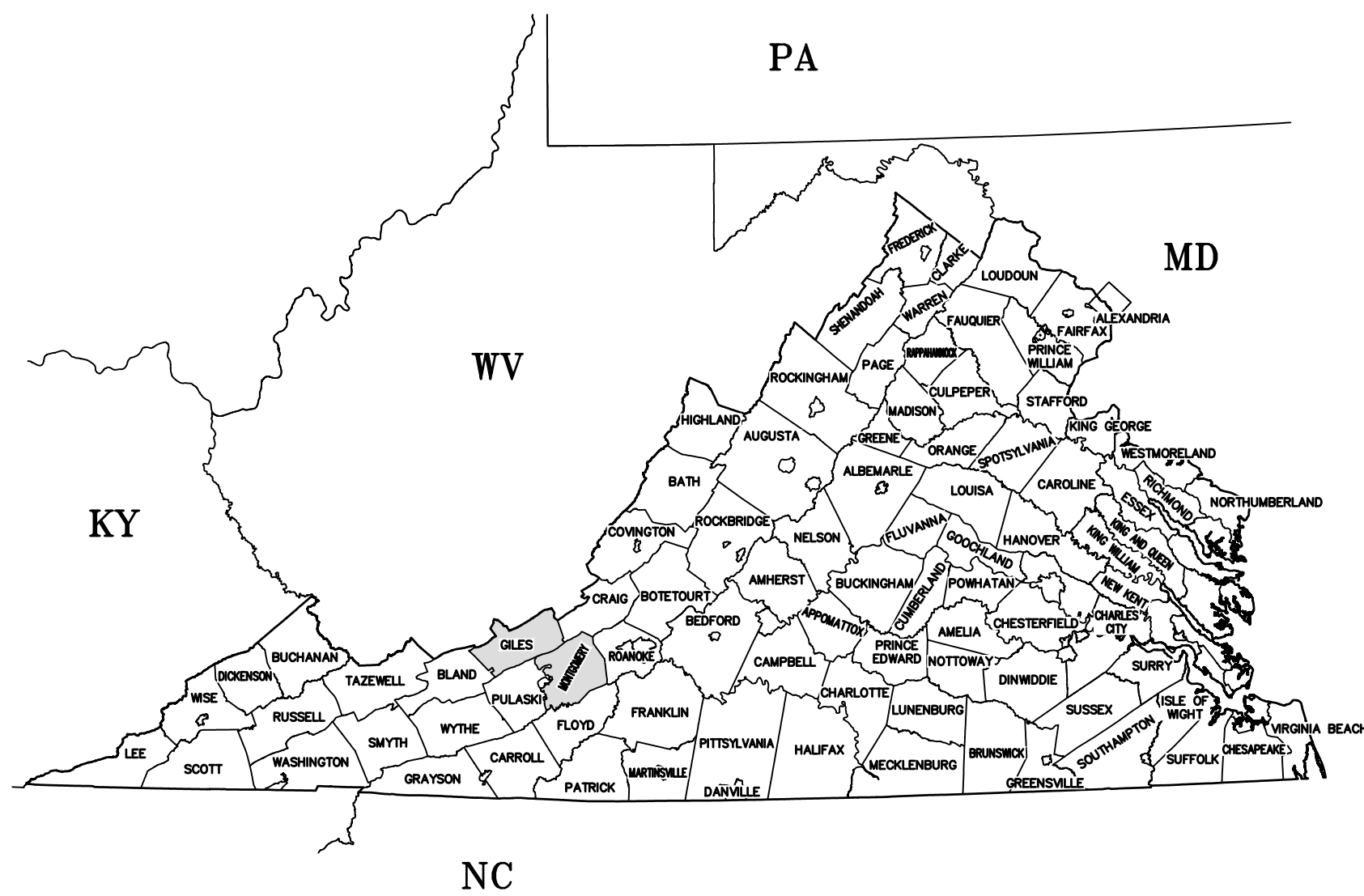


# MOUNTAIN VALLEY PIPELINE, LLC

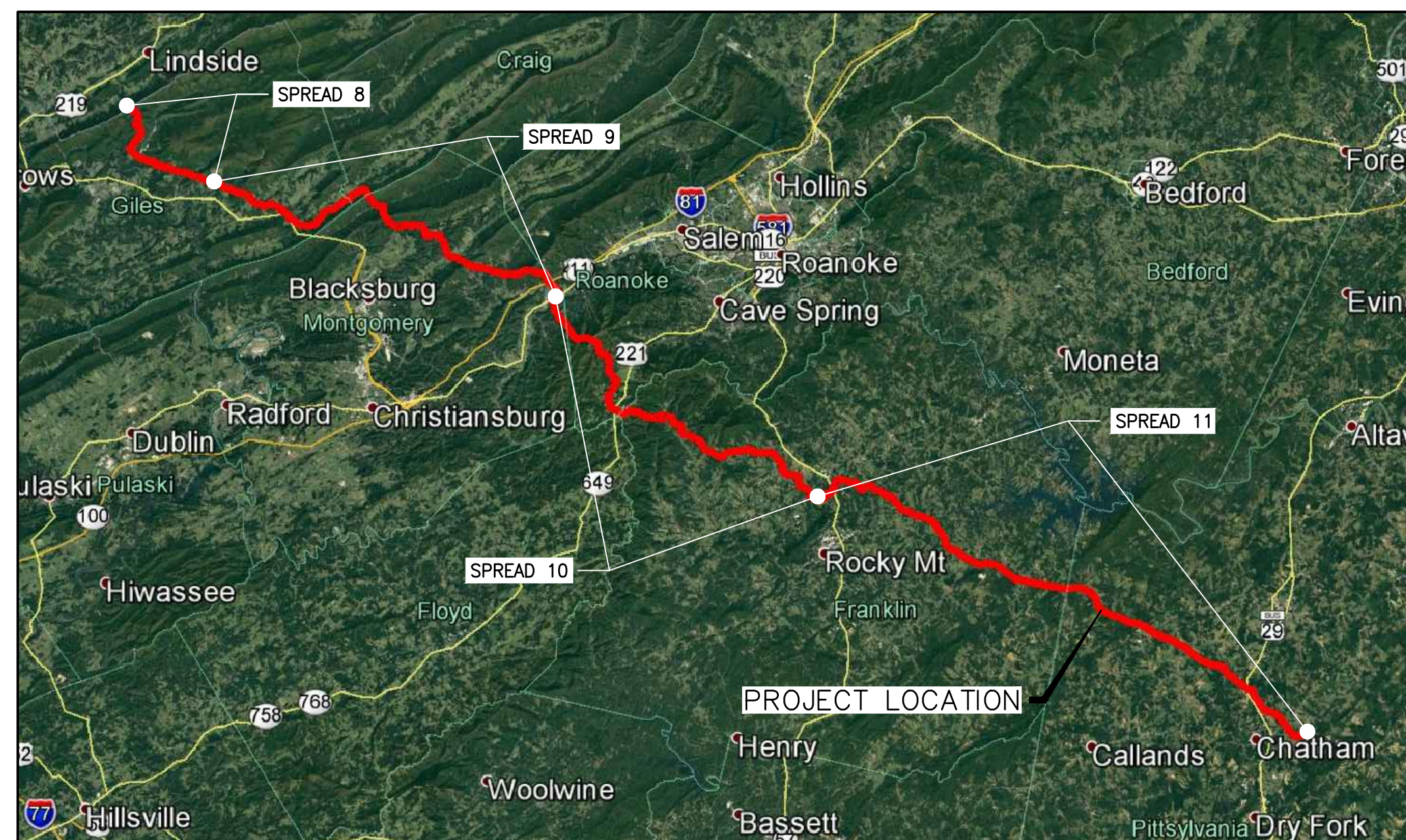
## EROSION & SEDIMENT CONTROL PLAN

### MVP PIPELINE PROJECT GILES COUNTY TO MONTGOMERY COUNTY SPREAD 9

DRAWING INDEX	
SHEET No.	DRAWING TITLE
GENERAL SET	
0.00	COVER SHEET
0.01 TO 0.21	EROSION AND SEDIMENT CONTROL DETAILS
0.22 TO 0.23	GENERAL NOTES AND LEGEND
SPREAD 9	
13.00A	VARIANCE AND EXEMPTION REQUESTS
13.01 TO 13.02	KEY PLAN
13.03EX TO 13.90EX	EXISTING CONDITIONS
13.03ES TO 13.90ES	EROSION & SEDIMENT CONTROL PLANS
13.03PC TO 13.90PC	POST CONSTRUCTION STORMWATER AND RESTORATION PLANS



A CERTIFIED CONSTRUCTION RECORD DRAWING FOR PERMANENT SWM FACILITIES SHALL BE SUBMITTED TO DEQ FOR APPROVAL. CONSTRUCTION INSPECTIONS AND SURVEYS, PERFORMED BY A LICENSED PROFESSIONAL, SHALL BE REQUIRED AT EACH STAGE OF INSTALLATION (CONSTRUCTION) AS NECESSARY TO CERTIFY THAT THE SWM FACILITY HAS BEEN BUILT IN ACCORDANCE WITH THE APPROVED PLAN AND DESIGN SPECIFICATIONS. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF TWO (2) BUSINESS DAYS' NOTICE TO THE CERTIFYING PROFESSIONAL TO ALLOW FOR CRITICAL INSPECTIONS.



**WATERS OF THE U.S. PERMITS CERTIFICATION**  
 I HEREBY CERTIFY THAT ALL WETLAND AND WATERBODY PERMITS REQUIRED BY LAW WILL BE OBTAINED PRIOR TO COMMENCING WITH LAND DISTURBING ACTIVITIES.  
 SIGNATURE \_\_\_\_\_  
 OWNER/DEVELOPER \_\_\_\_\_  
 NAME TITLE  
 NOTE: PERMITS MUST BE PRESENTED TO THE COUNTY INSPECTOR PRIOR TO LAND DISTURBANCE.

LOCATION MAP  
 MVP PIPELINE PROJECT  
 GILES COUNTY, VIRGINIA TO PITTSYLVANIA COUNTY, VIRGINIA



THREE DAYS BEFORE YOU DIG

CALL VA ONE CALL  
 SYSTEM TOLL FREE  
 811  
 OR  
 1-800-552-7001

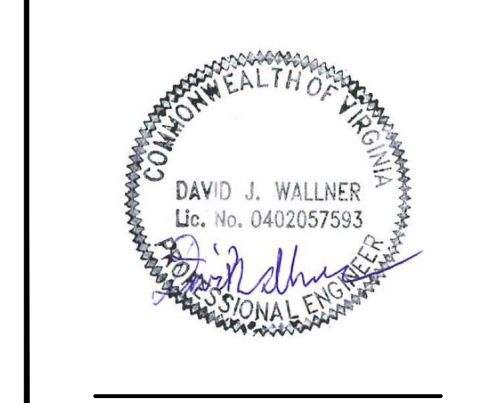
CONTRACTOR IS RESPONSIBLE TO IDENTIFY ALL UTILITIES. THE UTILITY LINES SHOWN ON THE PLAN ARE FOR INFORMATIONAL PURPOSES ONLY AND DO NOT REPRESENT SURVEYED LINE INFORMATION.

ADDED DETAILS FOR ROADS AND PADS	
NO.	DESCRIPTION
7	01/31/18 DW
6	01/26/18 KAL
5	01/08/18 DW
4	11/28/17 DW
3	11/01/17 DW
2	08/18/17 KAL
NO.	DATE
	DWN.:
	CHKD.:
	APPD.:

Mountain Valley Pipeline  
**EROSION AND SEDIMENT CONTROL PLANS**  
 MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE  
 MOUNTAIN VALLEY PIPELINE, LLC  
 555 SOUTHPOINTE BOULEVARD, SUITE 200  
 CANONSBURG, PA 15317

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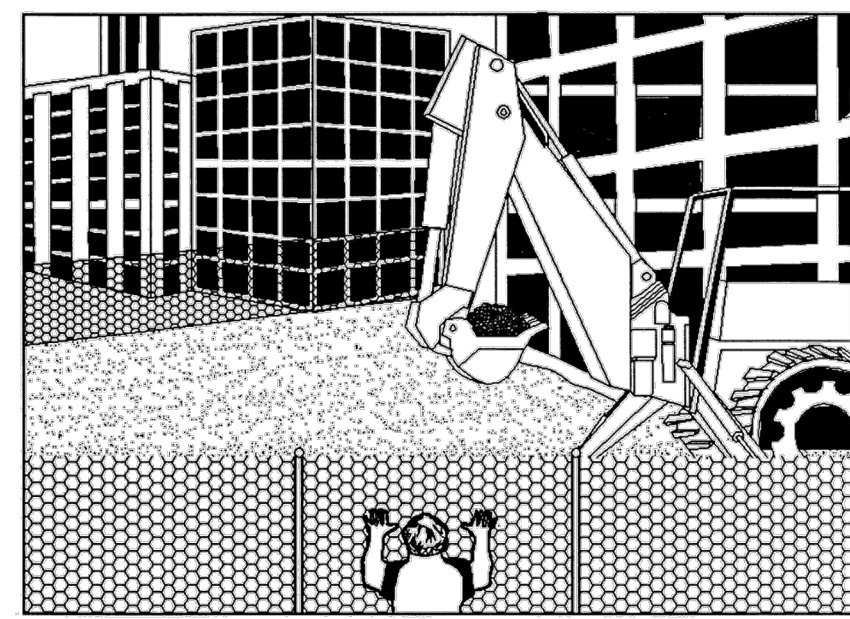
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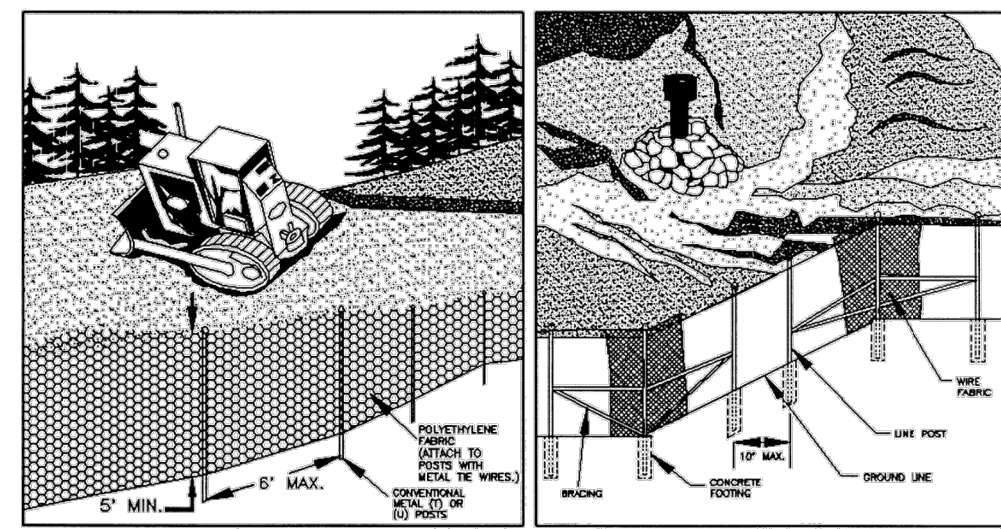
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### SAFETY FENCE



PERSPECTIVE VIEW



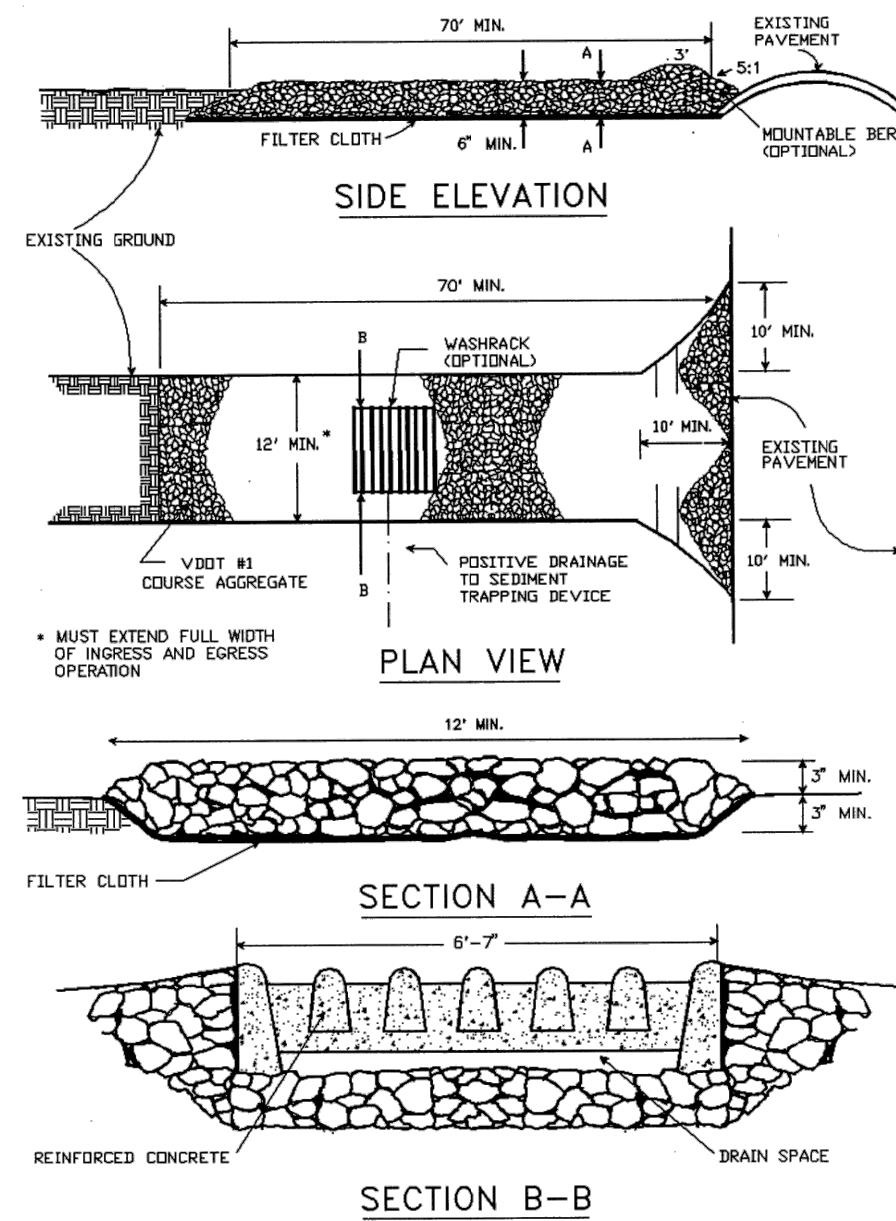
PERSPECTIVE VIEW PLASTIC FENCE

PERSPECTIVE VIEW METAL FENCE

Source: Adapted from Conwed Plastics and VDOT Road and Bridge Standards Plate 3.01-1

SAFETY FENCE  
TAKEN FROM VADEQ 1992 MANUAL

### STONE CONSTRUCTION ENTRANCE



Source: Adapted from 1983 Maryland Standards for Soil Erosion and Sediment Control, and Va. DSWC Plate 3.02-1

STONE CONSTRUCTION ENTRANCE  
TAKEN FROM VADEQ 1992 MANUAL

WASH RACK SHALL BE 20 FEET (MIN.) WIDE OR TOTAL WIDTH OF ACCESS.

WASH RACK SHALL BE DESIGNED AND CONSTRUCTED TO ACCOMMODATE ANTICIPATED CONSTRUCTION VEHICULAR TRAFFIC.

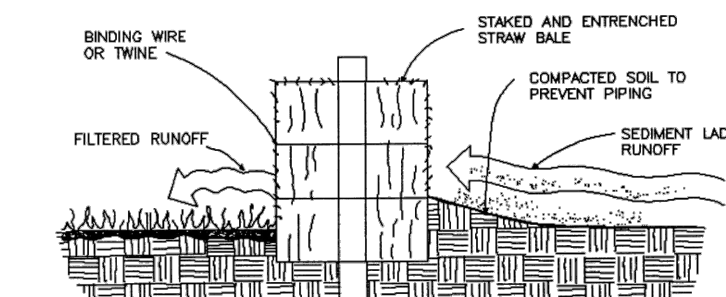
A WATER SUPPLY SHALL BE MADE AVAILABLE TO WASH THE WHEELS OF ALL VEHICLES EXITING THE SITE.

MAINTENANCE: ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE OF ROCK MATERIAL SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. DRAIN SPACE UNDER WASH RACK SHALL BE KEPT OPEN AT ALL TIMES. DAMAGE TO THE WASH RACK SHALL BE REPAIRED PRIOR TO FURTHER USE OF THE RACK. ALL SEDIMENT DEPOSITED ON ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER DRAINAGE COURSES IS NOT ACCEPTABLE.

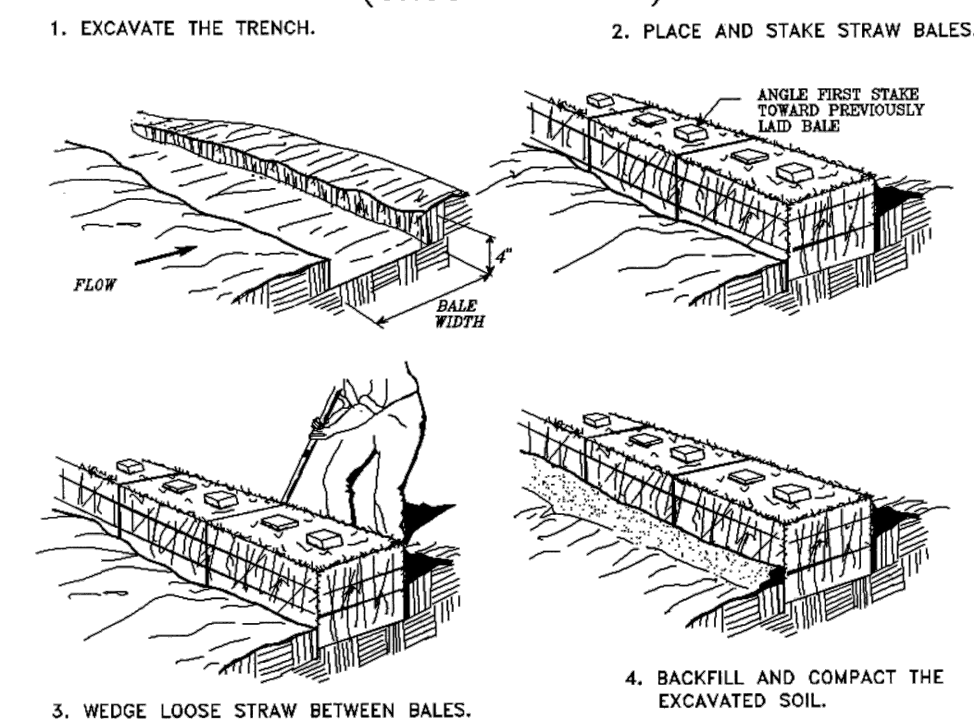
AT A MINIMUM, ROCK CONSTRUCTION ENTRANCES WITH WASH RACKS SHOULD BE CONSTRUCTED TO THE LENGTH, WIDTH, AND THICKNESS DIMENSIONS SHOWN ON STANDARD CONSTRUCTION DETAIL #3-2. A METAL WASH RACK OR LIVESTOCK GRATE IS AN ACCEPTABLE ALTERNATIVE TO THE REINFORCED CONCRETE ONE SHOWN IN THE STANDARD DETAIL. APPROACHES TO THE WASH RACK SHOULD BE LINED WITH AASHTO #1 AT A MINIMUM OF 25' ON BOTH SIDES. THE WASH RACK SHOULD DISCHARGE TO A SEDIMENT REMOVAL FACILITY, SUCH AS A CHANNEL LEADING TO A SEDIMENT REMOVAL DEVICE (E.G. A SEDIMENT TRAP OR SEDIMENT BASIN). ROCK CONSTRUCTION ENTRANCES WITH WASH RACKS SHOULD BE MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK WHEN NECESSARY AT THE END OF EACH WORKDAY. A STOCKPILE OF ROCK MATERIAL SHOULD BE MAINTAINED ON SITE FOR THIS PURPOSE. SEDIMENT DEPOSITED ON PAVED ROADWAYS SHOULD BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE.

NOTE: WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER DRAINAGE COURSES IS NOT ACCEPTABLE. DAMAGED WASH RACKS SHOULD BE REPAIRED AS NECESSARY TO MAINTAIN THEIR EFFECTIVENESS.

### STRAW BALE BARRIER



PROPERLY INSTALLED STRAW BALE (CROSS SECTION)

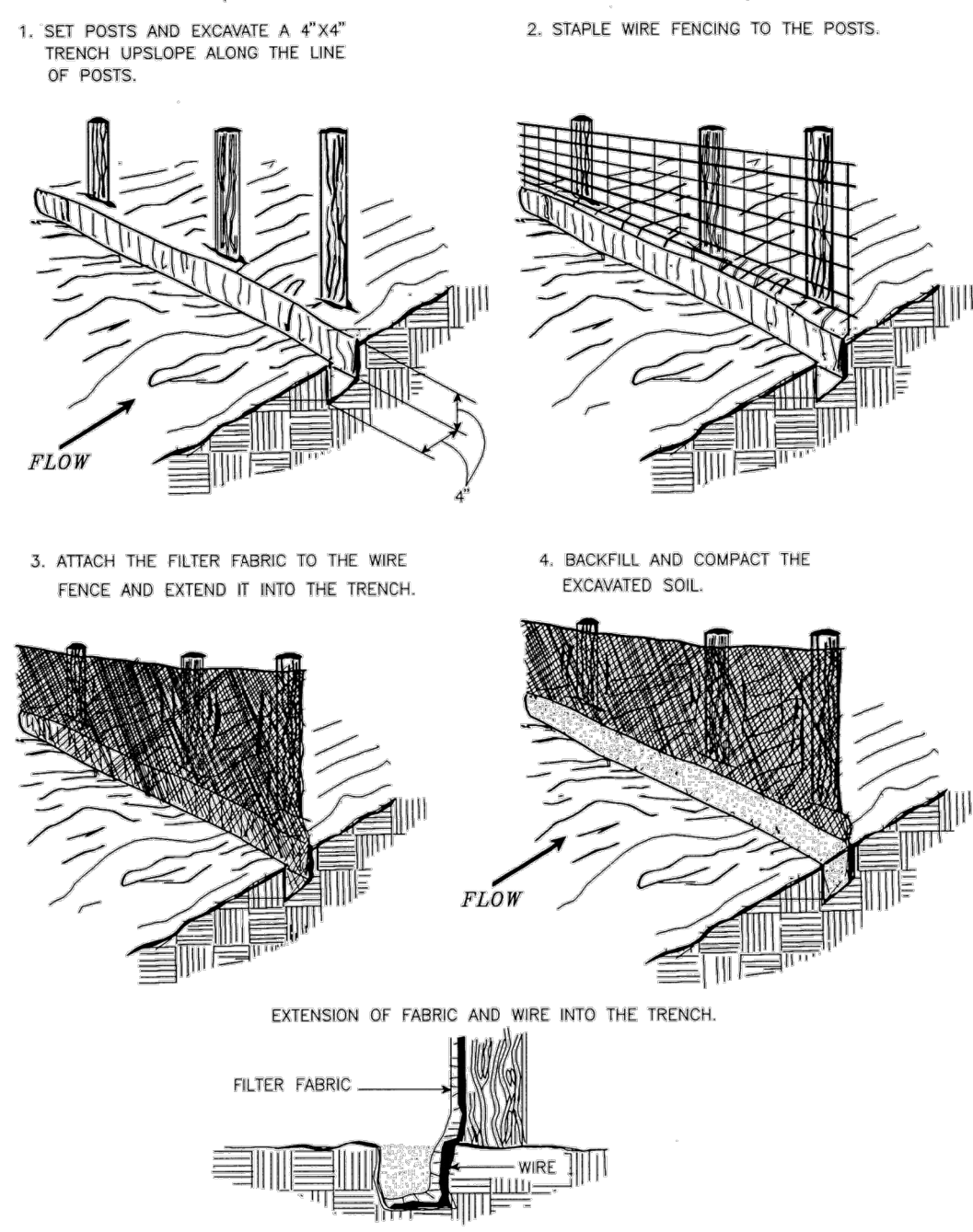


CONSTRUCTION OF STRAW BALE BARRIER

Source: Va. DSWC Plate 3.04-1

STRAW BALE BARRIER  
TAKEN FROM VADEQ 1992 MANUAL

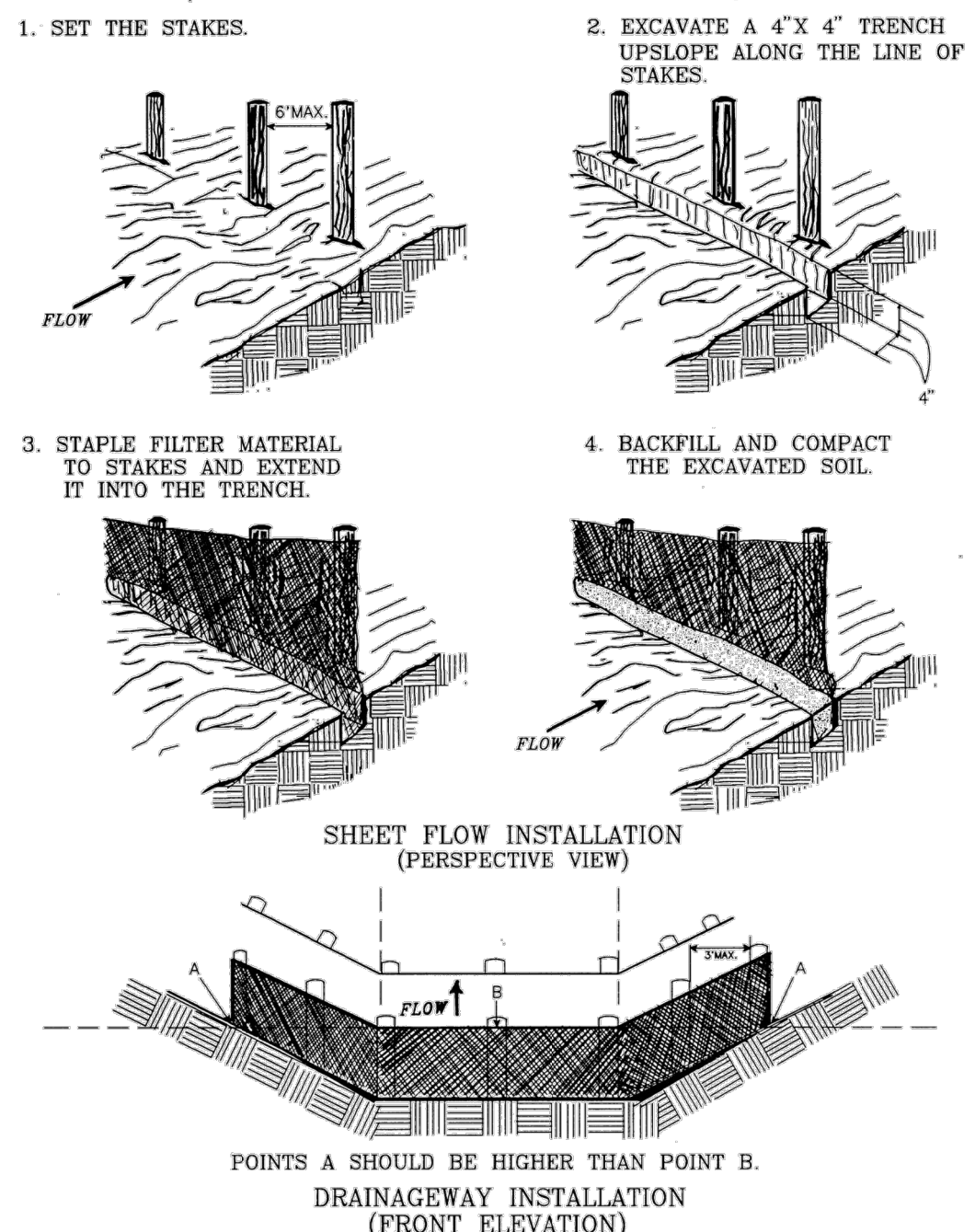
### CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)



Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant Plate 3.05-1

CONSTRUCTION OF SILT FENCE (WITH WIRE SUPPORT)  
TAKEN FROM VADEQ 1992 MANUAL

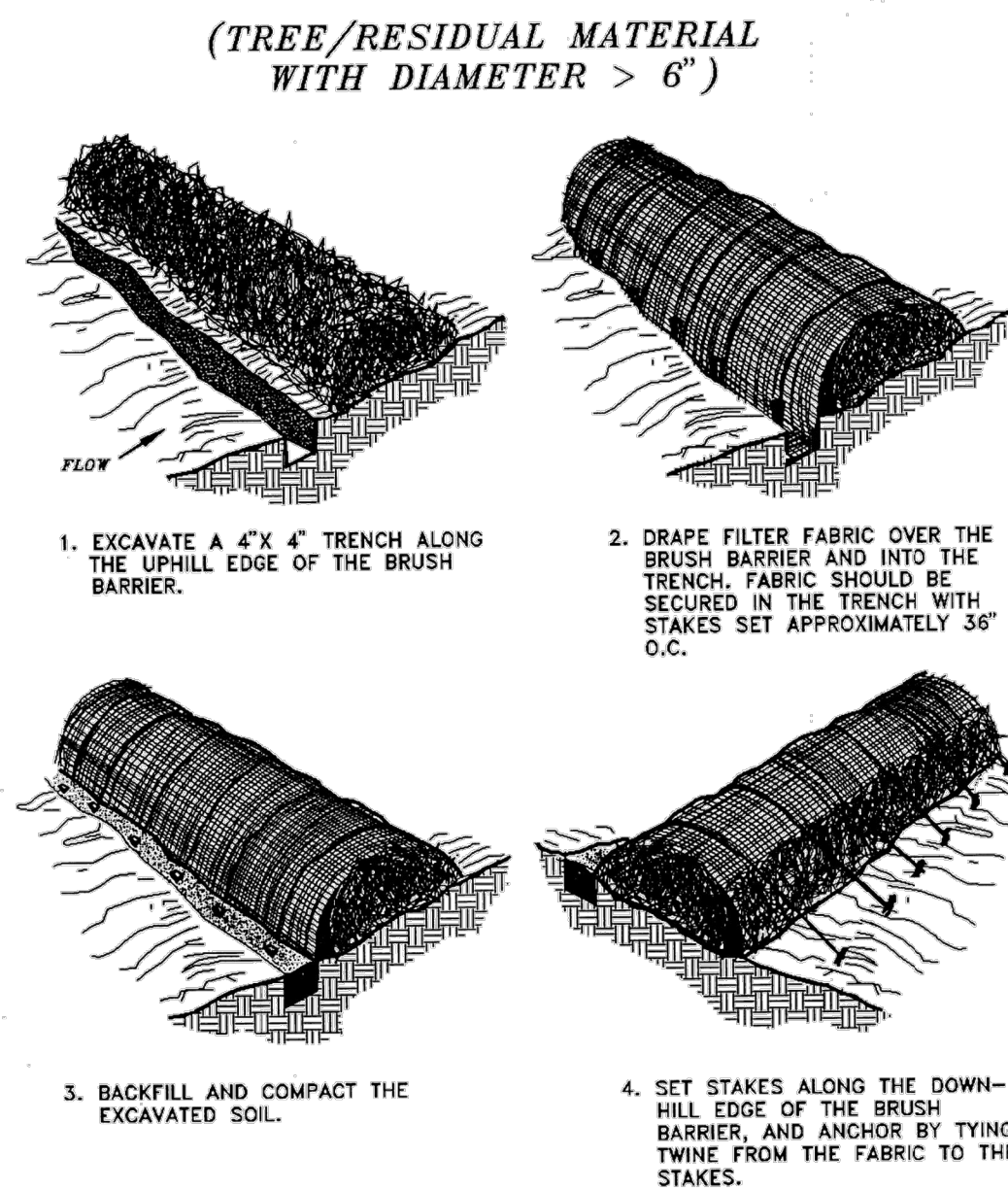
### CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)



Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant Plate 3.05-2

CONSTRUCTION OF SILT FENCE (WITHOUT WIRE SUPPORT)  
TAKEN FROM VADEQ 1992 MANUAL

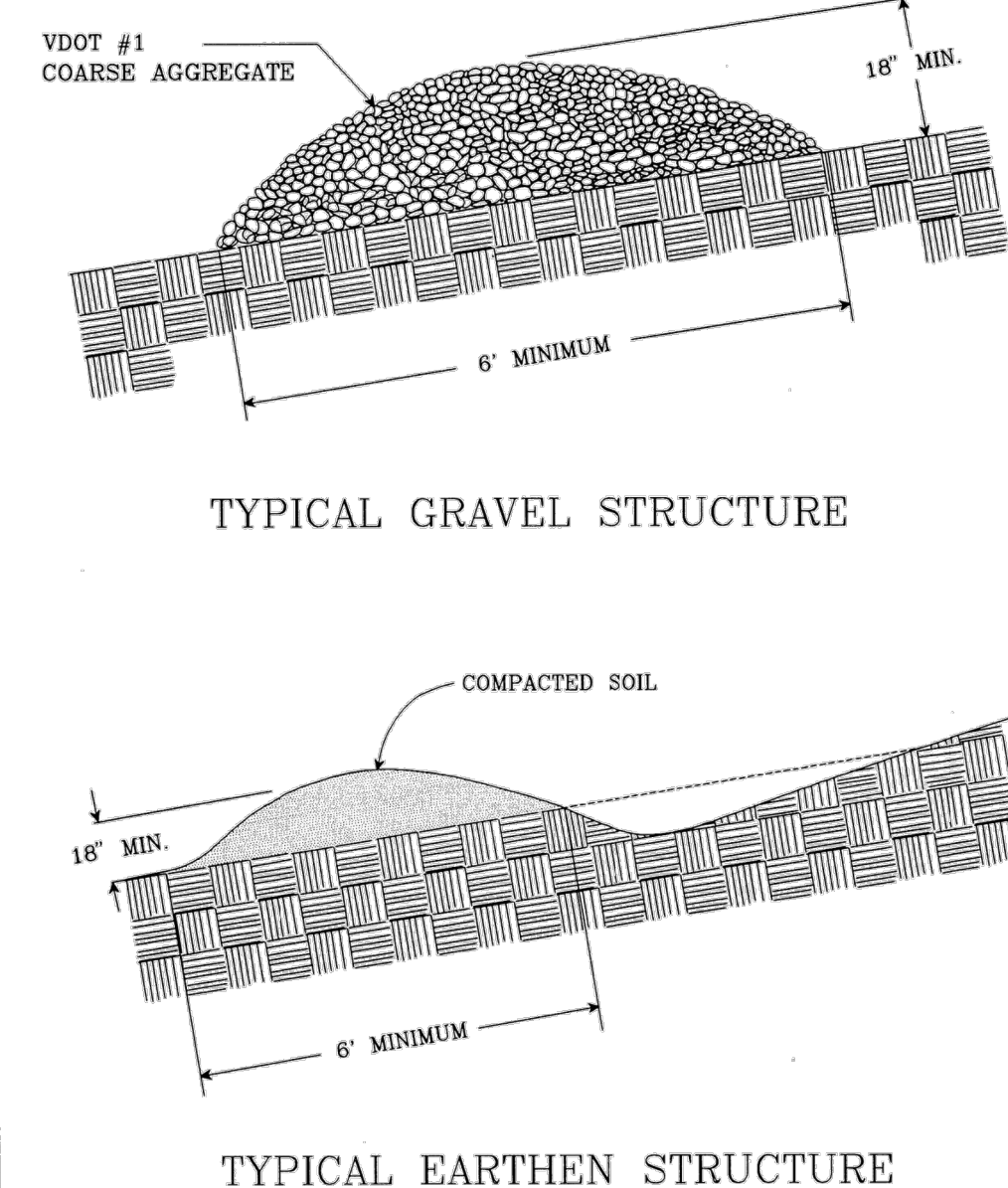
### CONSTRUCTION OF A BRUSH BARRIER COVERED BY FILTER FABRIC (TREE/RESIDUAL MATERIAL WITH DIAMETER > 6")



Source: Va. DSWC Plate 3.06-1

CONSTRUCTION OF A BRUSH BARRIER  
TAKEN FROM VADEQ 1992 MANUAL

### TEMPORARY RIGHT-OF-WAY DIVERSIONS



Source: Va. DSWC Plate 3.11-1

TEMPORARY RIGHT-OF-WAY DIVERSION  
DEVELOPED FROM VADEQ 1992 MANUAL

ADDED DETAILS FOR ROADS AND PADS	
ADDRESS VADEQ COMMENTS	
ADDRESS VADEQ COMMENTS	
ADDRESS VADEQ COMMENTS	
ADDRESS VADEQ COMMENTS	
ADDRESS VADEQ COMMENTS	
ADDRESS VADEQ COMMENTS	
NO.:	DATE:
CHKD.:	APPD.:
REVISIONS:	

Mountain Valley Pipeline  
EROSION AND SEDIMENT CONTROL PLANS  
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE

MOUNTAIN VALLEY PIPELINE, LLC  
555 SOUTHPOINTE BOULEVARD, SUITE 200  
CANONSBURG, PA 15317

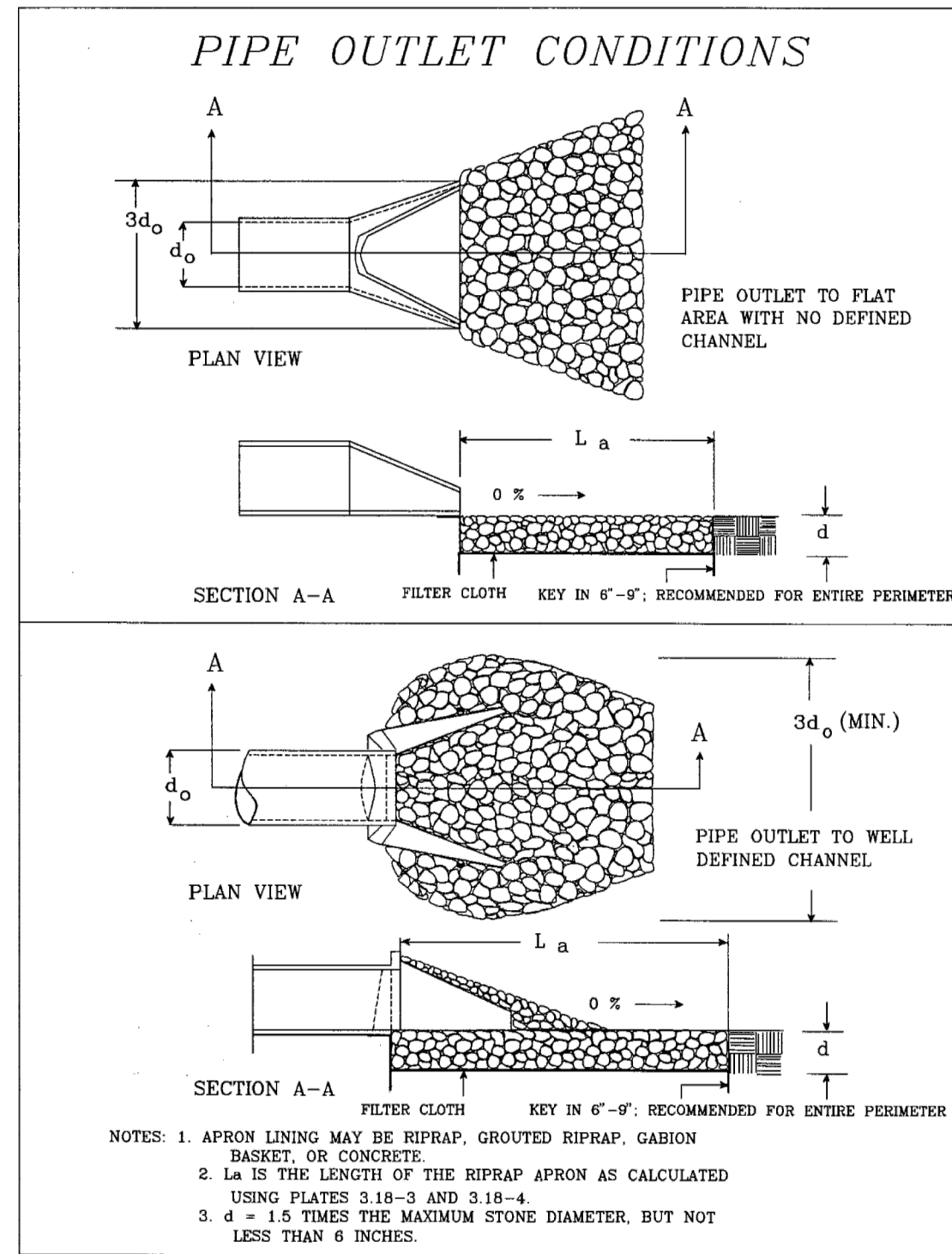
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FOSTER PLAZA 7  
PITTSBURGH, PA 15220

GENERAL DETAILS SET

DAVID J. WALLNER  
Lic. No. 0402057593  
Professional Engineer

DRAWN BY:	KAL
CHECKED BY:	HT
APPROVED BY:	RE
DATE:	11/28/2017
SCALE:	AS SHOWN
SHT. NO.	0.01 OF 0.23

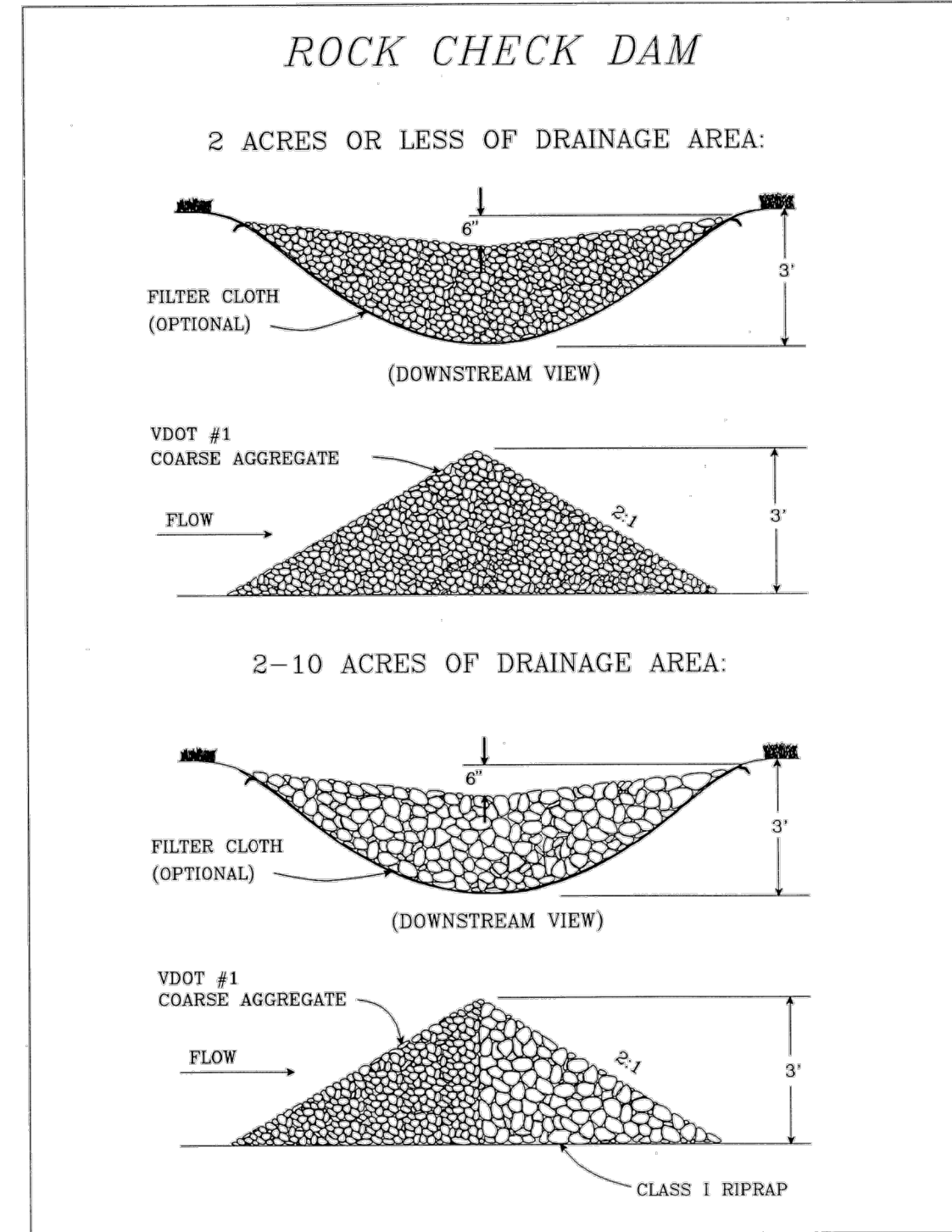




Source: Va. DSWC

Plate 3.18-1

PIPE OUTLET CONDITIONS  
TAKEN FROM VADEQ 1992 MANUAL



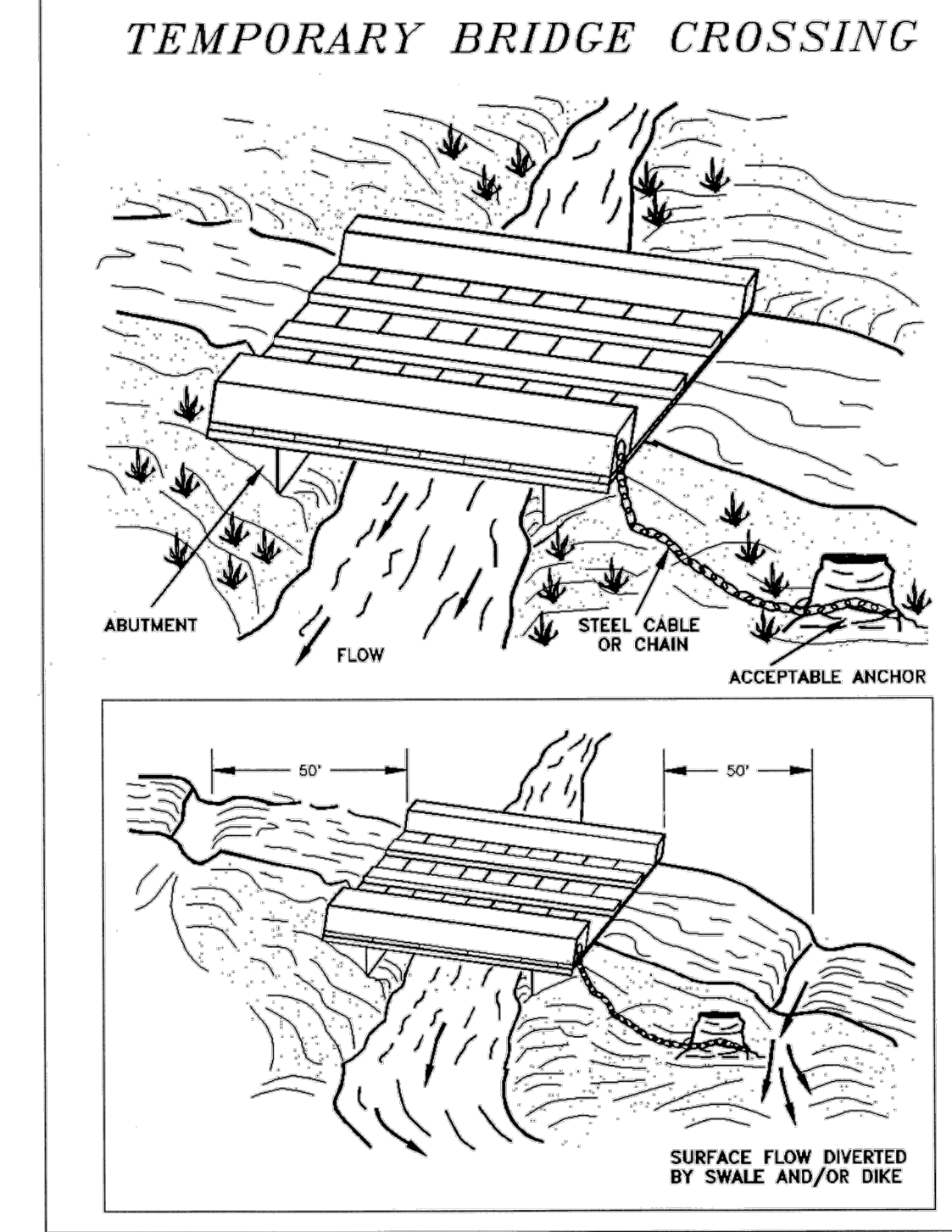
Source: Va. DSWC

Plate 3.20-1

ROCK CHECK DAM  
DEVELOPED FROM VADEQ 1992 MANUAL

NOTES:  
NO FORMAL DESIGN IS REQUIRED FOR A CHECK DAM, HOWEVER THE FOLLOWING CRITERIA SHOULD BE ADHERED TO WHEN SPECIFYING CHECK DAMS:

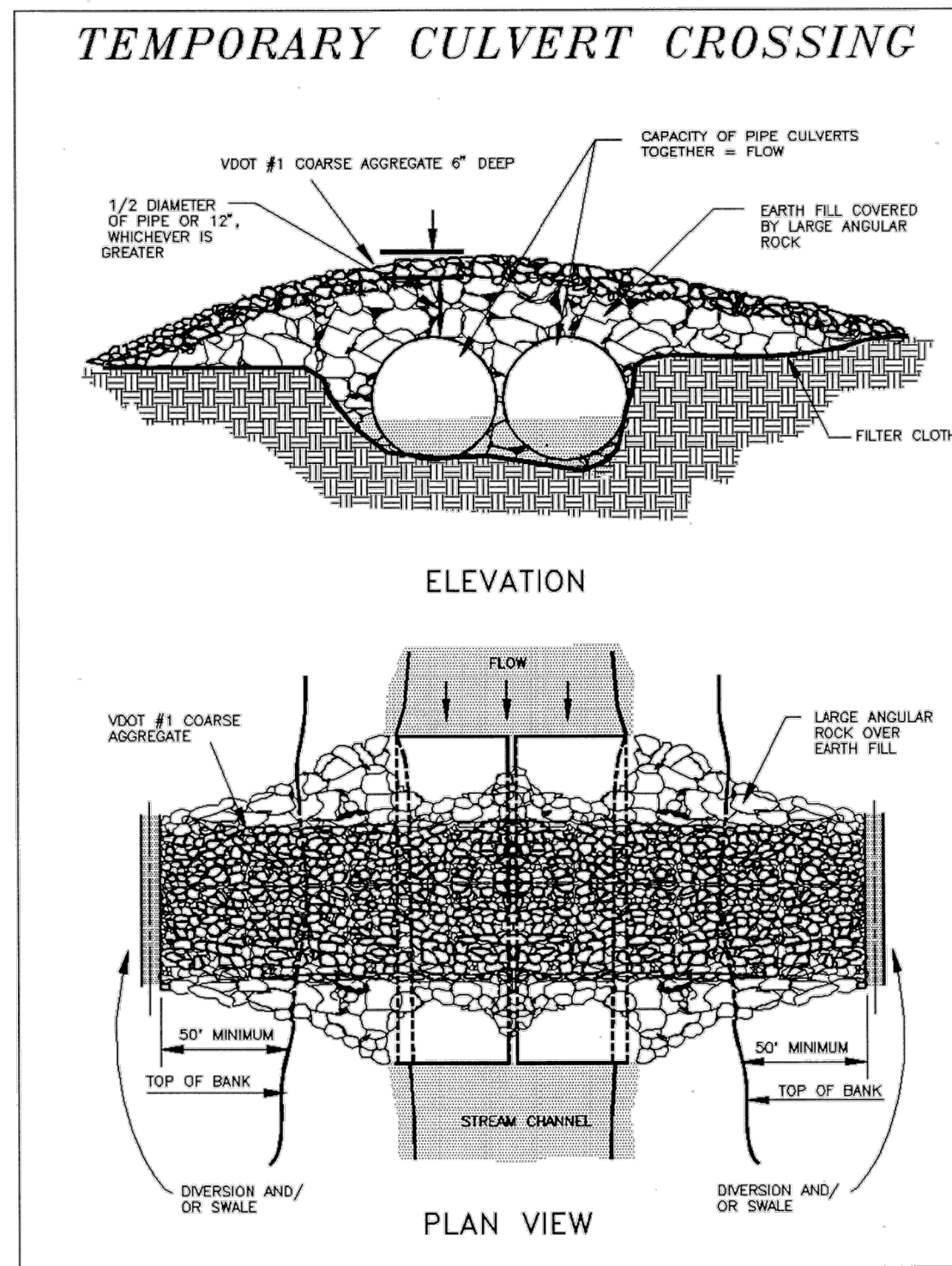
1. THE DRAINAGE AREA OF THE DITCH OR SWALE BEING PROTECTED SHALL NOT EXCEED 2 ACRES WHEN VDOT #1 COARSE AGGREGATE IS USED ALONE AND SHALL NOT EXCEED 10 ACRES WHEN A COMBINATION OF CLASS 1 RIPRAP (ADDED FOR STABILITY) AND VDOT #1 COARSE AGGREGATE IS USED.
2. THE MAXIMUM HEIGHT OF THE DAM SHALL BE 3.0 FEET.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 6 INCHES LOWER THAN THE OUTER EDGES. FIELD EXPERIENCE HAS SHOWN THAT MANY DAMS ARE NOT CONSTRUCTED TO PROMOTE THIS "WEIR" EFFECT. STORMWATER FLOWS ARE THEN FORCED TO THE STONE-SOIL INTERFACE, THEREBY PROMOTING SCOUR AT THE POINT AND SUBSEQUENT FAILURE OF THE STRUCTURE TO PERFORM ITS INTENDED FUNCTION.
4. FOR ADDED STABILITY, THE BASE OF THE CHECK DAM CAN BE KEYED INTO THE SOIL APPROXIMATELY 6 INCHES.
5. THE MAXIMUM SPACING BETWEEN THE DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE TOP OF THE DOWNSTREAM DAM.
6. HAND OR MECHANICAL PLACEMENT WILL BE NECESSARY TO ACHIEVE COMPLETE COVERAGE OF THE DITCH OR SWALE AND TO INSURE THAT THE CENTER OF THE DAM IS LOWER THAN THE EDGES.
7. FILTER CLOTH MAY BE USED UNDER THE STONE TO PROVIDE A STABLE FOUNDATION AND TO FACILITATE THE REMOVAL OF THE STONE.



Source: 1983 Maryland Standards and Specifications for Soil Erosion and Sediment Control

Plate 3.24-1

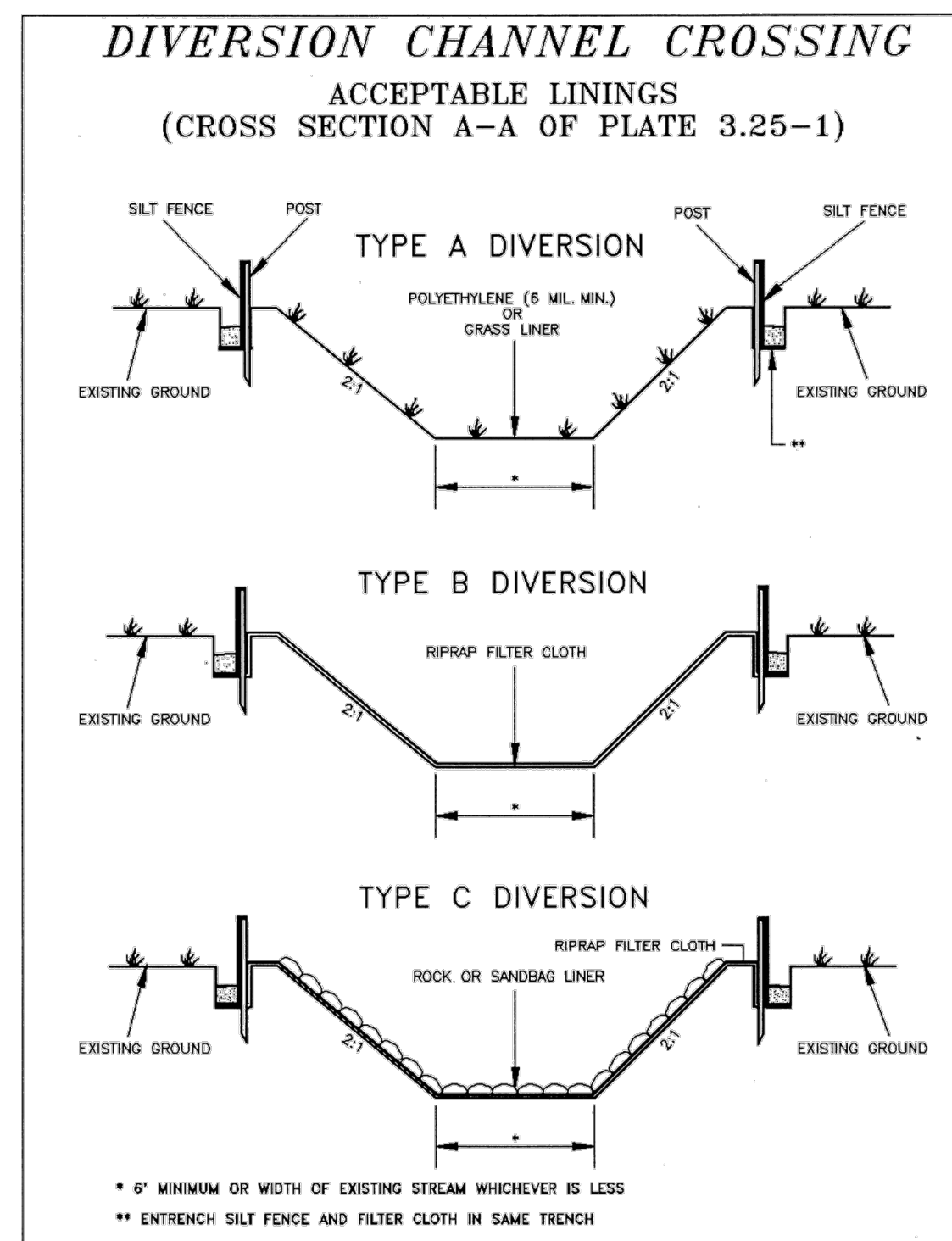
TEMPORARY BRIDGE CROSSING  
DEVELOPED FROM VADEQ 1992 MANUAL



Source: Va. DSWC

Plate 3.24-2

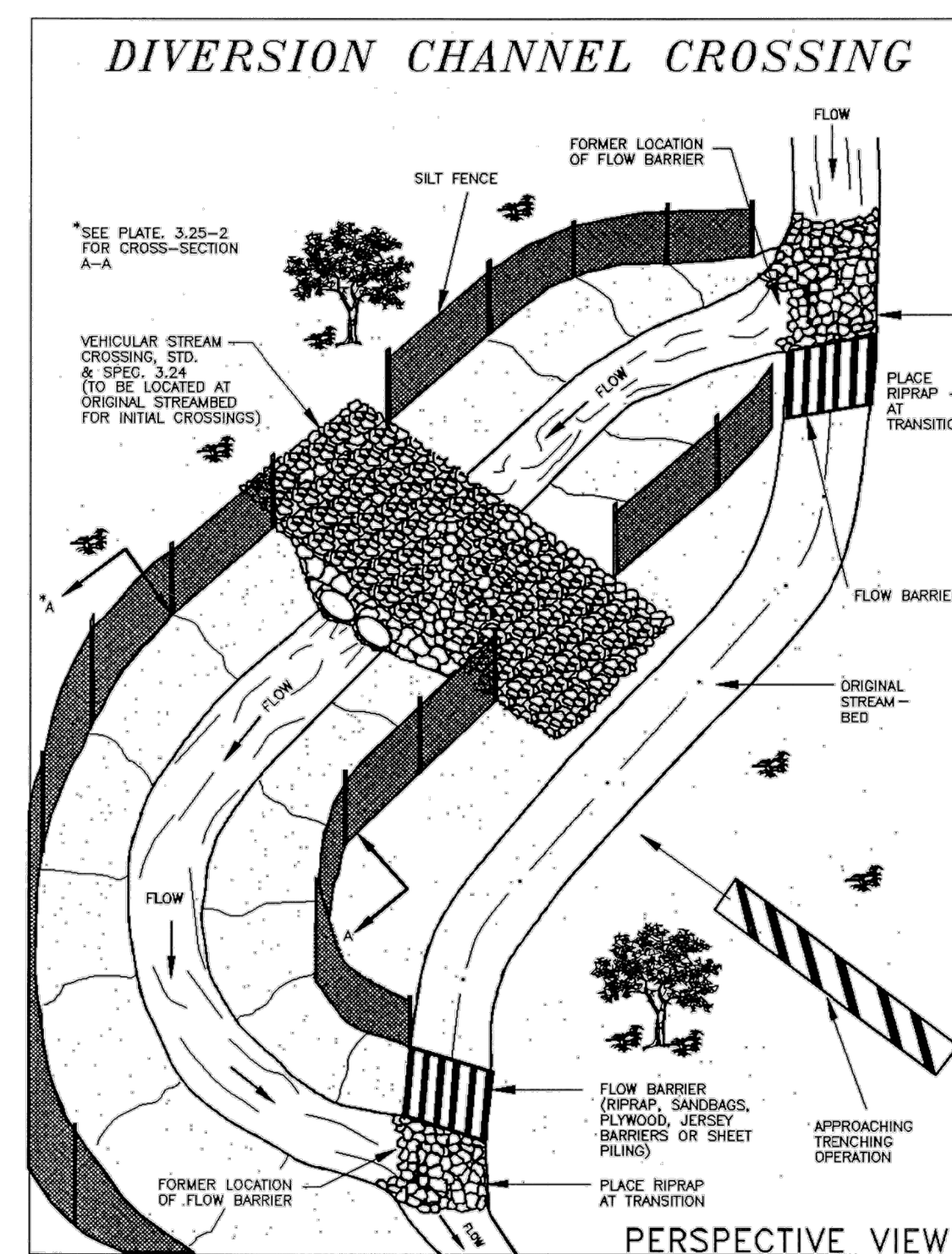
TEMPORARY CULVERT CROSSING  
TAKEN FROM VADEQ 1992 MANUAL



Source: Adapted from VDOT Standard Sheets

Plate 3.25-2

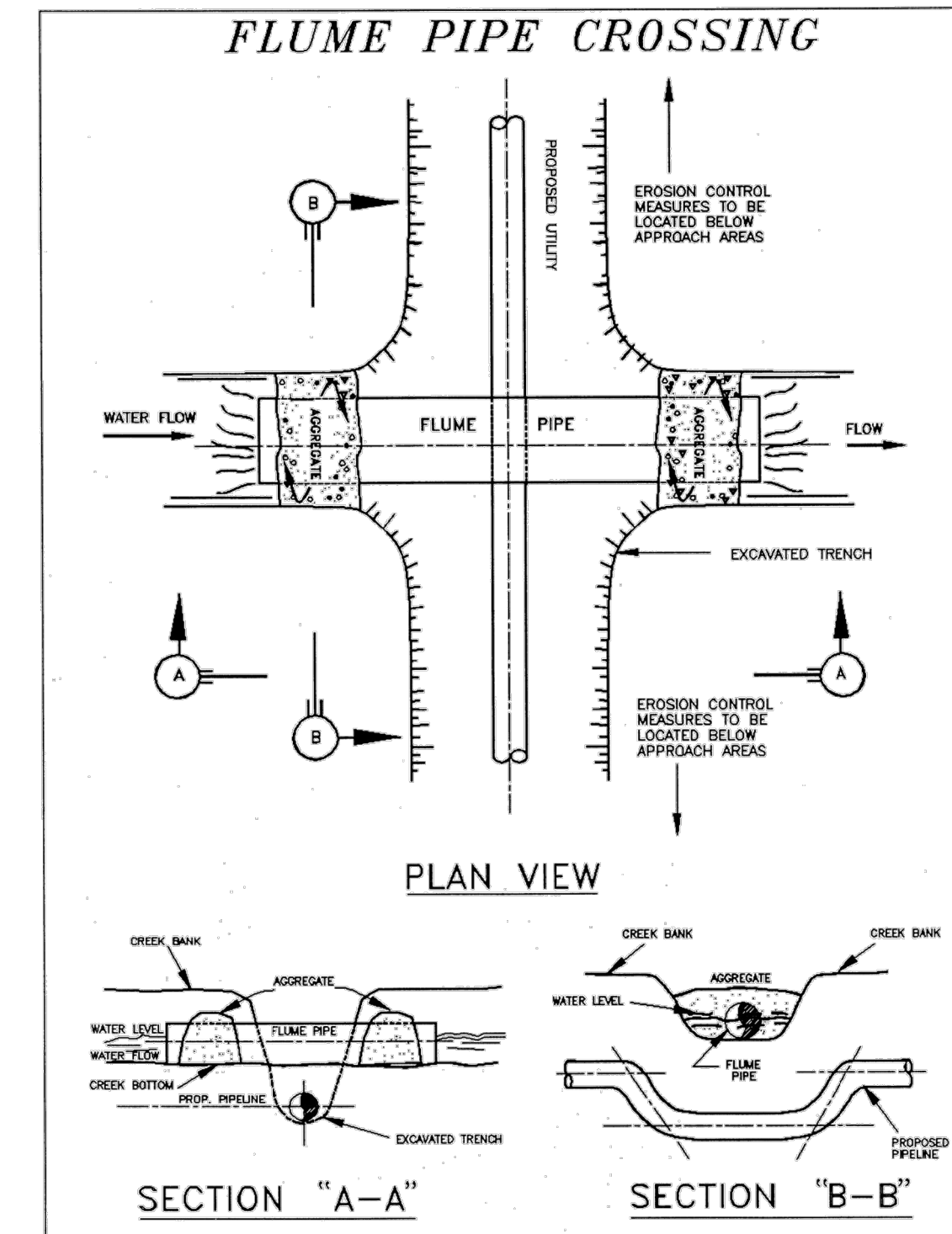
DIVERSION CHANNEL CROSSING  
DEVELOPED FROM VADEQ 1992 MANUAL



Source: Va. DSWC

Plate 3.25-1

DIVERSION CHANNEL CROSSING  
DEVELOPED FROM VADEQ 1992 MANUAL



Source: Va. DSWC

Plate 3.25-3

FLUME PIPE CROSSING  
DEVELOPED FROM VADEQ 1992 MANUAL

ADDED DETAILS FOR ROADS AND PADS	NO.	DATE	CHKD.	APPD.
ADDRESS VADEQ COMMENTS	7	01/31/18	KAL	
ADDRESS VADEQ COMMENTS	6	01/26/18	KAL	
ADDRESS VADEQ COMMENTS	5	01/08/18	KAL	
ADDRESS VADEQ COMMENTS	4	11/28/17	KAL	
ADDRESS VADEQ COMMENTS	3	11/01/17	KAL	
ADDRESS VADEQ COMMENTS	2	08/18/17	KAL	
DESCRIPTION:	NO.	DATE	CHKD.	APPD.

Mountain Valley Pipeline  
EROSION AND SEDIMENT CONTROL PLANS  
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE

MOUNTAIN VALLEY PIPELINE, LLC  
555 SOUTHPOINTE BOULEVARD, SUITE 200  
CANONSBURG, PA 15317

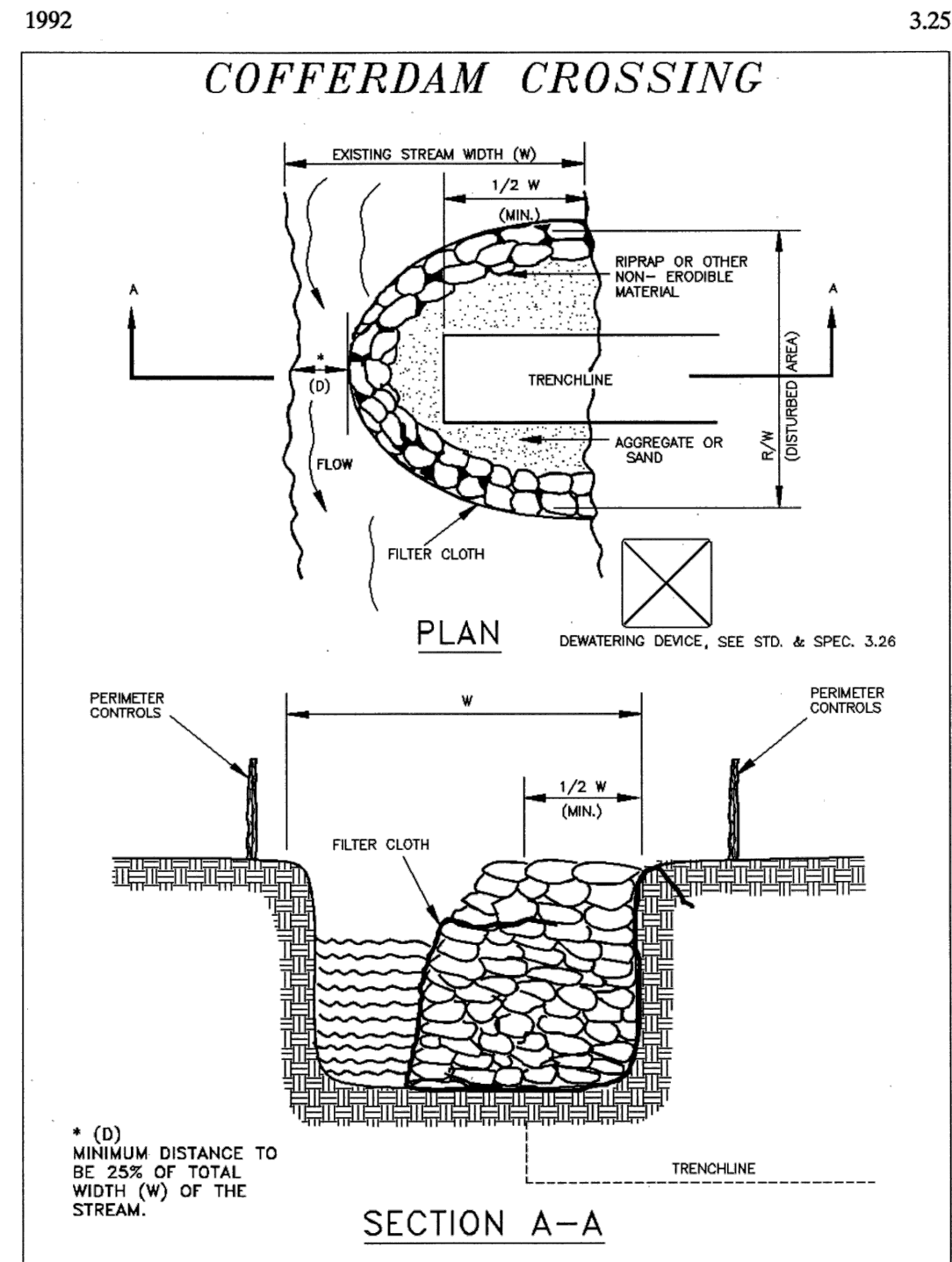
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GENERAL DETAILS SET

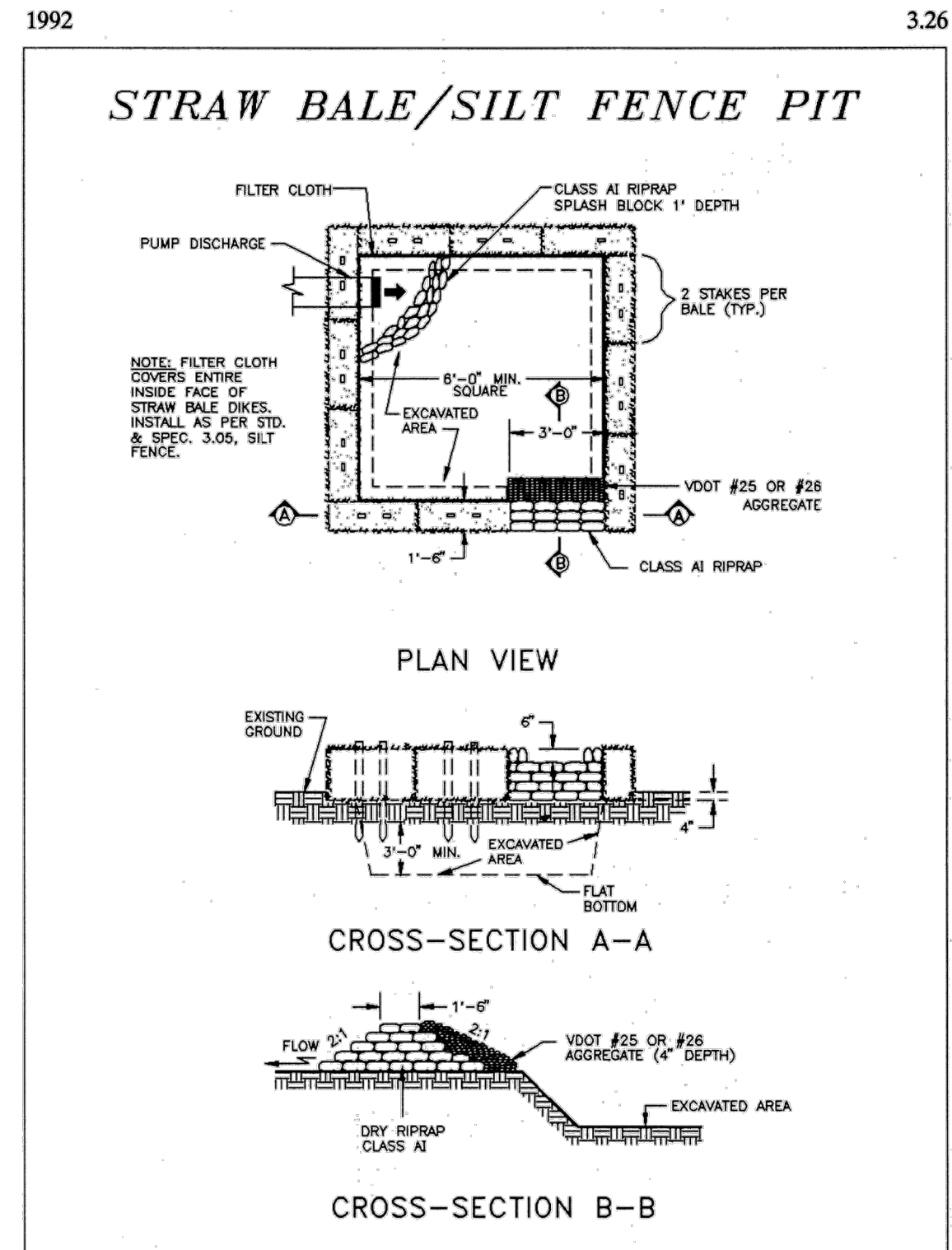
COMMONWEALTH OF PENNSYLVANIA  
DAVID J. WALLNER  
Lic. No. 0402057593  
Professional Engineer

DRAWN BY:	KAL
CHECKED BY:	HT
APPROVED BY:	RE
DATE:	11/28/2017
SCALE:	AS SHOWN
SHT. NO.	0.02 OF 0.23

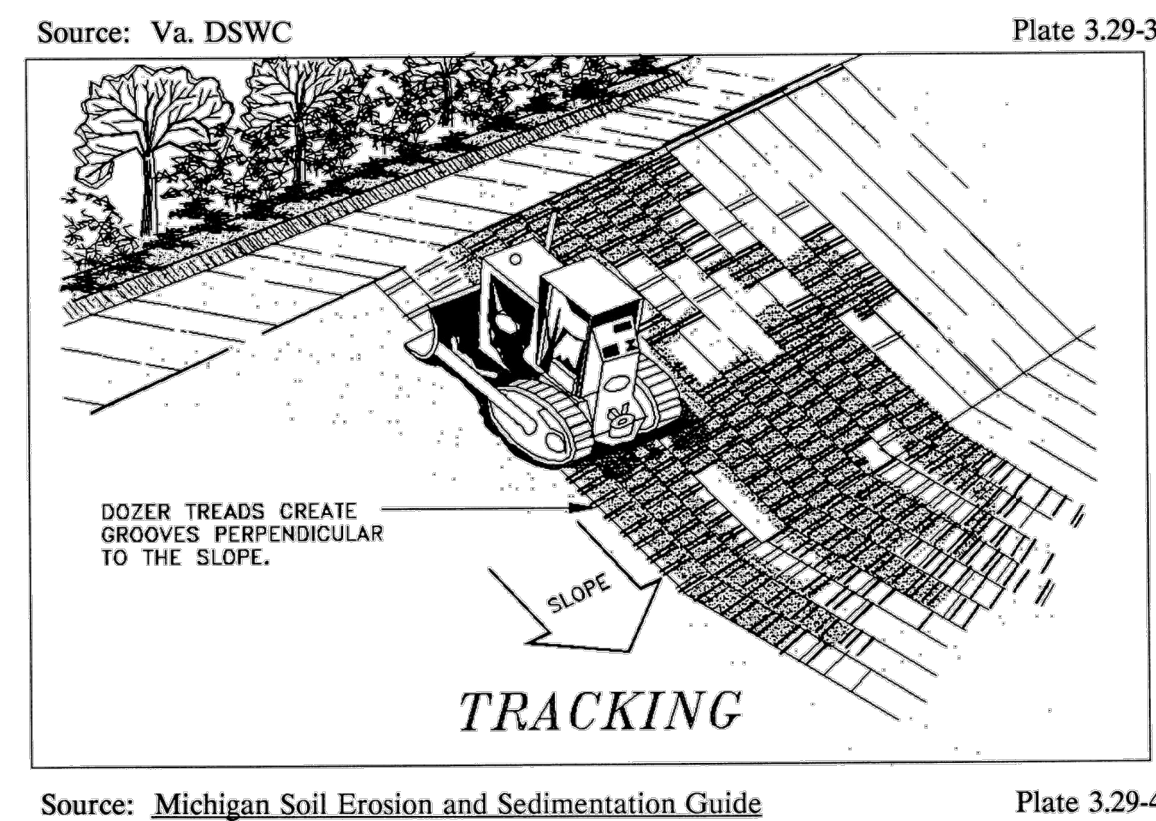
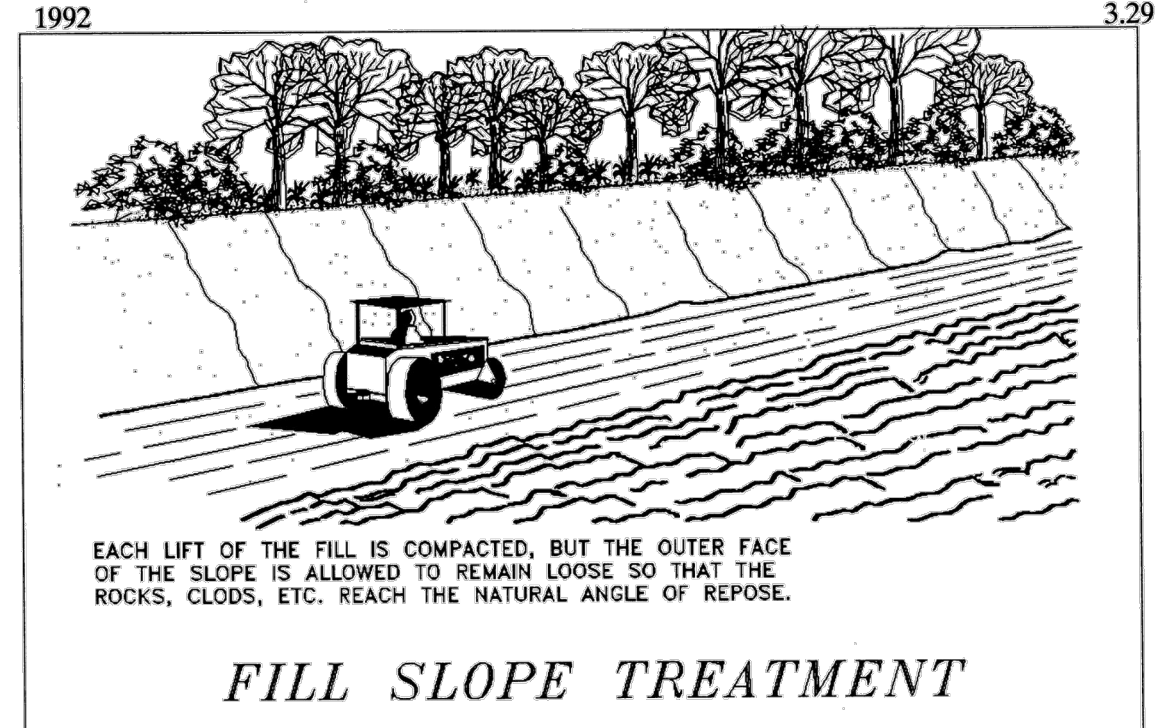




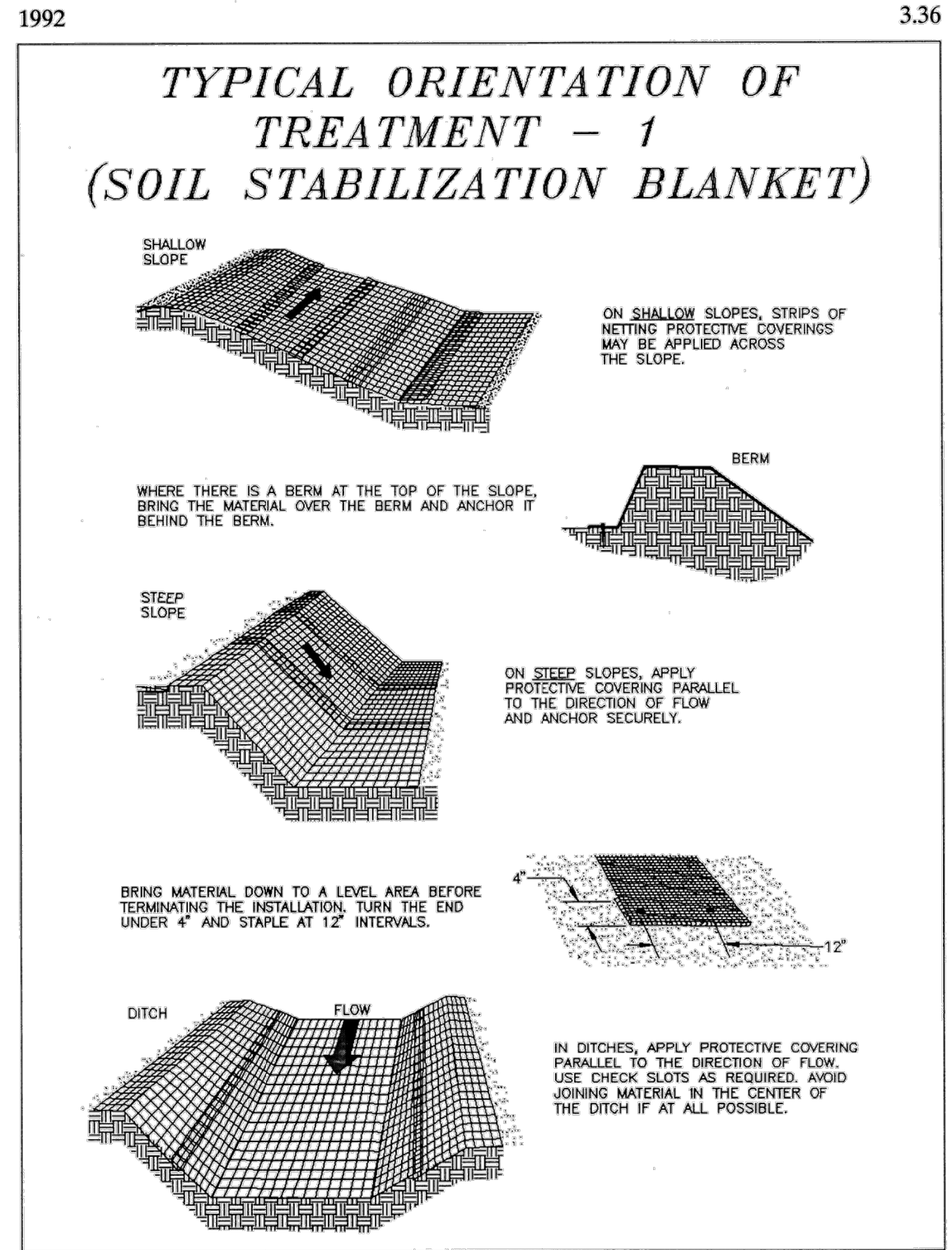
Source: Va. DSWC Plate 3.25-4  
**COFFERDAM STREAM CROSSING**  
 TAKEN FROM VADEQ 1992 MANUAL



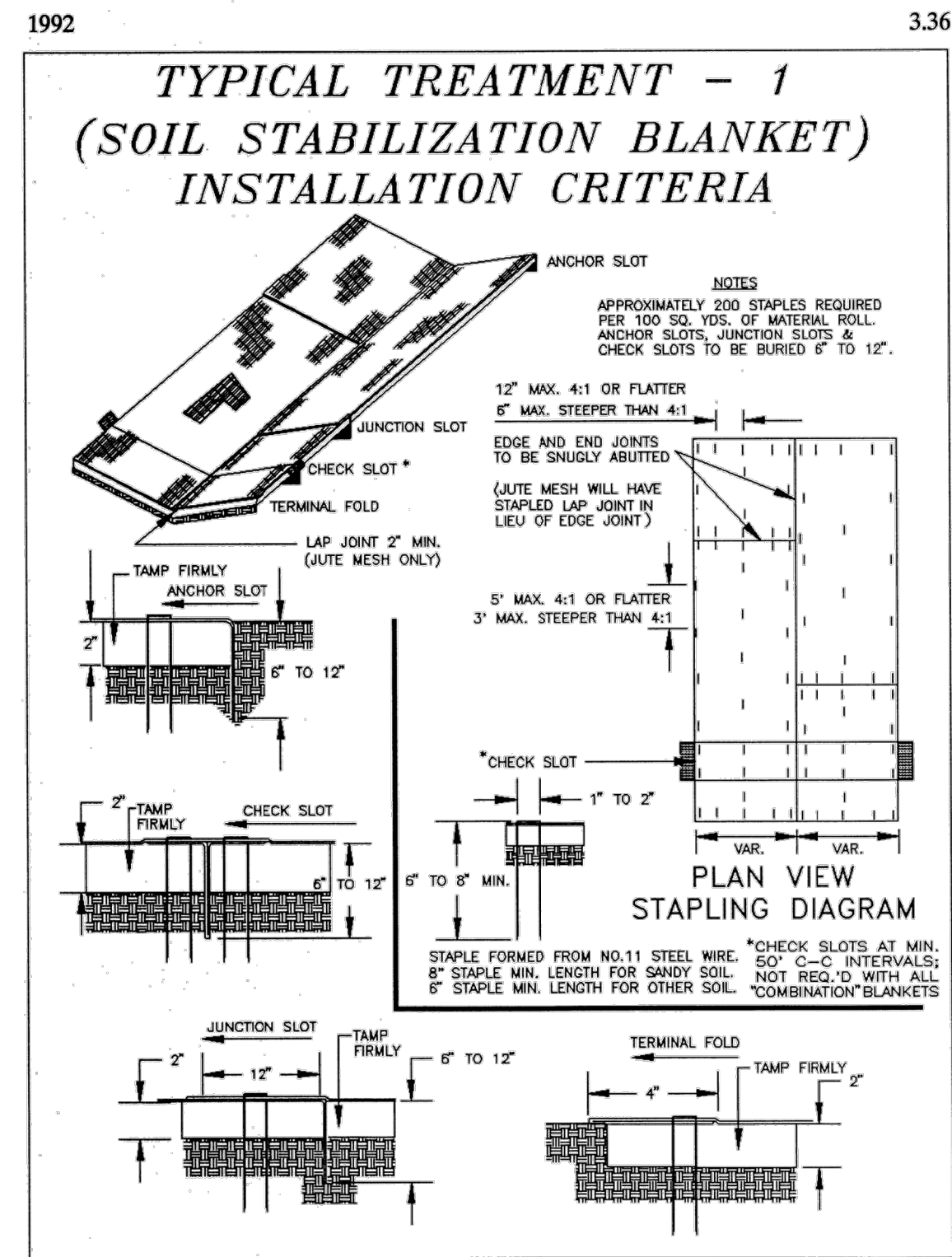
Source: Va. DSWC Plate 3.26-3  
**STRAW BALE/SILT FENCE PIT**  
 DEVELOPED FROM VADEQ 1992 MANUAL



Source: Va. DSWC Plate 3.29-3  
 Source: Michigan Soil Erosion and Sedimentation Guide Plate 3.29-4  
**FILL SLOPE TREATMENT & TRACKING**  
 TAKEN FROM VADEQ 1992 MANUAL

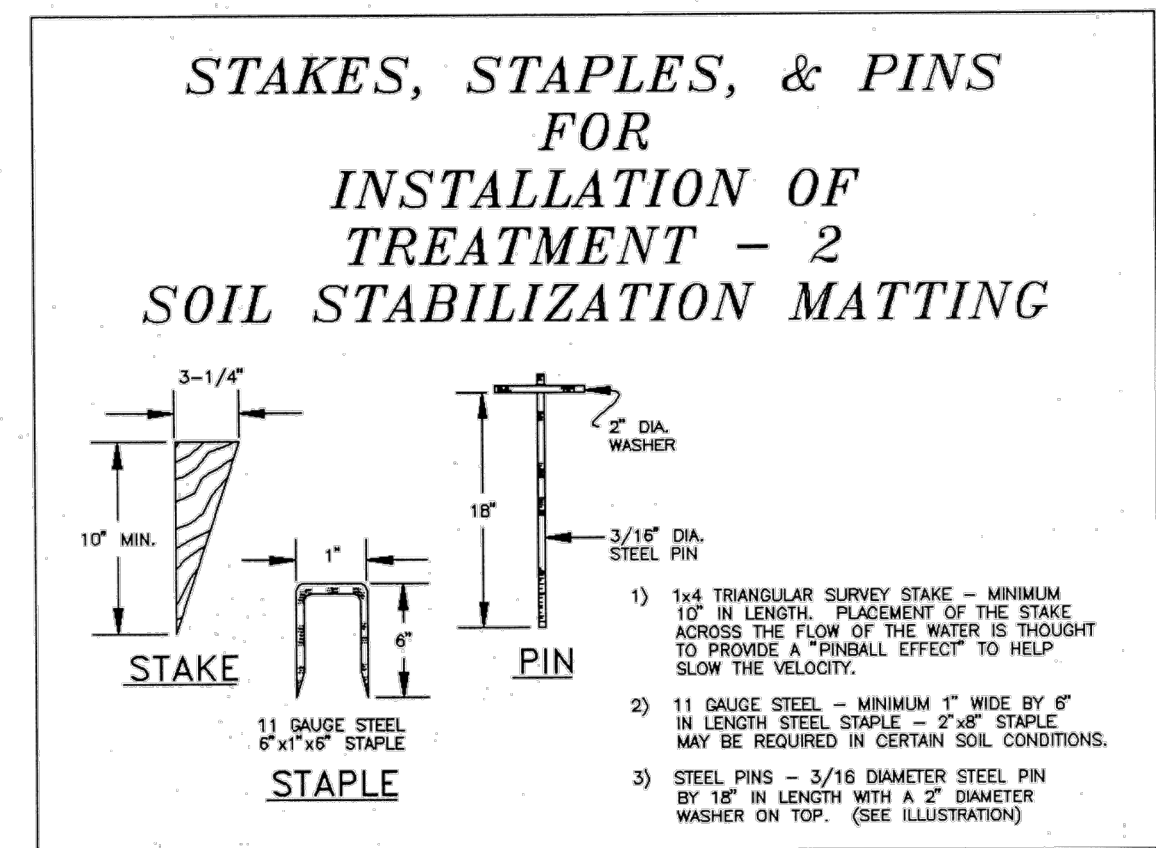


Source: Adapted from Ludlow Products Brochure Plate 3.36-1  
**TYPICAL ORIENTATION OF TREATMENT**  
**SOIL STABILIZATION BLANKET**  
 DEVELOPED FROM VADEQ 1992 MANUAL



Source: VDOT Road and Bridge Standards Plate 3.36-2

**SOIL STABILIZATION BLANKET**  
 INSTALLATION CRITERIA  
 DEVELOPED FROM VADEQ 1992 MANUAL

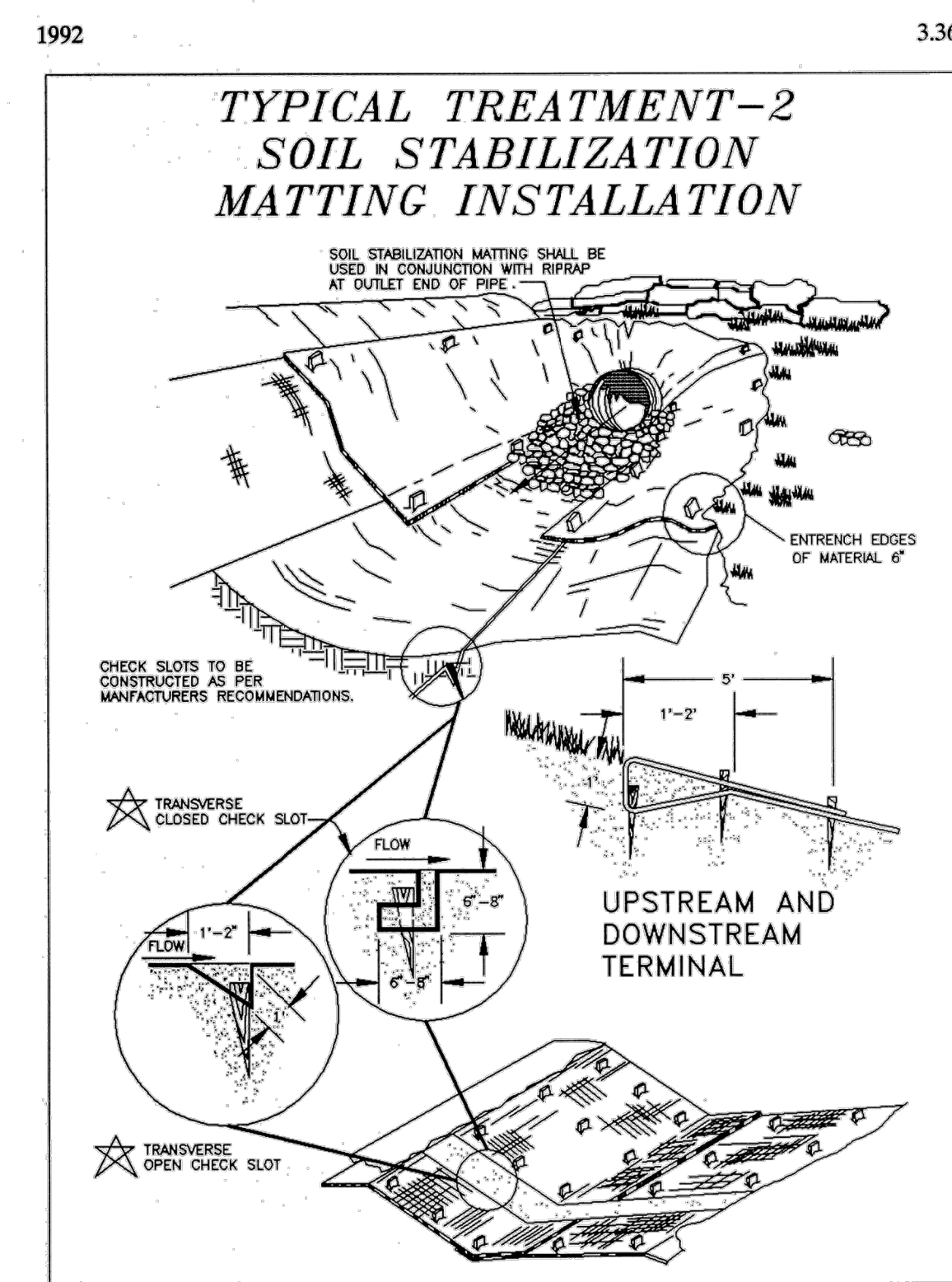


Source: Product literature from Greenstreak, Inc. Plate 3.36-3

**Installation Requirements**

**Site Preparation** - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1 inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. If necessary, redirect any runoff away from the ditch or slope during installation.

**STAKES, STAPLES, & PINS FOR INSTALLATION**  
**OF SOIL STABILIZATION MATTING**  
 DEVELOPED FROM VADEQ 1992 MANUAL



Source: VDOT Road and Bridge Standards Plate 3.36-4

**TYPICAL TREATMENT**  
**SOIL STABILIZATION MATTING INSTALLATION**  
 DEVELOPED FROM VADEQ 1992 MANUAL

NO.	DATE	CHKD.	APPD.	DESCRIPTION
7	01/31/18	KAL	RE	ADDED DETAILS FOR ROADS AND PADS
6	01/26/18	KAL	RE	ADDRESS VADEQ COMMENTS
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Mountain Valley Pipeline  
**EROSION AND SEDIMENT CONTROL PLANS**  
**MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE**  
 MOUNTAIN VALLEY PIPELINE, LLC  
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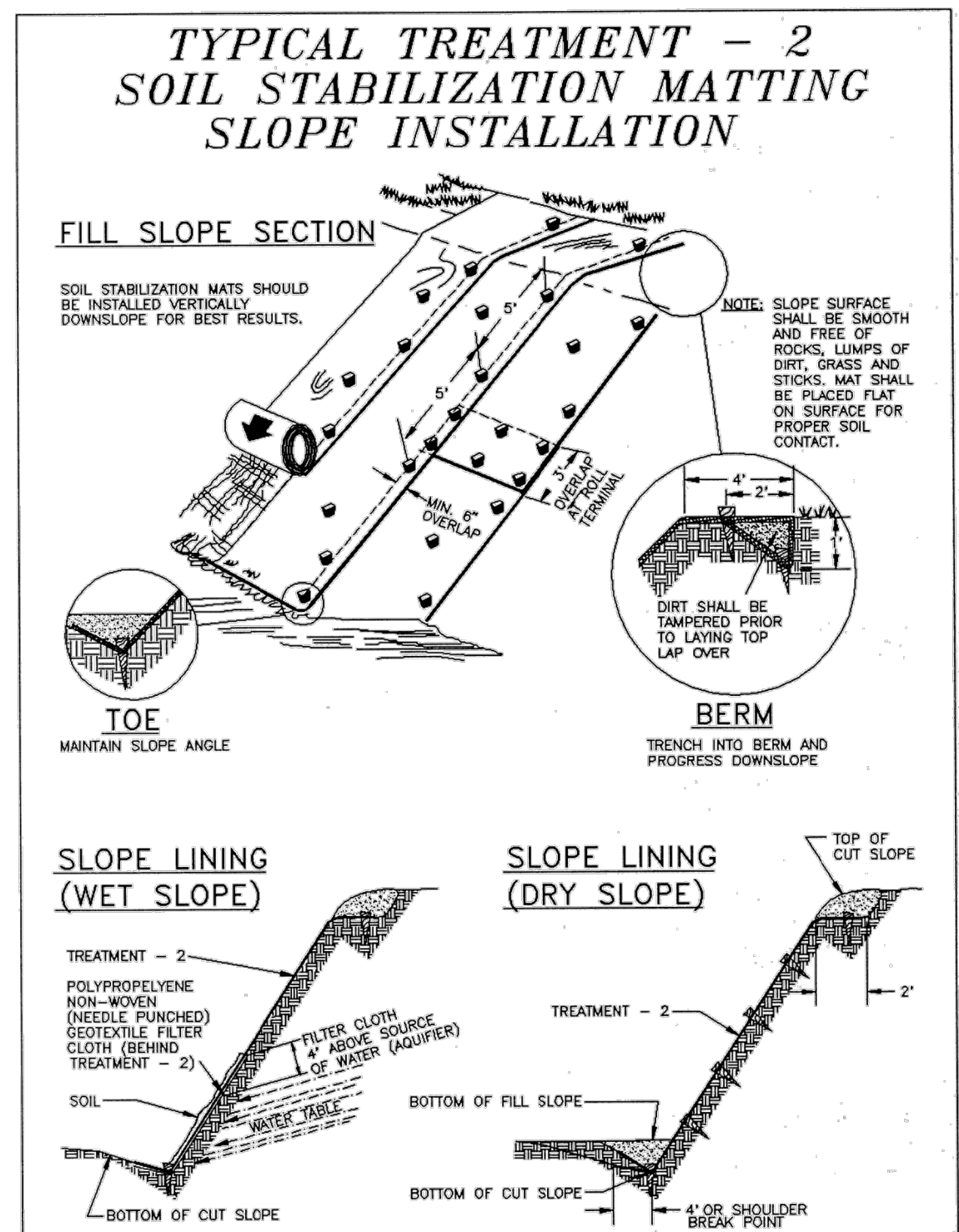
COMMONWEALTH OF PENNSYLVANIA  
 DAVID J. WALLNER  
 Lic. No. 040207593  
 PROFESSIONAL ENGINEER

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APPROVED BY:	RE
DATE:	11/28/2017
SCALE:	AS SHOWN
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1992

3.36



Source: VDOT Road and Bridge Standards

Plate 3.36-5

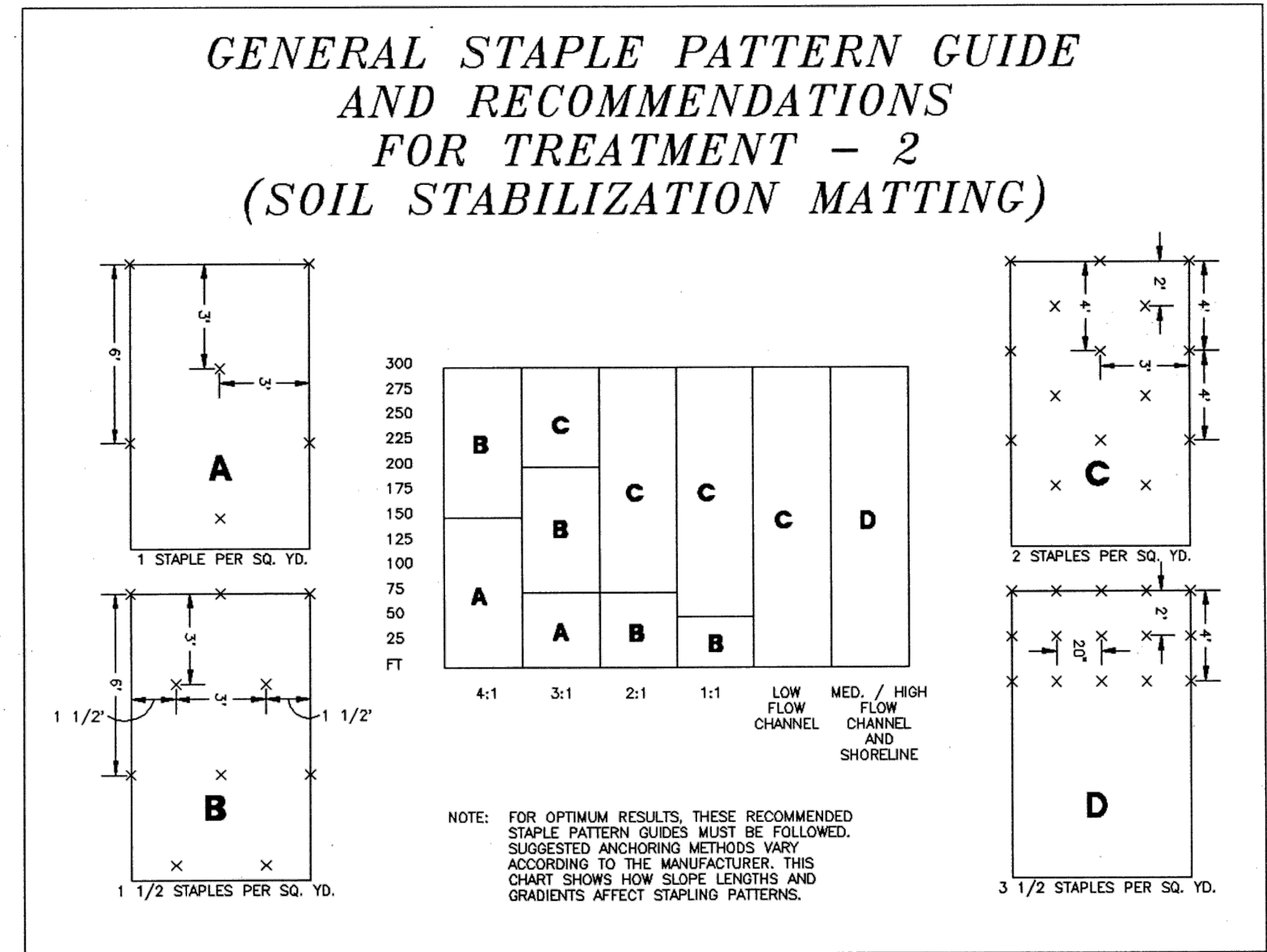
**SOIL STABILIZATION MATTING SLOPE**

**NOTE:**  
FOR LANDS ON THE JEFFERSON NATIONAL FOREST, IF THE USE OF STABILIZATION NETTING IS REQUIRED/PERMITTED, WILDLIFE FRIENDLY GEOTEXTILES MUST BE USED. THESE PRODUCTS MUST EITHER NOT CONTAIN NETTING, OR NETTING MUST BE MADE OF 100% BIODEGRADABLE NON-PLASTIC MATERIALS SUCH AS JUTE, SISAL, OR COIR FIBER. PLASTIC NETTING (SUCH AS POLYPROPYLENE, NYLON, POLYETHYLENE, AND POLYESTER), EVEN IF ADVERTISED AS BIODEGRADABLE, IS NOT ACCEPTED ALTERNATIVE. ANY NETTING USED MUST ALSO HAVE A LOOSE-WEAVE DESIGN WITH MOVABLE JOINTS BETWEEN HORIZONTAL AND VERTICAL TWINES TO REDUCE THE CHANCE FOR WILDLIFE ENTANGLEMENT, INJURY, OR DEATH. (CA COASTAL COMMISSION, 2012)

III - 368

Source: Product literature from North American Green

Plate 3.36-6



1992

3.36

**GENERAL STAPLE PATTERN GUIDE  
& RECOMMENDATIONS FOR TREATMENT**  
DEVELOPED FROM VADEQ 1992 MANUAL

ADDED DETAILS FOR ROADS AND PADS
ADDRESS VADEQ COMMENTS
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ADDRESS VADEQ COMMENTS
ADDRESS VADEQ COMMENTS
ADDRESS VADEQ COMMENTS
DESCRIPTION:
NO.:
DATE:
DWN.:
CHKD.:
APPD.:
REVISIONS:

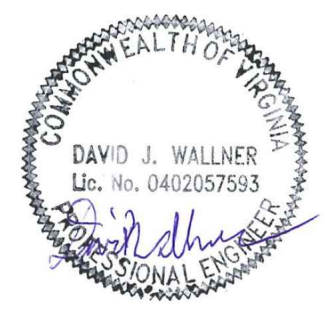
**Mountain Valley Pipeline**  
EROSION AND SEDIMENT CONTROL PLANS  
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE

**MOUNTAIN VALLEY PIPELINE, LLC**  
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GENERAL DETAILS SET



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APPROVED BY:	RE
DATE:	11/28/2017
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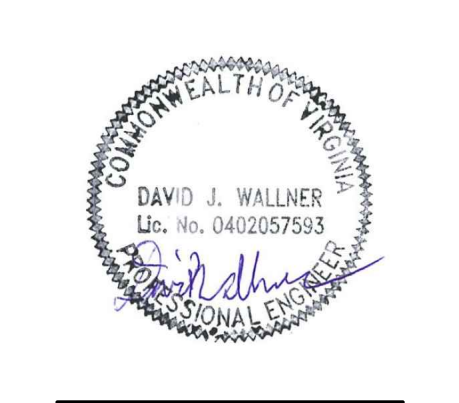
All project specific details are at the end of the documents

NO.	DATE	DWN.	CHKD.	APPD.	DESCRIPTION
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3	11/01/17	KAL	RE	DW	ADDRESS VADCO COMMENTS
2	08/18/17	KAL	RE	DW	ADDRESS VADCO COMMENTS

  
**EROSION AND SEDIMENT CONTROL PLANS**  
 MOUNTAIN VALLEY PIPELINE PROJECT -- H600 LINE  
  
 MOUNTAIN VALLEY PIPELINE, LLC  
 555 SOUTHPOINTE BOULEVARD, SUITE 200  
 CANONSBURG, PA 15317

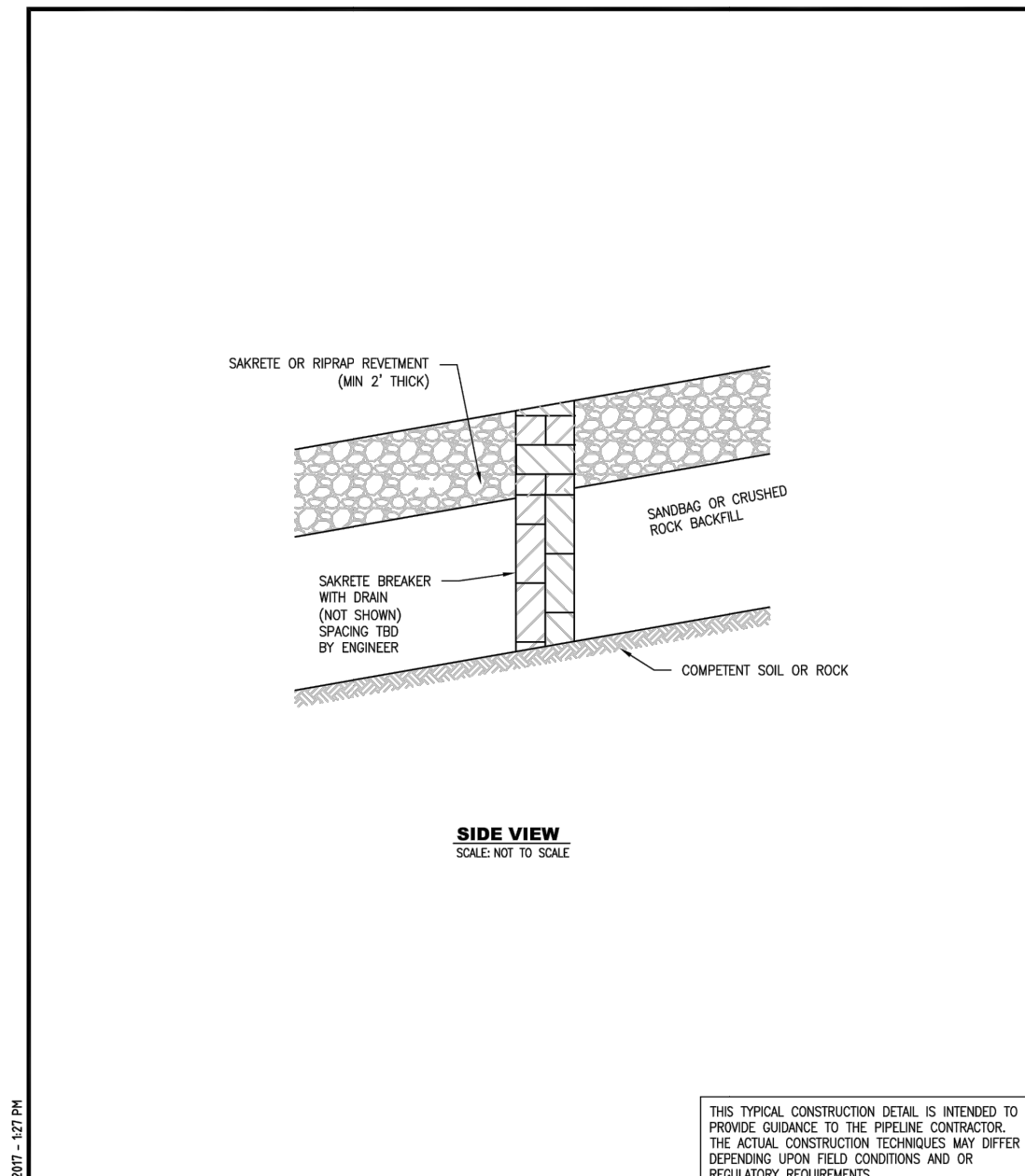
  
**TETRA TECH**  
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 661 ANDERSEN DRIVE  
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GENERAL DETAILS SET

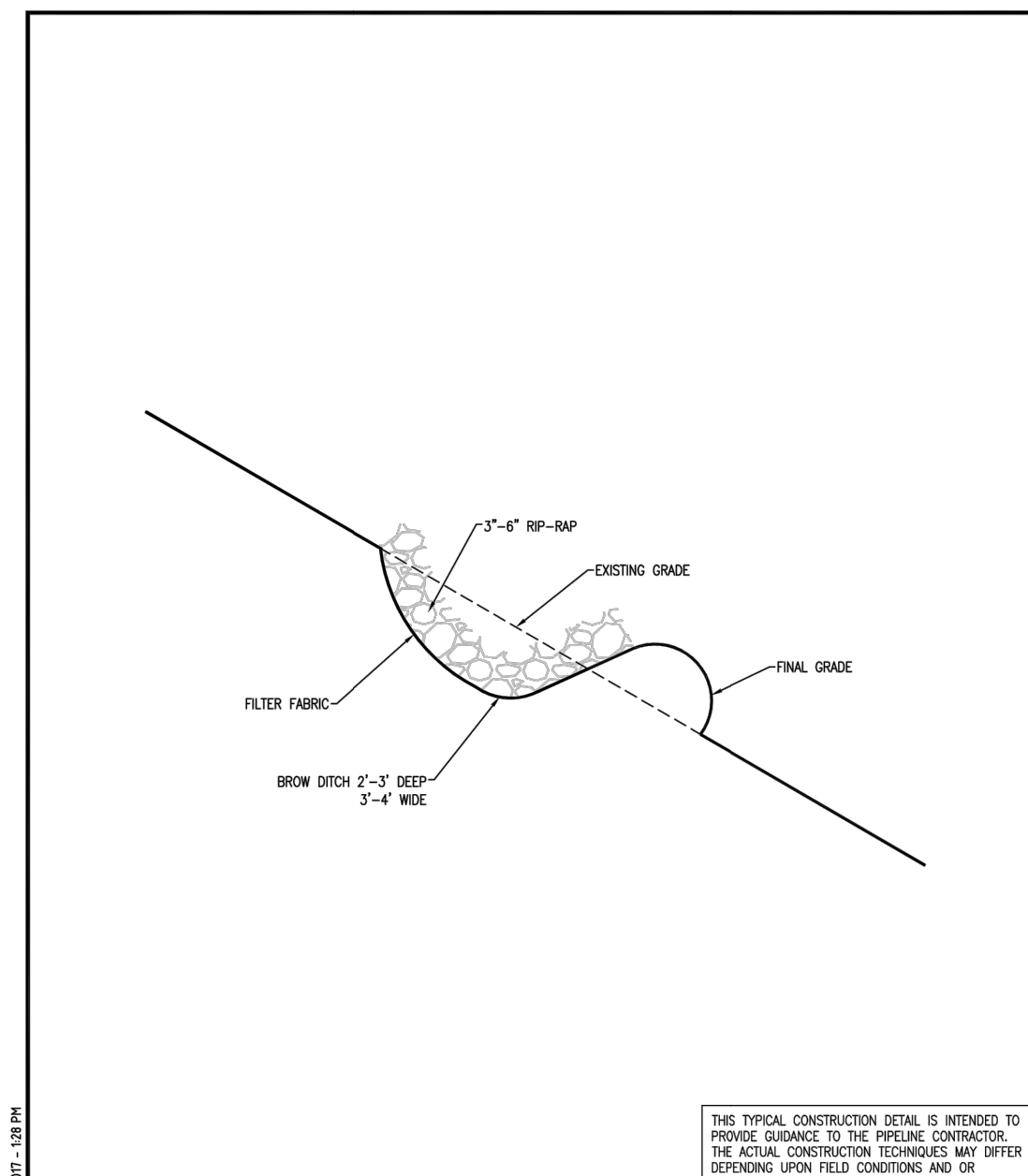


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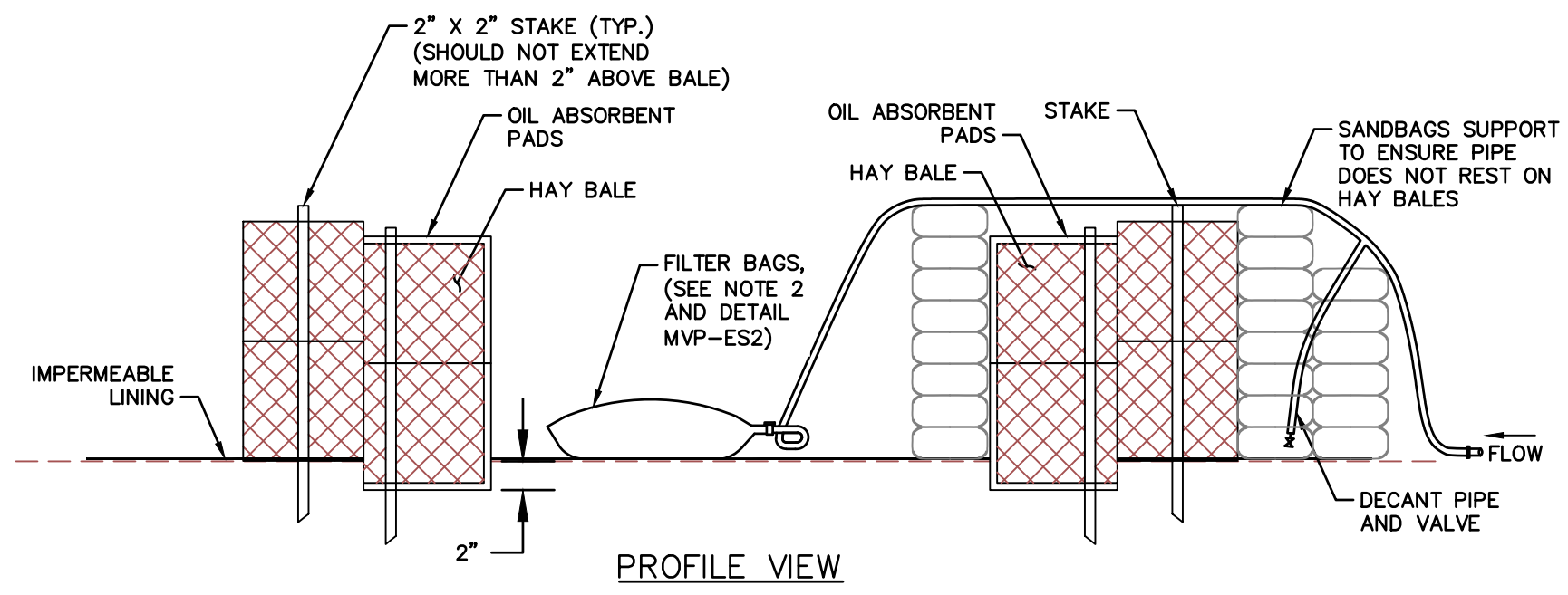
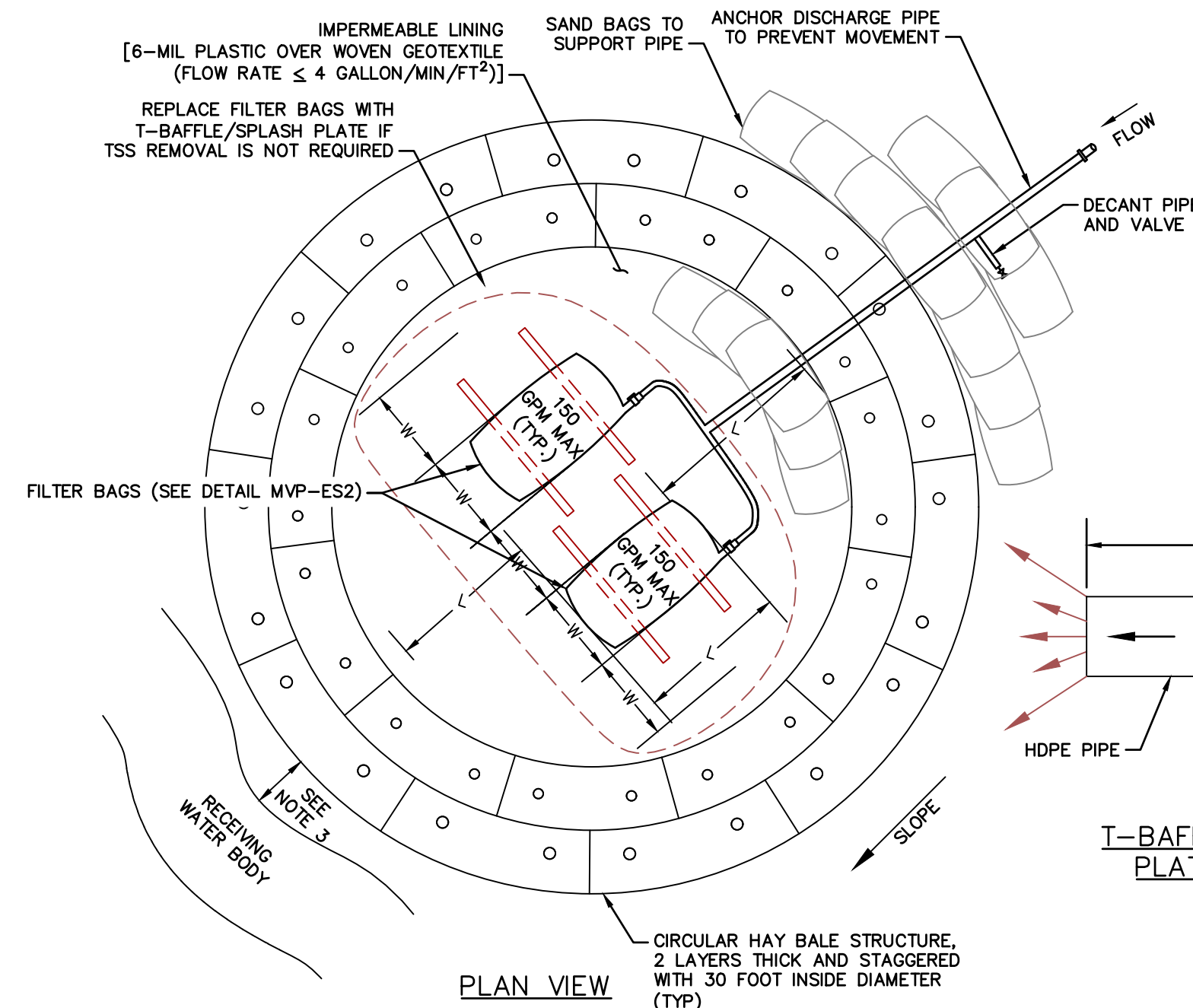




DRAWN TO: MVP	DATE: 2/03/2016	CHECKED BY: MAF	DATE: 2/03/2016
APP'D: MAF	DATE: 08/11/17	SCALE: N.T.S.	SHEET: 1 OF 1
JOB NO.:	PROJECT ID: MVP - VA PORTION	DESIGN ENGINEERING	DRAWING NO. MVP-45
REV: 0	TYPICAL CONSTRUCTION DETAIL		
STEEP SLOPE REVEMENT			



DRAWN TO: MVP	DATE: 7/12/2016	CHECKED BY: MAF	DATE: 7/12/2016
APP'D: MAF	DATE: 08/11/17	SCALE: N.T.S.	SHEET: 1 OF 1
JOB NO.:	PROJECT ID: MVP - VA PORTION	DESIGN ENGINEERING	DRAWING NO. MVP-46
REV: 0	TYPICAL CONSTRUCTION DETAIL		
BROW DITCH DETAIL			

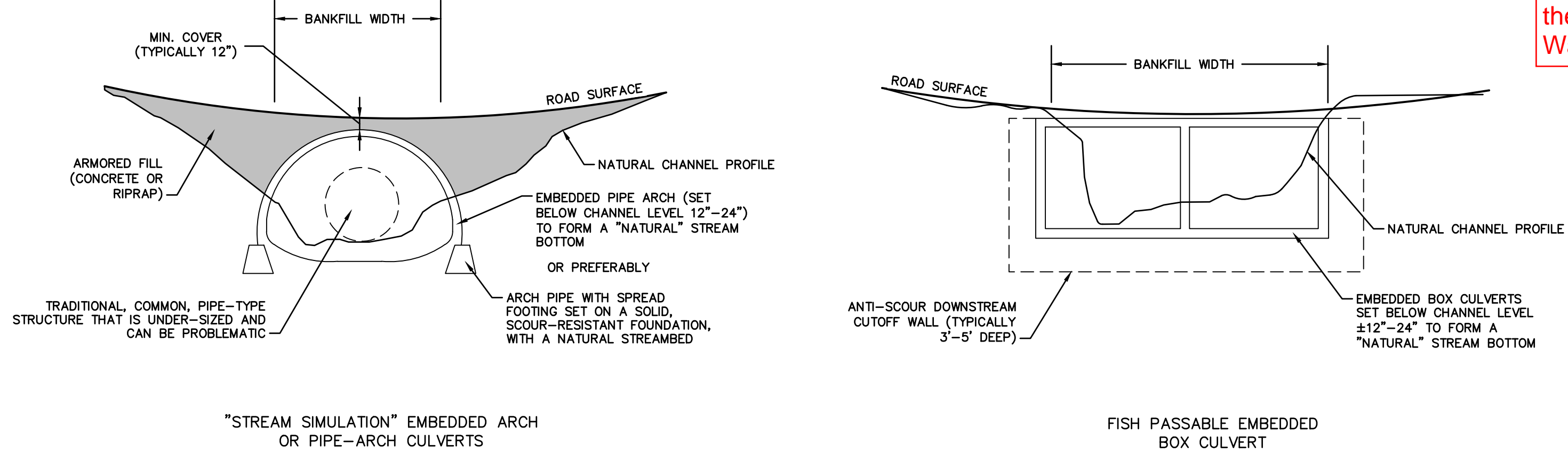


- NOTES:**
- NOTICE OF INTENT MUST BE SUBMITTED AND NOTIFICATION OF PERMIT COVERAGE RECEIVED PRIOR TO DISCHARGING HYDROSTATIC TEST WATER.
  - INCREASE SIZE OF DISCHARGE STRUCTURE AND NUMBER OF FILTER BAGS TO MATCH REQUIRED DISCHARGE RATE AND TSS REMOVAL AS LONG AS REQUIRED LAND IS AVAILABLE. ADD ADDITIONAL SMALLER DISCHARGE STRUCTURES IF SPACE IS LIMITED. ELIMINATE FILTER BAG(S) IF TSS REMOVAL NOT REQUIRED AND REPLACE WITH T-BAFFLE/ SPLASH PLATE.
  - HYDROSTATIC WATER DISCHARGE STRUCTURE WILL BE LOCATED AT LEAST 100 FEET FROM THE EDGE OF A DELINEATED WETLAND, AND 50 FEET OR THE CHANNEL WIDTH, WHICHEVER IS GREATER, FROM THE TOP OF BANK OF A RECEIVING STREAM.
  - HYDROSTATIC WATER DISCHARGE STRUCTURE WILL BE LOCATED SUCH THAT IT DRAINS TO A WELL-VEGETATED AREA WITH SLOPES BETWEEN 1% AND 5% TOWARD THE RECEIVING WATERBODY.
  - THE DISCHARGE RATE TO THE STRUCTURE SHOULD BE LIMITED TO THE LOWEST POSSIBLE RATE TO MINIMIZE ANY POTENTIAL IMPACT ON AQUATIC LIFE AND TO REDUCE THE POTENTIAL FOR EROSION (E.G., 150 GPM).
  - IF MUNICIPAL WATER IS USED FOR TESTING, HOLD THE WATER IN THE PIPE FOR AT LEAST 24 HOURS PRIOR TO DISCHARGE TO MEET TOTAL RESIDUAL CHLORINE LIMITS.
  - IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROLS AS REQUIRED IN VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), 3RD ED., 1992.

**DISCHARGE STRUCTURES TO BE USED FOR HYDROSTATIC TEST WATER**  
NOT TO SCALE

Test Break Name	Test Break Coordinates		Proposed Outfall Coordinates		Anticipated Discharge Volume (gal)	Recommended Discharge Range (GPM)	Time to Release (days)	# of Hay Bale Structures	Receiving Water Name
	Latitude	Longitude	Latitude	Longitude					
9A	37° 20' 30.66"	-80° 37' 9.84"	37° 20' 32.42"	-80° 37' 9.64"	3,620,000	600 to 1200	4 to 2	2 to 4	Little Stony Creek
9B	37° 16' 7.85"	-80° 18' 52.91"	37° 16' 6.010"	-80° 18' 55.920"	1,580,000	300 to 600	4 to 2	1 to 2	North Fork Roanoke River
9C	37° 13' 50.92"	-80° 11' 53.89"	37° 13' 50.290"	-80° 11' 52.360"	3,040,000	600 to 1200	4 to 2	2 to 4	UNT to Roanoke River

**TESTING DISCHARGE LOCATION INFORMATION**



**"FISH FRIENDLY" CULVERT STRUCTURES**  
NOT TO SCALE

NOTE: LOW-WATER CROSSINGS THAT PROVIDE PASSAGE FOR FISH AND OTHER AQUATIC SPECIES. THE EMBEDDED CULVERTS WOULD HAVE A LAYER OF STREAMBED MATERIAL AT LEAST 1- TO 2-FOOT THICK COVERING THE CULVERT FLOOR.

Stream ID	Access Road	Drainage Area (ac)	10-Year Design Flow (cfs)	Culvert Length (ft)	Existing Inlet Cover (ft) <sup>3</sup>	Existing Outlet Cover (ft) <sup>3</sup>	Proposed Inlet Cover (ft) <sup>4</sup>	Proposed Outlet Cover (ft) <sup>4</sup>	Lidar Elevation at Inlet (ft) <sup>1</sup>	Lidar Elevation at Outlet (ft) <sup>1</sup>	Invert Elevation at Inlet (ft) <sup>2</sup>	Invert Elevation at Outlet (ft) <sup>2</sup>	Culvert Slope	Replacement Culvert Type	Replacement Culvert Material	Culvert Dimensions (Span/Rise)	Embedment Depth (in)	Scour Protection
S-MN32	33 + 35.49	426.08	524.55	12	3	3	7.667	7.667	1317.895	1317.827	1313.562	1313.494	0.6%	Box Culvert	Concrete	12'/8"	16	AASHTO Riprap Class A
S-MN33	25 + 83.30	14.23	40.40	12	2	2	2.75	2.75	1321.995	1321.737	1318.828	1315.570	2.2%	Box Culvert	Concrete	4'/3"	14	AASHTO Riprap Class A
S-MN34	20 + 88.96	87.49	278.12	12	1	1	5.313	5.313	1338.584	1337.743	1335.917	1335.076	7.0%	Box Culvert	Concrete	9'/6"	20	Grouted Riprap

<sup>1</sup>Roadway crest elevation based on Lidar elevation at inlet + required fill.  
<sup>2</sup>Calculated culvert invert based on Lidar elevations adjusted for stream depth from wetland data sheets.  
<sup>3</sup>Based on wetland data sheet maximum top of bank height (assumed measurement from bottom of stream to top of road).  
<sup>4</sup>Fill required to accommodate box culvert.

ADDED DETAILS FOR ROADS AND PADS

DW	RE	KAL
DW	RE	KAL
DW	RE	KAL
DW	RE	KAL
DW	RE	KAL
DW	RE	KAL
DW	RE	KAL
DW	RE	KAL

ADDRESS VABEO COMMENTS

NO. DATE: CHK. APPD. DESCRIPTION:

REVISIONS:

Mountain Valley Pipeline  
EROSION AND SEDIMENT CONTROL PLANS  
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE

MOUNTAIN VALLEY PIPELINE, LLC  
555 SOUTHPOINTE BOULEVARD, SUITE 200  
CANONSBURG, PA 15317

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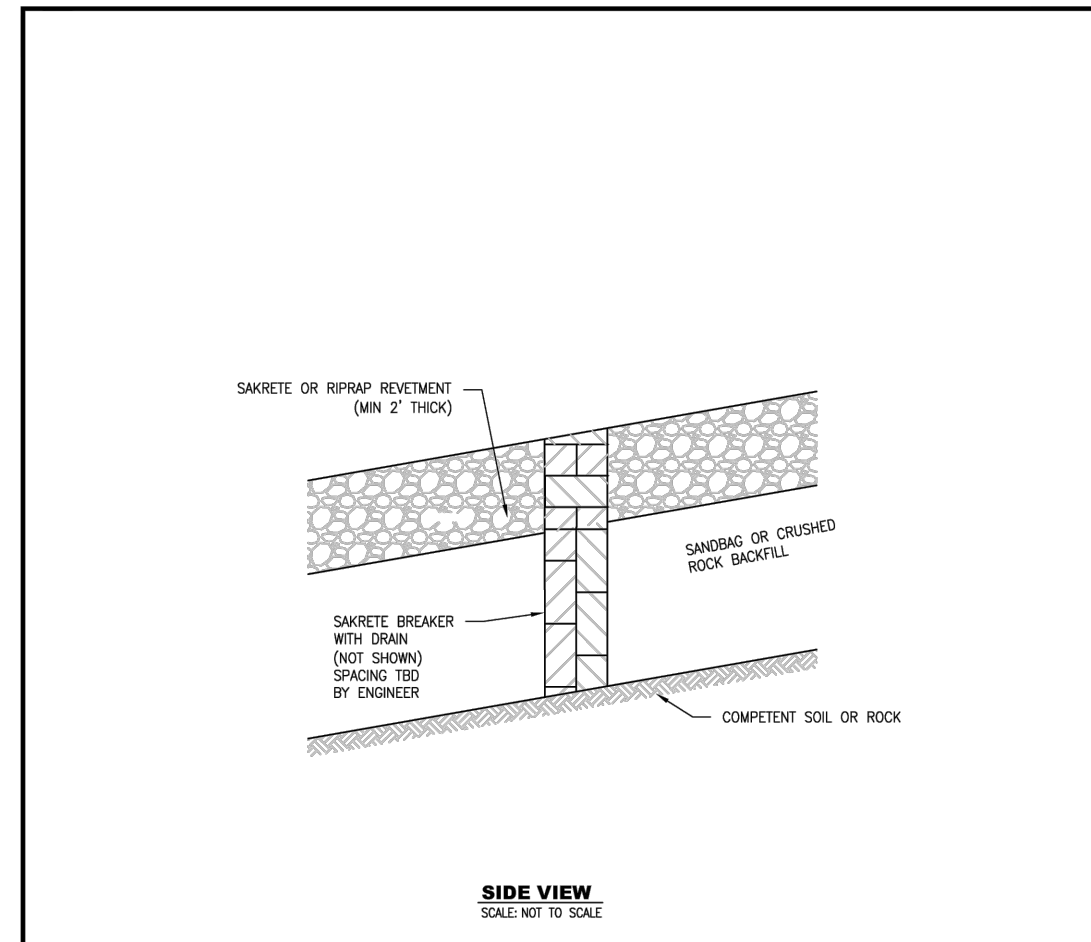
661 ANDERSEN DRIVE  
FOSTER PLAZA 7  
PITTSBURGH, PA 15220

GENERAL DETAILS SET

DAVID J. WALLNER  
Lic. No. 0402057593  
Professional Engineer

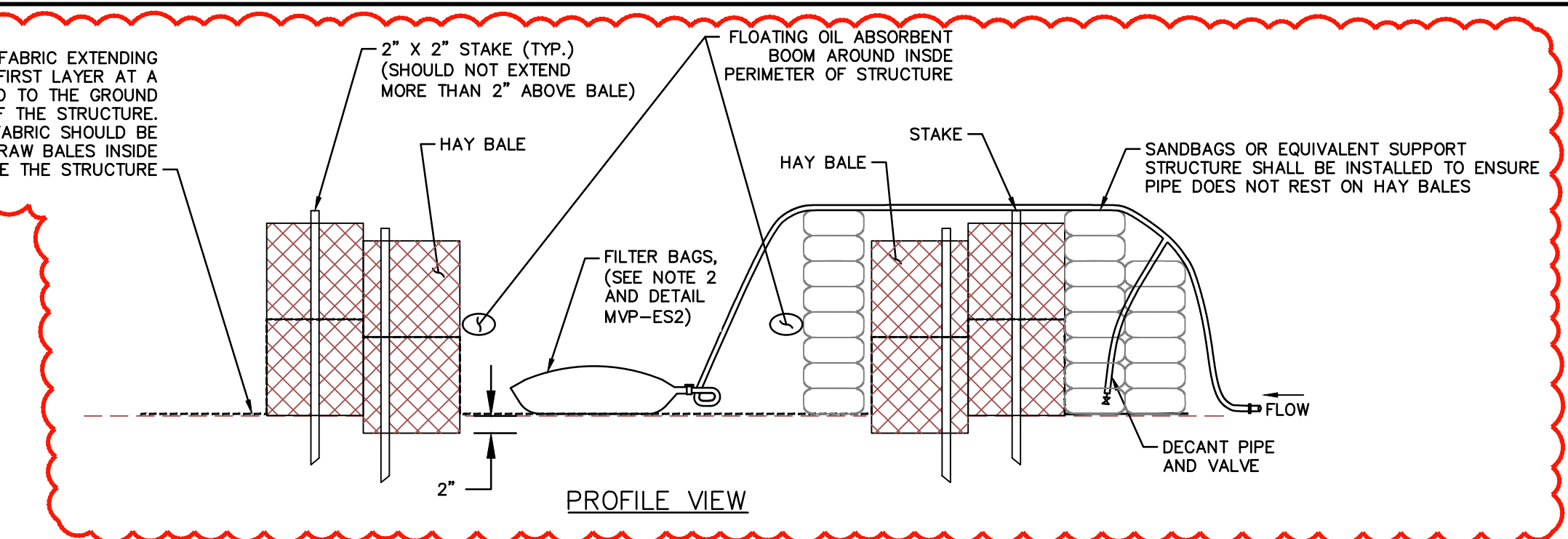
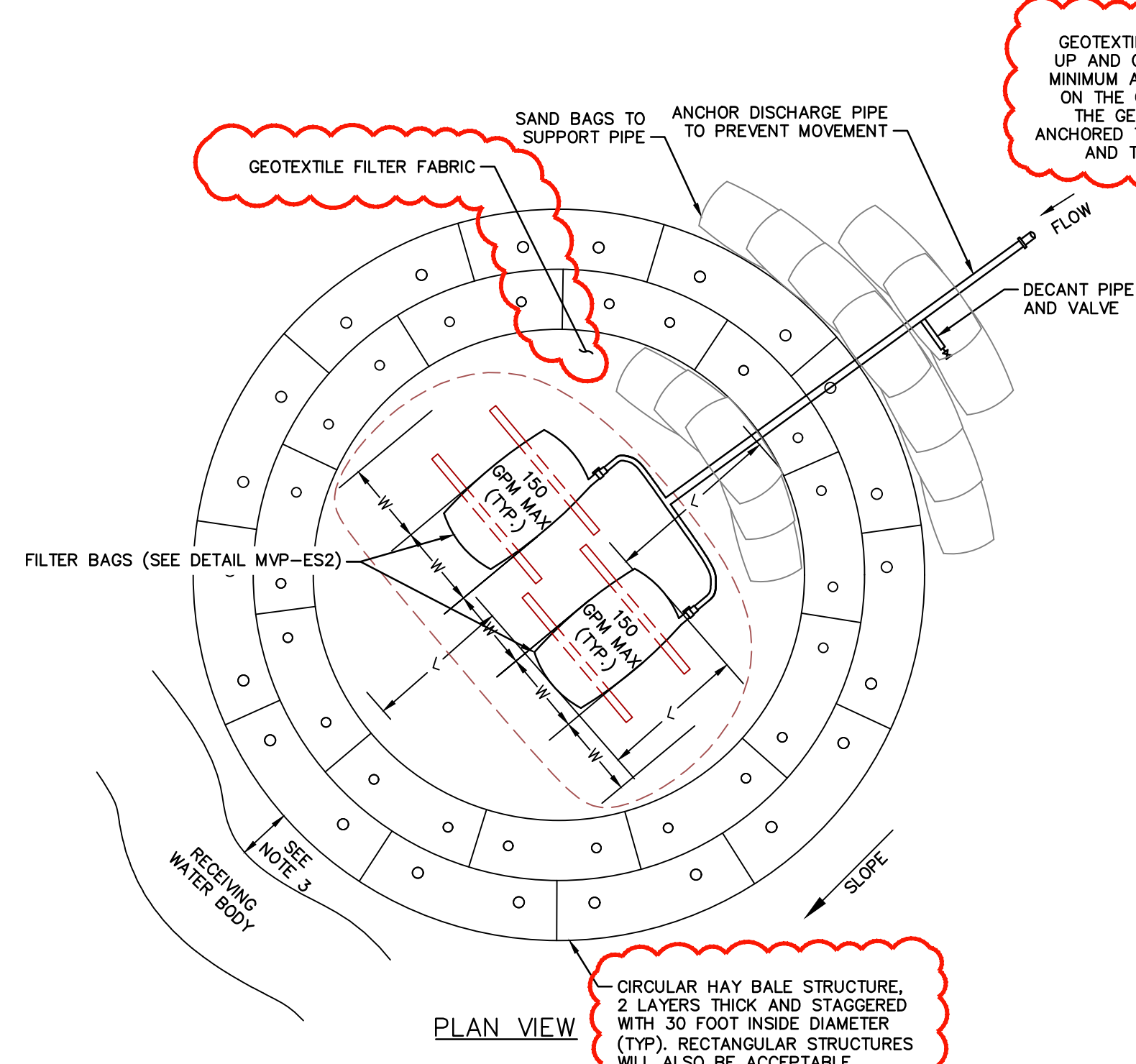
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CHECKED BY: HT  
APPROVED BY: RE  
DATE: 11/28/2017  
SCALE: AS SHOWN  
SHT. NO. 0.21 OF 0.23





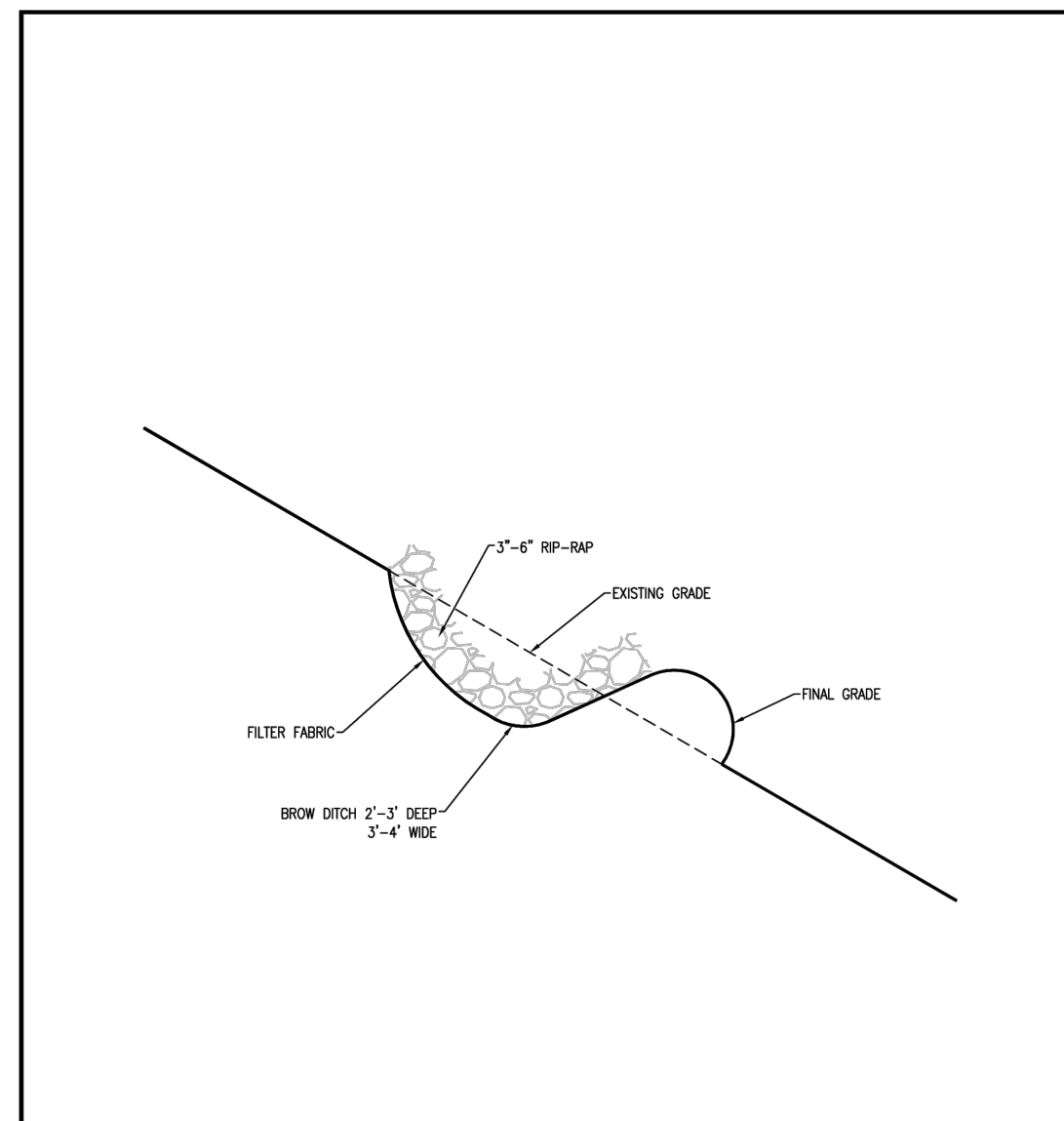
DRAWN TO: MWF	DATE: 2/03/2016	<p>DESIGN ENGINEERING</p>	TYPICAL CONSTRUCTION DETAIL	
CHECKED: MWF	DATE: 2/03/2016		STEEP SLOPE REVETMENT	
APP'D:	DATE: 06/11/17		DRAWING NO. MVP-45	REV. 0
SCALE: N.T.S.	SHEET 1 OF 1			
JOB NO.:				
PROJECT ID:	MVP - VA PORTION			

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY VARY DEPENDING UPON FIELD CONDITIONS AND/OR REGULATORY REQUIREMENTS.



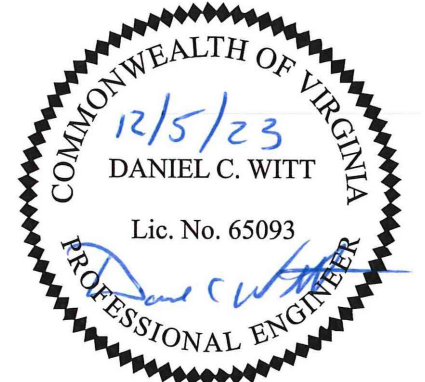
- NOTES:
- NOTICE OF INTENT MUST BE SUBMITTED AND NOTIFICATION OF PERMIT COVERAGE RECEIVED PRIOR TO DISCHARGING HYDROSTATIC TEST WATER.
  - INCREASE SIZE OF DISCHARGE STRUCTURE AND NUMBER OF FILTER BAGS TO MATCH REQUIRED DISCHARGE RATE AND TSS REMOVAL AS LONG AS REQUIRED LAND IS AVAILABLE. ADD ADDITIONAL SMALLER DISCHARGE STRUCTURES IF SPACE IS LIMITED.
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  - IMPLEMENT ADDITIONAL EROSION AND SEDIMENT CONTROLS AS REQUIRED IN VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), 3RD ED., 1992.

DISCHARGE STRUCTURES TO BE USED FOR HYDROSTATIC TEST WATER  
NOT TO SCALE



DRAWN TO: MWF	DATE: 7/12/2016	<p>DESIGN ENGINEERING</p>	TYPICAL CONSTRUCTION DETAIL	
CHECKED: MWF	DATE: 7/12/2016		BROW DITCH DETAIL	
APP'D:	DATE: 06/11/17		DRAWING NO. MVP-46	REV. 0
SCALE: N.T.S.	SHEET 1 OF 1			
JOB NO.:				
PROJECT ID:	MVP - VA PORTION			

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY VARY DEPENDING UPON FIELD CONDITIONS AND/OR REGULATORY REQUIREMENTS.



THIS SEAL APPLIES ONLY TO REVISIONS DATED 12-05-23

NO.	DATE	CHKD.	APPD.	DESCRIPTION
1	12/05/23	IHH	DCW	REDLINE REVISIONS TO HYDROSTATIC DISCHARGE DETAIL
2	01/31/18	KAL	DW	ADDED DETAILS FOR ROADS AND PADS
3	01/28/18	KAL	DW	ADDRESS VABEQ COMMENTS
4	01/08/18	KAL	DW	ADDRESS VABEQ COMMENTS
5	11/28/17	KAL	DW	ADDRESS VABEQ COMMENTS
6	11/01/17	KAL	DW	ADDRESS VABEQ COMMENTS

EROSION AND SEDIMENT CONTROL PLANS
   
 MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE
   
 MOUNTAIN VALLEY PIPELINE, LLC
   
 2200 ENERGY DRIVE
   
 CANONSBURG, PA 15317

complex world | CLEAR SOLUTIONS™
   
 661 ANDERSEN DRIVE
   
 FOSTER PLAZA 7
   
 PITTSBURGH, PA 15220

GENERAL DETAILS SET

DRAWN BY:	JUZ
CHECKED BY:	IHH
APPROVED BY:	DCW
DATE:	12/05/2023
SCALE:	AS SHOWN
SHT. NO.	0.21 OF 0.23



**GENERAL CONSTRUCTION SEQUENCE**

THE FOLLOWING IS A GENERAL SEQUENCE FOR EARTHMOVING ACTIVITIES ASSOCIATED WITH CONSTRUCTION OF THE PIPELINE:

- INSTALL TEMPORARY EROSION AND SEDIMENT CONTROLS PRIOR TO EARTH DISTURBANCE. REFER TO BEST MANAGEMENT PRACTICES (BMP) INSTALLATION AND REMOVAL NOTES. APPROPRIATE BMPs SHOULD BE PLACED AROUND SENSITIVE AREAS PRIOR TO EARTH DISTURBANCE. STONE CONSTRUCTION ENTRANCES (SCE) ARE TO BE PROVIDED AT ALL LOCATIONS WHERE ACCESS ROADS AND PIPELINES WILL BE ACCESSING OR CROSSING A PUBLIC ROADWAY. NOTE THAT SILT FENCE, COMPOST FILTER SOCK AND SUPER SILT FENCE IS BEING INSTALLED AS PART OF A "SYSTEM" OF EROSION CONTROL BMPs INCLUDING CLEAN WATER DIVERSIONS, WATERBARS AND BONDED FIBER MATRIX. THIS BMP SYSTEM APPROACH ALLOWS MVP TO MANAGE SLOPE LENGTH LIMITATIONS OF SUPER SILT BY INTRODUCING SLOPE BREAKS AND ADDITIONAL SURFACE EROSION PROTECTION.
- INSTALL TEMPORARY E&S CONTROLS FOR STREAM CROSSINGS AT LOCATIONS SHOWN ON THE E&S PLAN SHEETS. NO EARTH DISTURBANCE ACTIVITIES WITHIN 50 FEET OF STREAM CHANNELS WILL BE PERFORMED UNTIL MATERIALS NEEDED TO COMPLETE THE CROSSING ARE AT THE NEAREST AVAILABLE LOCATION.
- GENERAL CLEARING AND GRUBBING OF THE TREES AND BRUSH ALONG THE RIGHT-OF-WAY (ROW) FOR PIPELINE TRENCHING MAY COMMENCE TO THE WIDTH SPECIFIED IN THE ROW AGREEMENTS OR CONSTRUCTION ALIGNMENT SHEETS, WHICHEVER IS LESS. SMALLER DEBRIS, SUCH AS SHRUBS OR LIMBS, ARE TO BE CHIPPED AND UTILIZED ON-SITE AS PART OF THE SOIL STABILIZATION. WHERE CHIPPED MATERIAL IS USED AS MULCH, SPREAD AT A RATE NOT TO EXCEED 1 TON/ACRE. UNLESS OTHERWISE DIRECTED BY THE LANDOWNER, LOGS WILL EITHER BE HAULED OFF-SITE OR GIVEN TO THE LANDOWNER UPON THEIR REQUEST; STUMPS AND/OR LOGS WILL BE GROUND, CHIPPED, WINDROWED, OR HAULED OFF-SITE.
- INSTALL CLEAN WATER DIVERSIONS AND CLEAN WATER DIVERSION PIPES IN ACCORDANCE WITH VESCH STD & SPEC 3.09 AND MVP-ES50 AND MCP-ESS0.1. IN ADDITION, INSTALL OUTLET STRUCTURES FOR CLEAN WATER PIPES IN ACCORDANCE WITH MVP-ES51 AND MVP-ES51.1. FOLLOWING INSTALLATION OF CLEAN WATER DIVERSION BERMS STABILIZE THE UPHILL SIDE OF THE BERM USING TEMPORARY SEED, EROSION CONTROL MATTING OR BONDED FIBER MATRIX. FINALLY INSTALL ROCK CHECK DAMS IN ACCORDANCE WITH VESCH STD & SPEC 3.20 EXCEPT THAT COMPOST FILTER SOCK OR NATIVE ROCK (SIZED APPROPRIATELY PER VESCH STD & SPEC 3.20) EXCAVATED DURING GRADING WILL BE USED FOR CONSTRUCTION.
- INSTALL TEMPORARY AND PERMANENT RIGHT-OF-WAY DIVERSIONS/WATERBARS IMMEDIATELY AFTER INITIAL DISTURBANCE OF THE SOIL IN ACCORDANCE WITH THE WATERBAR SPACING AND SIZING REQUIREMENTS SHOWN ON THE PLAN AND DETAIL SHEETS (SEE DETAILS VADEQ STD & SPEC 3.11 AND MVP-17). RIGHT-OF-WAY DIVERSIONS/WATERBARS WILL BE CONSTRUCTED OF SOIL, AND USED TO REDUCE RUNOFF VELOCITY AND DIVERT WATER OFF THE PIPELINE ROW. WATERBARS WILL BE INSTALLED WITH SUMP FILTERS (DETAIL MVP-ES42) AT THE DISCHARGE END.
- EXCAVATE PIPELINE TRENCH AND BEGIN GRADING OF PROPOSED METER AND RECTIFIER ANODE BED SITES. THE PROPOSED CONSTRUCTION ROW AND EXTRA WORKSPACES ARE TO BE USED AS A WORK AREA FOR TRENCH EXCAVATION, EQUIPMENT MOVEMENT AND THE TEMPORARY STORAGE OF SOIL STOCKPILES, AS NEEDED. EQUIPMENT, SOIL STOCKPILES, AND OTHER MATERIALS ARE TO REMAIN UPSLOPE OF BMPs DURING CONSTRUCTION ACTIVITIES. REFER TO BMP INSTALLATION AND REMOVAL SEQUENCE FOR THE BMPs TO BE USED FOR PROTECTION DURING TRENCH EXCAVATION AND AROUND TEMPORARY SOIL STOCKPILES. STOCKPILES AND NON-WORK AREA SLOPES WILL BE STABILIZED THROUGH AN APPLICATION OF EITHER MULCH (ORGANIC, EROSION CONTROL BLANKET OR BONDED FIBER MATRIX) OR TEMPORARY SEED. SEGREGATION OF TOPSOIL AND SUBSOIL WILL BE PERFORMED WHERE TRENCH EXCAVATION TAKES PLACE IN AN AGRICULTURAL, WETLAND, OR RESIDENTIAL AREA.
- PIPELINE SECTIONS WILL BE TRANSPORTED TO THE WORK AREA AND STRUNG ALONG THE WORKING SIDE OF THE ROW PARALLEL TO THE TRENCH LINE. WELDING CAN OCCUR IN OR OUT OF THE TRENCH. THE PIPELINE WILL BE BENT TO CONFORM TO THE TRENCH CONTOUR, ALIGNED WELDED AND PLACED ON TEMPORARY SUPPORTS ALONGSIDE THE TRENCH. WELDS WILL BE VISUALLY AND RADIO-GRAPHICALLY INSPECTED AND REPAIRED AS NECESSARY. THE PIPE SECTION WILL BE LOWERED INTO THE TRENCH AND PLACED ON PADDING PER MVP CONSTRUCTION STANDARDS. ANY WETNESS ENCOUNTERED DURING CONSTRUCTION WORK WILL BE DEWATERED BY USING PUMPS, HOSES, AND PUMPED BAGS (DETAIL MVP-ES2), AND WILL BE DISCHARGED TO A WELL VEGETATED, UPLAND AREA.
- STREAM PIPELINE CROSSING CONSTRUCTION METHODS WILL BE INSTALLED AT LOCATIONS SHOWN ON THE E&S PLAN SHEETS AND AS SPECIFIED ON DETAIL SHEET. STREAM BANK STABILIZATION WILL BE INSTALLED IMMEDIATELY FOLLOWING COMPLETION OF PIPELINE INSTALLATION AS SHOWN ON THE DETAIL SHEET.
- INSTALL TRENCH BREAKERS AT LOCATIONS SHOWN ON THE DRAWINGS OR AS DIRECTED BY MVP AND AS SPECIFIED ON THE DETAIL SHEET (DETAIL MVP-20).
- THE TRENCH WILL SUBSEQUENTLY BE BACKFILLED WITH SUITABLE EXCAVATED MATERIAL. THE BACKFILL MATERIAL WILL BE SLIGHTLY CROWNED IN UPLAND AREAS TO ALLOW FOR SETTLEMENT THAT MAY OCCUR. CROWNING THE SOIL SLIGHTLY OVER THE PIPELINE WILL HELP PREVENT FUTURE STORM WATER-RELATED PROBLEMS FROM SETTLING OF THE BACKFILLED AREA. NO CROWNING OF SOILS WILL TAKE PLACE IN WETLANDS, STREAMS, OR FLOOD PLAINS. IN AREAS WHERE TOPSOIL HAS BEEN SEGREGATED, THE SUBSOIL WILL BE REPLACED FIRST, AND THEN THE TOPSOIL WILL BE SPREAD OVER THE AREA FROM WHICH IT WAS REMOVED. DISTURBED AREAS WILL BE RESTORED TO THEIR APPROXIMATE ORIGINAL TOPOGRAPHIC CONTOURS.
- STABILIZE EXPOSED AND UNWORKED SOILS BY APPLICATION OF EFFECTIVE BMPs THAT PROTECT THE SOIL FROM THE EROSION FORCES OF RAINDROPS, FLOWING WATER, AND WIND. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. WHERE A DENUDED AREA WILL REMAIN IDLE FOR MORE THAN 7 CALENDAR DAYS, TEMPORARY SEEDING (VA STD & SPEC 3.31, TABLE 3.31-B) WILL BE APPLIED TO THE ROUGH GRADED AREA. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.
- IN THE UNLIKELY EVENT THAT THERE ARE EXCESS EXCAVATED MATERIALS REMAINING AFTER THE TRENCH HAS BEEN BACKFILLED, THE MATERIAL IS TO BE DISPOSED OF WITHIN THE EXISTING ROW IN AN UPLAND AREA OUTSIDE OF THE 100-YEAR FLOOD PLAIN. MATERIAL WILL BE SPREAD IN A THIN LAYER AND TIED INTO EXISTING CONTOURS TO CREATE POSITIVE DRAINAGE FOR STORMWATER RUNOFF.
- CONSTRUCT PERMANENT RIGHT-OF-WAY DIVERSION/WATERBARS AFTER COMPLETION OF GRADING IN ACCORDANCE WITH THE WATERBAR SPACING AND SIZING REQUIREMENTS SHOWN ON PLAN AND DETAIL SHEETS (DETAIL MVP-17).
- PRIOR TO SEEDING MVP WILL DISC AREAS TO A DEPTH OF 4-6" TO FACILITATE REVEGETATION. DISCING WILL BE PERFORMED ON SUBSOILS TO A DEPTH OF 4-6" AND AGAIN FOLLOWING TOPSOILING.
- REVEGETATE DISTURBED AREA PER THE TABLES ON DETAILS MVP-ES11.1 TO 11.9 AND MVP-12.1 TO 12.4 OR PER LANDOWNER REQUEST. FOR 3:1 OR STEEPER SLOPES THE DISTURBED AREA WILL HAVE EROSION CONTROL FABRIC (BLANKETING, HYDROSEEDING, FLEXTERRA, OR APPROVED EQUAL) INSTALLED AS SHOWN ON DETAIL SHEET (DETAILS VA STD & SPEC 3.36, MVP-ES40 AND MVP ES-40.1).
- RE-ESTABLISH APPROPRIATE DRAINAGE IN EXISTING ROAD CHANNELS PRIOR TO SEEDING AND MULCHING.
- CONDUCTING INSPECTIONS OF TEMPORARY ESC CONTROLS AND SWM BMPs ON AT LEAST THE FOLLOWING FREQUENCIES:
  - IN NON-TMDL WATERSHEDS:
    - AT LEAST ONCE EVERY FIVE BUSINESS DAYS, OR
    - AT LEAST ONCE EVERY 10 BUSINESS DAYS AND NO LATER THAN 48 HOURS FOLLOWING A MEASURABLE STORM EVENT (OR ON THE NEXT BUSINESS DAY IF THE STORM EVENT OCCURS WHEN THERE ARE MORE THAN 48 HOURS BETWEEN BUSINESS DAYS.
  - IN TMDL WATERSHEDS:
    - AT LEAST ONCE EVERY FOUR BUSINESS DAYS, OR
    - AT LEAST ONCE EVERY 5 BUSINESS DAYS AND NO LATER THAN 48 HOURS FOLLOWING A MEASURABLE STORM EVENT (OR ON THE NEXT BUSINESS DAY IF THE STORM EVENT OCCURS WHEN THERE ARE MORE THAN 48 HOURS BETWEEN BUSINESS DAYS.

TEMPORARY BMP'S WILL BE REMOVED UPON ACHIEVING VEGETATIVE STABILIZATION, WHICH IS DEFINED AS "A GROUND COVER IS ACHIEVED THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE AND WILL INHIBIT EROSION". DISTURBED AREAS NOT ATTAINING AN ACCEPTABLE VEGETATIVE COVER SHALL BE RESEEDED AS NEEDED UNTIL THE ENDPOINT IS ACHIEVED.
- ALL POLLUTANTS, INCLUDING WASTE MATERIALS AND DEMOLITION DEBRIS THAT OCCUR ON SITE DURING CONSTRUCTION SHALL BE HANDLED AND LEGALLY DISPOSED OF IN A MANNER THAT DOES NOT CAUSE CONTAMINATION OF SURFACE WATERS. WOODY DEBRIS MAY BE CHIPPED AND SPREAD ON-SITE.

FOR STREAM CROSSINGS, REFER TO THE FOLLOWING STEPS:

- INSTALL TEMPORARY EQUIPMENT BRIDGE, BYPASS HOSE, FLUME, PUMP, OR COFFERDAM AS DESCRIBED IN STREAM CROSSING DETAILS AROUND THE WORK AREA.
- DEWATER WORK AREA UTILIZING PUMP WATER FILTER BAGS. WHERE POSSIBLE, EXCAVATION WILL BE FROM THE TOP OF THE STREAM BANK.
- INSTALL TRENCH PLUGS, PIPE, AND BACKFILL.
- STABILIZE CHANNEL EXCAVATION AND STREAM BANKS PRIOR TO REDIRECTING STREAM FLOW.
- REMOVE BYPASS HOSE, FLUME, PUMP, AND TEMPORARY DAM AS NEEDED.

FOR STREAM CROSSINGS WHERE CONVENTIONAL BORE TECHNIQUES PROPOSED, REFER TO THE FOLLOWING STEPS:

- EXCAVATE LAUNCHING AND RECEIVING PITS LOCATED IN WORKSPACE ON EACH SIDE OF THE FEATURE BEING CROSSED.
- STABILIZE AND/OR PROVIDE APPROPRIATE E&S CONTROLS AROUND THE RESULTING SPOIL PILES IN ACCORDANCE WITH THE REQUIREMENTS APPLICABLE TO SOIL STOCKPILES.
- LOWER BORING MACHINE INTO LAUNCHING PIT, AND BORE HORIZONTAL HOLE TO A DIAMETER EQUAL TO THE DIAMETER OF THE PIPE ( OR CASING, IF REQUIRED) AT THE DEPTH OF THE PIPELINE INSTALLATION.
- PUSH THE PIPELINE SECTION AND/OR CASING THROUGH THE BORE FROM THE LAUNCHING PIT TO THE RECEIVING PIT. IF ADDITIONAL PIPELINE SECTIONS ARE REQUIRED TO SPAN THE LENGTH OF THE BORE, THEY WILL BE WELDED TO THE FIRST SECTION OF THE PIPELINE IN THE LAUNCHING PIT BEFORE BEING PUSHED THROUGH THE BORE.
- DEWATER LAUNCHING AND RECEIVING PITS UTILIZING PUMP WATER FILTER BAGS AS NEEDED DURING BORE OPERATIONS.
- BACKFILL AND STABILIZE LAUNCHING AND RECEIVING PITS UPON COMPLETION OF THE BORE.

IF WORKING WITHIN A WETLAND AREA, FOLLOW THE GENERALIZED CONSTRUCTION SEQUENCE BELOW:

- INSTALL EITHER SUPER SILT FENCE, ORANGE CONSTRUCTION FENCE, OR COMPOST FILTER SOCKS ALONG THE PERIMETERS OF THE SITE AS SHOWN ON THE CONSTRUCTION DRAWINGS.
- MATS, PADS, OR SIMILAR DEVICES WILL BE USED DURING THE CROSSINGS OF WETLANDS. ORIGINAL GRADES THROUGH WETLANDS MUST BE RESTORED AFTER TRENCHING AND BACKFILLING. ANY EXCESS FILL MATERIALS MUST BE REMOVED FROM THE WETLAND AND NOT SPREAD WITHIN WETLANDS.
- SOIL EXCAVATED FROM WETLAND AREAS WILL BE CAREFULLY REMOVED WITH THE ROOTS INTACT. THIS SOIL WILL BE PLACED IN A SEPARATE STOCKPILE TO BE REUSED DURING THE WETLAND SURFACE RESTITUTION.
- DEWATER WORK AREA UTILIZING PUMPED WATER FILTER BAGS.
- INSTALL PIPE.
- INSTALL TRENCH PLUGS IN WETLAND AREAS TO PREVENT THE TRENCH FROM DRAINING THE WETLAND OR CHANGING ITS HYDROLOGY.
- BACKFILL PIPE TRENCH. BACKFILL THE TOP 12-INCHES OF THE EXCAVATED TRENCH WITH THE STOCKPILED WETLAND SOIL TO MATCH ORIGINAL SURFACE GRADES.
- COMPACT BACKFILL AND GRADE THE SURFACE OF THE TRENCH AREA TO ALLOW FOR POSITIVE DRAINAGE TO SOIL E&SCS AND TO PREPARE DISTURBED AREAS FOR PERMANENT TRENCH RESTORATION.
- MAINTAIN ALL E&SCS DEVICES UNTIL SITE WORK IS COMPLETE AND A GROUND COVER IS ACHIEVED THAT IS UNIFORM AND MATURE ENOUGH TO SURVIVE AND INHIBIT EROSION.
- REMOVE ALL SOIL AND E&SC MEASURES UPON ESTABLISHMENT OF A GROUND COVER THAT IS UNIFORM AND MATURE ENOUGH TO SURVIVE AND INHIBIT EROSION. RE-GRADE AND REVEGETATE AREAS DISTURBED DURING THE REMOVAL OF THE SOIL E&SCS.

**BMP MAINTENANCE**

- TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL BMPs SHALL BE MAINTAINED AND REPAIRED AS NEEDED TO ASSURE CONTINUED PERFORMANCE OF THEIR INTENDED FUNCTION. MAINTENANCE AND REPAIR SHALL BE CONDUCTED IN ACCORDANCE WITH THE APPROVED STANDARDS AND SPECIFICATIONS.
- IN NON-AGRICULTURAL AREAS THE VISUAL SURVEY SHALL BE COMPARED TO THE DENSITY AND COVER OF ADJACENT UNDISTURBED LANDS. IN AGRICULTURAL AREAS, THE VISUAL SURVEY SHALL BE COMPARED TO THE ADJACENT UNDISTURBED PORTIONS OF THE SAME FIELD, UNLESS THE EASEMENT AGREEMENT SPECIFIES OTHERWISE.
- WETLANDS ALONG THE PROPOSED PIPELINE ARE EXPECTED TO EXHIBIT VARYING DEGREES OF SATURATION AND WATER ELEVATION, REQUIRING A VARIETY OF PLANT SPECIES TO BE RE-ESTABLISHED. IN UNSATURATED WETLANDS, MOST VEGETATION WILL BE REPLACED BY SEEDING. SATURATED WETLANDS WILL TYPICALLY BE ALLOWED TO RE-VEGETATE NATURALLY. WETLAND REVEGETATION WILL BE CONSIDERED SUCCESSFUL WHEN THE COVER OF HERBACEOUS AND/OR WOODY SPECIES IS AT LEAST 80 PERCENT OF THE TYPE, DENSITY, AND DISTRIBUTION OF THE VEGETATION IN ADJACENT WETLAND AREAS THAT WERE NOT DISTURBED BY CONSTRUCTION. REVEGETATION EFFORTS WILL CONTINUE UNTIL WETLAND REVEGETATION IS SUCCESSFUL.
- CONDUCTING INSPECTIONS OF TEMPORARY ESC CONTROLS AND SWM BMPs AT LEAST ONCE EVERY FOUR BUSINESS DAYS.
- TEMPORARY EROSION AND SEDIMENT CONTROL BMPs SHOULD BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY BMPs ARE NO LONGER NEEDED. TRAPPED SEDIMENT SHALL BE REMOVED OR STABILIZED ON SITE. DISTURBED SOIL RESULTING FROM REMOVAL OF BMPs OR VEGETATION SHALL BE PERMANENTLY STABILIZED.

**RESTORATION BMP PHASING**

THE FOLLOWING IS THE SEQUENCE OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE REMOVAL AND INSTALLATION RELATED TO RESTORATION ACTIVITIES. THIS WORK WILL OCCUR BETWEEN RESTORATION OF PIPELINE LIMIT OF DISTURBANCE TO PRE-CONSTRUCTION GRADES AND FINAL CLOSURE OF THE PROJECT DEFINED AS "ACHIEVING VEGETATIVE STABILIZATION". THE SEQUENCE IS:

- REMOVE AND GRADE OUT THE CLEAN WATER DIVERSION DIKE.
- REMOVE DOWNSLOPE BMPs UTILIZED DURING CONSTRUCTION AND IMMEDIATELY REPLACE WITH 12-IN COMPOST FILTER SOCK. ON SLOPES GREATER THAN 30%, AN ADDITIONAL INTERMEDIATE 12-IN COMPOST FILTER SOCKS WILL BE PLACED PER THE SLOPE SPACING (MVP-ES3.2) TO ATTENUATE THE VELOCITY OF RUNOFF IN THE RECLAIMED AREA.
- APPLY SPECIALTY SEEDS AS REQUIRED THAT WILL NOT BE INCLUDED IN THE MULCH PHASE (STEP 4), SEED THE AREA USING THE SEED MIXES AND RATES SPECIFIED IN MVP-ES11.1 TO MVP-ES11.9 AND MVP-ES12.1 TO MVP-ES12.4.
- APPLY MULCH IN THE FORM OF ORGANIC MULCH (PER MVP-ES45), SOIL STABILIZATION MATTING (PER VADEQ STD & SPEC 3.36), OR HYDRAULIC EROSION CONTROL PRODUCT (PER MVP-ES40).
- FOLLOWING A DETERMINATION THAT THE SITE HAS ACHIEVED VEGETATIVE STABILIZATION, THE COMPOST FILTER SOCK WILL BE "OPENED" AND THE MULCH CONTAINED WITHIN WILL BE SPREAD WITHIN THE LIMITS OF DISTURBANCE.

DCW	TD	DW	DW	DW	DW	DW	DW	DW	DW	APPR:	CHKD:	APPD:
ADDRESS VADEQ COMMENTS ON CROSSING METHOD CHANGE												
ADDED CONVENTIONAL BORE SEQUENCE FOR INITIAL DEQ REVIEW												
ADDED DETAILS FOR ROADS AND PADS												
ADDRESS VADEQ COMMENTS												
ADDRESS VADEQ COMMENTS												
ADDRESS VADEQ COMMENTS												
DESCRIPTION:												
REVISONS:												

**Mountain Valley Pipeline**

**EROSION AND SEDIMENT CONTROL PLANS**

**MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE**

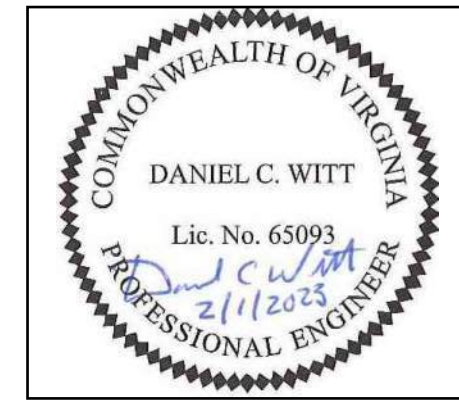
**MOUNTAIN VALLEY PIPELINE, LLC**  
555 SOUTHPOINTE BOULEVARD, SUITE 200  
CANONSBURG, PA 15317

**TETRA TECH**

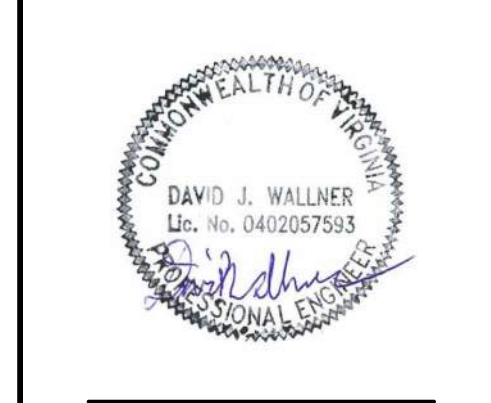
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**GENERAL DETAILS SET**



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**BEST MANAGEMENT PRACTICES (BMP) INSTALLATION & REMOVAL NOTES**

TEMPORARY AND PERMANENT BMPs WILL BE USED DURING CONSTRUCTION ACTIVITIES TO AVOID AND/OR MINIMIZE ADVERSE ENVIRONMENTAL EFFECTS OF CONSTRUCTION ACTIVITIES.

THE FOLLOWING ARE GENERAL BMP INSTALLATION NOTES FOR PIPELINE CONSTRUCTION ACTIVITIES.

- A STONE CONSTRUCTION ENTRANCE, PER VESCH STD & SPEC 3.02 AND MVP-ES20, SHALL BE PROVIDED AT ALL LOCATIONS WHERE CONSTRUCTION TRAFFIC WILL BE ACCESSING A PAVED ROAD DIRECTLY FROM A DISTURBED AREA.
- TEMPORARY SEDIMENT BARRIERS, INCLUDING APPROPRIATELY SIZED COMPOST FILTER SOCK, SILT FENCE OR SILT FENCE WILL BE PLACED AROUND SOIL STOCKPILES, AS NEEDED.
- COMPOST FILTER SOCK WILL BE PLACED AROUND WETLANDS AND WATERBODIES IN AND ADJACENT TO THE WORK AREA PRIOR TO ANY TRENCHING ACTIVITIES. COMPOST FILTER SOCK HAS BEEN SIZED PER MVP-ES3 AND THE SIZE IS SPECIFIED ON THE PLAN SETS UTILIZING THE LINE TYPES CONTAINED IN THE LEGEND ON EACH SHEET.
- STOCKPILE SLOPES WILL BE 2:1 OR FLATTER, AND STOCKPILES WILL NOT EXCEED 35 FEET IN HEIGHT.
- TEMPORARY STREAM CROSSINGS SHALL BE INSTALLED AS INDICATED ON THE E&S PLAN SHEETS AND AS PER THE E&S DETAIL SHEETS.
- WATERBARS WILL BE INSTALLED IMMEDIATELY AFTER INITIAL DISTURBANCE OF THE SOIL IN ACCORDANCE WITH THE SPACING AND SIZING REQUIREMENTS SHOWN ON PLAN AND DETAIL SHEET. WATERBARS WILL BE CONSTRUCTED OF SOIL TO REDUCE RUNOFF VELOCITY AND DIVERT WATER OFF THE PIPELINE ROW.
- EXCAVATED TRENCH SPOIL MATERIAL WILL BE USED FOR TEMPORARY RIGHT OF WAY DIVERSIONS AS SHOWN IN THE DETAIL AT THE LOCATIONS INDICATED ON THE PLAN SHEETS.
- TRENCH DEWATERING, IF NEEDED, WILL BE CONDUCTED USING A PUMP AND HOSE. WATER WILL BE RELEASED INTO A FILTER BAG THAT WILL BE LOCATED IN A WELL-VEGETATED UPLAND AREA.
- TRENCH BREAKERS WILL BE INSTALLED ON SLOPES ADJACENT TO STREAMS, WETLANDS, AND ROAD CROSSINGS TO PREVENT SUBSURFACE EROSION. TRENCH BREAKERS WILL BE INSTALLED AS SHOWN ON THE DETAILS.
- THE WORK AREA WILL BE BACKFILLED FOLLOWING PIPELINE INSTALLATION OR OTHER EXCAVATION WORK. IN AREAS WHERE TOPSOIL HAS BEEN SEGREGATED, THE SUBSOIL WILL BE REPLACED FIRST, AND THEN THE TOPSOIL WILL BE SPREAD OVER THE AREA FROM WHICH IT WAS REMOVED. DISTURBED AREAS WILL BE RESTORED TO THEIR ORIGINAL TOPOGRAPHIC CONTOURS.
- PERMANENT WATERBARS, WILL BE CONSTRUCTED WITH A TWO PERCENT (TYPICAL) OUTSLOPE TO DIVERT SURFACE FLOW TO A WELL VEGETATED STABLE AREA.
- IMMEDIATELY FOLLOWING BACKFILLING ALL DISTURBED AREAS WILL BE GRADED IN PREPARATION FOR SEEDING AND MULCHING. PRIOR TO SEEDING MVP WILL DISC AREAS TO A DEPTH OF 4-6" TO FACILITATE REVEGETATION. DISCING WILL BE PERFORMED ON SUBSOILS TO A DEPTH OF 4-6" AND AGAIN FOLLOWING TOPSOILING. THE CONSTRUCTION SITE SHOULD BE STABILIZED AS SOON AS POSSIBLE AFTER COMPLETION. ESTABLISHMENT OF FINAL COVER MUST BE INITIATED NO LATER THAN 7 DAYS AFTER REACHING FINAL GRADE. REFER TO TABLES ON THIS SHEET FOR TEMPORARY AND PERMANENT SEEDING SPECIFICATIONS.
- FOR 3:1 OR STEEPER SLOPES THE DISTURBED AREA WILL HAVE EROSION CONTROL BLANKETING INSTALLED AS INDICATED ON DETAIL SHEET.
- TEMPORARY SEDIMENT BARRIERS WILL BE MAINTAINED UNTIL VEGETATION HAS BECOME ESTABLISHED WITH A GROUND COVER THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE AND WILL INHIBIT EROSION. ONCE THIS COVERAGE HAS BEEN OBTAINED, APPROPRIATE CONTROLS WILL BE REMOVED FROM THE WORK AREA. AREAS DISTURBED DURING THE REMOVAL OF THE EROSION CONTROLS WILL BE STABILIZED IMMEDIATELY.
- ALL WASTE MATERIAL WILL BE TRANSPORTED OFFSITE FOR RECYCLING AND/OR DISPOSAL AT A FACILITY APPROVED TO RECEIVE THE MATERIAL.
- IN NON-AGRICULTURAL AREAS THE VISUAL SURVEY SHALL BE COMPARED TO THE DENSITY AND COVER OF ADJACENT UNDISTURBED LANDS. IN AGRICULTURAL AREAS, THE VISUAL SURVEY SHALL BE COMPARED TO THE ADJACENT UNDISTURBED PORTIONS OF THE SAME FIELD, UNLESS THE EASEMENT AGREEMENT SPECIFIES OTHERWISE.
- WETLANDS ALONG THE PROPOSED PIPELINE ARE EXPECTED TO EXHIBIT VARYING DEGREES OF SATURATION AND WATER ELEVATION, REQUIRING A VARIETY OF PLANT SPECIES TO BE RE-ESTABLISHED. IN UNSATURATED WETLANDS, MOST VEGETATION WILL BE REPLACED BY SEEDING. SATURATED WETLANDS WILL TYPICALLY BE ALLOWED TO RE-VEGETATE NATURALLY. WETLAND REVEGETATION WILL BE CONSIDERED SUCCESSFUL WHEN THE COVER OF HERBACEOUS AND/OR WOODY SPECIES IS AT LEAST 80 PERCENT OF THE TYPE, DENSITY, AND DISTRIBUTION OF THE VEGETATION IN ADJACENT WETLAND AREAS THAT WERE NOT DISTURBED BY CONSTRUCTION. REVEGETATION EFFORTS WILL CONTINUE UNTIL WETLAND REVEGETATION IS SUCCESSFUL.

**STREAM CROSSING PROCEDURES**

**GENERAL:** PROCEDURES THAT WILL BE FOLLOWED AT STREAM CROSSING LOCATIONS INCLUDE THE FOLLOWING:

- MINIMIZE CLEARING AND GRUBBING OF VEGETATION UP TO STREAMS, AS POSSIBLE, UNTIL THE TIME OF THE PIPELINE INSTALLATION;
- ONLY THAT AREA WHICH IS REQUIRED FOR PIPELINE INSTALLATION SHALL BE DISTURBED WITHIN THE PROPOSED LIMIT OF DISTURBANCE OR RIGHT-OF-WAY AT STREAM CROSSINGS; LOCATING STAGING AREAS 50 FEET AWAY FROM THE STREAM, WHERE POSSIBLE;
- STORING CHEMICALS, STORING EQUIPMENT, WASHING EQUIPMENT, OR REFUELING EQUIPMENT MUST BE DONE IN AREAS THAT ARE GREATER THAN 100 FEET AWAY FROM THE STREAM;
- SPOIL PILE PLACEMENT AND BMPs WILL BE MONITORED AT ALL TIMES DURING STREAM CROSSING PROCEDURES; ONCE WORK WITHIN A STREAM AREA IS STARTED, IT WILL BE CONDUCTED CONTINUOUSLY TO COMPLETION; EMPHASIS WILL BE PLACED ON MINIMIZING TIME OF DISTURBANCE;
- SPOILS FROM STREAM CROSSINGS MUST BE PLACED AT LEAST 10 FEET FROM THE WATER'S EDGE; AND
- CONSTRUCTION EQUIPMENT WILL NOT BE ALLOWED IN THE STREAM CHANNEL WHEN EXCAVATION CAN BE DONE FROM EITHER SIDE OR A TEMPORARY CROSSING WHILE WORKING AT THE STREAM CROSSING.
- ESC BMPs WILL BE MONITORED/MAINTAINED AT ALL TIMES FOLLOWING INITIAL EARTH DISTURBANCE AND WILL CONTINUE UNTIL RESTORATION IS DEEMED COMPLETE.

THE FOLLOWING SECTIONS DESCRIBE STREAM CROSSING TECHNIQUES THAT MAY BE USED DURING PIPELINE RELOCATION/INSTALLATION ACTIVITIES. REFER TO THE DETAIL SHEETS AND APPROVED STANDARDS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

**DRY CROSSING TECHNIQUES:**

THESE TECHNIQUES WILL BE USED TO PERFORM PIPELINE WORK IN A RELATIVELY DRY WORKING CONDITION OR AROUND THE OPEN EXCAVATION. THESE TECHNIQUES INCLUDE PUMP AROUND AND FLUME PIPE CROSSING METHODS. THE LIMITING FACTORS FOR THESE TECHNIQUES ARE USUALLY STREAM SIZE, FLOW, AND WATER DEPTH.

DIRECTIONAL BORING IS ALSO A TECHNIQUE THAT CAN BE UTILIZED AS IT WILL LESSEN THE IMPACTS ON THE WATERBODIES.

E&S CONTROL MEASURES WILL BE INSTALLED PRIOR TO ANY EARTH DISTURBANCE AND MONITORED/MAINTAINED UNTIL CONSTRUCTION AND RESTORATION THROUGH THE WATER-BODY IS COMPLETE.

FLUME PIPE METHOD: PLEASE SEE DETAIL SHEETS AND SWPPP FOR MORE INFORMATION ON THE FLUME PIPE METHOD. THIS PROCEDURE INVOLVES CONSTRUCTING TWO BULKHEADS, EITHER SANDBAGS OR PLASTIC DAMS, TO DIRECT THE STREAM FLOW THROUGH A FLUME PIPE PLACED OVER THE TRENCH PRIOR TO EXCAVATION. THE FLUME SHALL BE ALIGNED AS TO PREVENT BANK EROSION AND BED SCOUR. THE FLUME WILL NOT BE REMOVED DURING TRENCHING, PIPE LAYING OR BACKFILLING.

PUMP AROUND METHOD: PLEASE SEE THE DETAIL SHEETS AND APPROVED STANDARDS AND SPECIFICATIONS FOR MORE INFORMATION ON THE PUMP AROUND METHOD. THIS PROCEDURE INVOLVES CONSTRUCTING TWO BULKHEADS, EITHER SANDBAGS OR PLASTIC DAMS. THE UPSTREAM DAM WILL CAUSE THE WATER TO POND WHERE IT CAN BE PUMPED AROUND THE WORK AREA AND BE DISCHARGED BEHIND THE DOWNSTREAM BULKHEAD. PUMPS OF SUFFICIENT SIZE TO TRANSMIT THE FLOW DOWNSTREAM WILL BE USED. BACKUP PUMPS MUST BE ON-SITE. PUMP INTAKES MUST BE SCREENED. PUMP DISCHARGES MUST NOT CAUSE SCOUR.

**CONVENTIONAL BORE TECHNIQUES:**

TO COMPLETE A CONVENTIONAL BORE OR GUIDED CONVENTIONAL BORE, TWO PITS WILL BE EXCAVATED, ONE ON EACH SIDE OF THE FEATURE TO BE BORED. A BORING MACHINE WILL BE LOWERED INTO ONE PIT, AND A HORIZONTAL HOLE WILL BE BORED TO A DIAMETER EQUAL TO THE DIAMETER OF THE PIPE (OR CASING, IF REQUIRED) AT THE DEPTH OF THE PIPELINE INSTALLATION. THE PIPELINE SECTION AND/OR CASING WILL THEN BE PUSHED THROUGH THE BORE TO THE OPPOSITE PIT. IF ADDITIONAL PIPELINE SECTIONS ARE REQUIRED TO SPAN THE LENGTH OF THE BORE, THEY WILL BE WELDED TO THE FIRST SECTION OF THE PIPELINE IN THE BORE PIT BEFORE BEING PUSHED THROUGH THE BORE (MVP-51 TYPICAL WATERBODY CONVENTIONAL BORE).

**TEMPORARY ROAD CROSSINGS:**

TEMPORARY ROAD CROSSINGS, CONSISTING OF BRIDGES OF TIMBER MATS OR CLEAN ROCK FILL AND FLUME(S), WILL BE INSTALLED TO CROSS MINOR OR INTERMEDIATE STREAMS. TIMBER MATS SHALL BE USED TO CROSS SMALLER STREAMS WHERE THE SPAN OF THE MAT WILL STRETCH FROM BANK TO BANK. CLEAN ROCK FILL AND FLUMED CROSSINGS WILL BE UTILIZED WHERE IT IS NOT FEASIBLE TO UTILIZE TIMBER MATS. AS AN ALTERNATIVE, PORTABLE BRIDGES MAY BE USED INSTEAD FOR SMALL CROSSINGS. EQUIPMENT WILL NOT BE ALLOWED TO FORD FLOWING STREAMS DURING CONSTRUCTION ACTIVITIES. TEMPORARY ROAD CROSSINGS OF STREAMS MUST MAINTAIN FOR ADEQUATE FLOW DOWNSTREAM.

**STREAM BANK STABILIZATION:**

PERMANENT STABILIZATION SHALL OCCUR IMMEDIATELY UPON INSTALLATION, BACKFILLING, AND GRADING AT EACH STREAM CROSSING.

**LEGEND**

- CLEAN WATER DIVERSION DIKE (SEE DETAIL MVP-ES50 AND MVP-ES51)
- STREAM
- US FOREST SERVICE (NATIONAL FOREST) LANDS
- APPALACHIAN NATIONAL SCENIC TRAIL
- EXISTING ROAD/TRAIL
- EXISTING PROPERTY LINE
- EXISTING STATE LINE
- EXISTING COUNTY LINE
- POND
- WETLAND
- ACID FORMING MATERIAL
- AGRICULTURAL LAND USE BOUNDARY
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD CENTERLINE
- PROPOSED PIPELINE
- PROPOSED SILT FENCE
- PROPOSED SUPER SILT FENCE (SEE DETAIL MVP-ES9.2)
- PROPOSED REINFORCED FILTRATION DEVICE (SEE DETAILS MVP-ES9, 9.1, 9.2, 9.3)
- ORANGE CONSTRUCTION SAFETY FENCE
- PROPOSED 12" COMPOST FILTER SOCK (SEE DETAILS MVP-ES3, 3.1, 3.2)
- PROPOSED 18" COMPOST FILTER SOCK (SEE DETAILS MVP-ES3, 3.1, 3.2)
- PROPOSED 24" COMPOST FILTER SOCK (SEE DETAILS MVP-ES3, 3.1, 3.2)
- GRASS-LINED CHANNEL (SEE DETAIL MVP-ES39)
- CLEAN WATER DIVERSION PIPE
- TIMBER MAT (SEE DETAIL MVP-ES37)
- STEEP SLOPE EROSION CONTROL (SEE NOTE 2)
- STEEP SLOPE AREAS (SEE NOTE 4)
- PROPOSED ROCK CONSTRUCTION ENTRANCE
- PROPOSED TRENCH BREAKER (SEE DETAIL MVP-20)
- TEMPORARY ROW DIVERSION/WATER BAR (VADEQ STD & SPEC 3.11)
- PERMANENT SLOPE BREAKER/ROW DIVERSION/WATER BAR (SEE DETAILS MVP-17, ES38, AND SCHEDULE)

**NOTES:**

- TOPSOIL SEGREGATION WILL BE PERFORMED IN ALL-CONSTRUCTION AREAS OF THE PROJECT IN ACCORDANCE WITH DETAIL MVP-ES46.1 THROUGH MVP-ES46.3.
- FLEXITERRA, EARTHGUARD OR EQUIVALENT MAY BE USED AS A SUBSTITUTE TO EROSION CONTROL BLANKET AS DIRECTED BY MVP.
- CONTRACTOR IS RESPONSIBLE TO IDENTIFY ALL UTILITIES. THE UTILITY LINES SHOWN ON THE PLAN ARE FOR INFORMATIONAL PURPOSES ONLY AND DO NOT REPRESENT SURVEYED LINE INFORMATION.
- SLOPES OF 30' OR GREATER EXIST. CONSTRUCTION FOR STEEP SLOPES TO BE PERFORMED USING STEEP SLOPE TECHNIQUES IDENTIFIED IN THE DETAIL SHEETS. ALSO REFER TO THE SITE-SPECIFIC DESIGN OF STABILIZATION MEASURES IN SELECTED HIGH-HAZARD PORTIONS OF THE ROUTE OF THE PROPOSED MOUNTAIN VALLEY PIPELINE PROJECT.
- WHERE CONSTRUCTION CONDITIONS PRECLUDE THE USE OF DIVERSION DITCHES DUE TO SITE CONDITIONS THE CONTRACTOR WILL INSTALL SILT FENCE AT THE DIRECTION OF MVP.
- IMPROVEMENTS TO PERMANENT AND TEMPORARY ACCESS ROADS WILL BE PERFORMED PER THE SITE SPECIFIC ACCESS ROAD DETAILS.
- TEMPORARY ACCESS ROAD CROSSING OF STREAMS AND WETLANDS WILL UTILIZE TIMBERMATS. ANY PERMANENT ROAD CROSSINGS WILL BE CONDUCTED VIA CULVERTS.
- ALL NON VMRC STREAM CROSSINGS WILL BE PERFORMED AS DESCRIBED IN THE STREAM CROSSING TABLE INCLUDED IN THIS PACKAGE.

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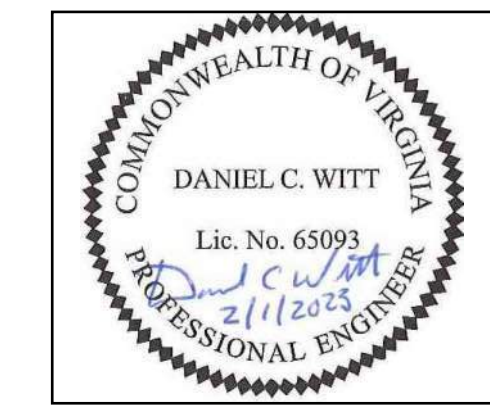
**Mountain Valley Pipeline**  
EROSION AND SEDIMENT CONTROL PLANS  
MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE

**MOUNTAIN VALLEY PIPELINE, LLC**  
555 SOUTHPOINTE BOULEVARD, SUITE 200  
CANONSBURG, PA 15317

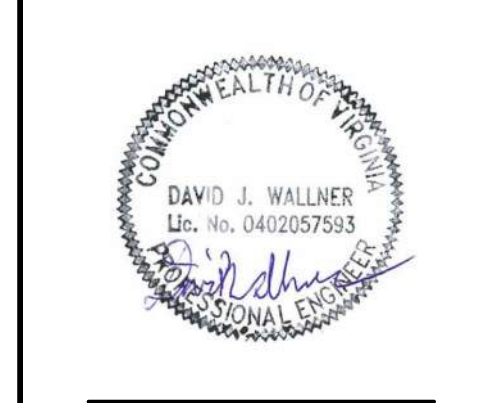
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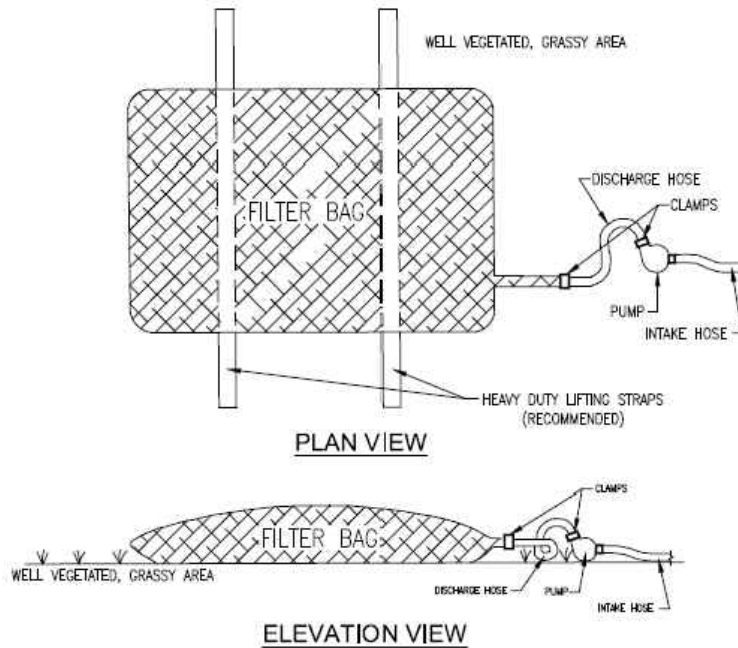


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LOW VOLUME FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH, DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS. HIGH VOLUME FILTER BAGS SHALL BE MADE FROM WOVEN GEOTEXTILES THAT MEET THE FOLLOWING STANDARDS:

Property	Test Method	Minimum Standard
Avg. Wide Width Strength	ASTM D-4884	60 lb/in
Grab Tensile	ASTM D-4632	205 lb
Puncture	ASTM D-4833	110 lb
Mullen Burst	ASTM D-3786	350 psi
UV Resistance	ASTM D-4355	70%
AOS % Retained	ASTM D-4751	80 Sieve

A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES SHALL BE PROVIDED. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME 1/2 FULL OF SEDIMENT. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED. BAGS SHALL BE PLACED ON STRAPS TO FACILITATE REMOVAL UNLESS BAGS COME WITH LIFTING STRAPS ALREADY ATTACHED.

BAGS SHALL BE LOCATED IN WELL-VEGETATED (GRASSY) AREA, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE UNDERLAYMENT AND FLOW PATH SHALL BE PROVIDED. BAGS MAY BE PLACED ON FILTER STONE TO INCREASE DISCHARGE CAPACITY. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5%. FOR SLOPES EXCEEDING 5%, CLEAN ROCK OR OTHER NON-ERODIBLE AND NON-POLLUTING MATERIAL MAY BE PLACED UNDER THE BAG TO REDUCE SLOPE STEEPNESS.

NO DOWNSLOPE SEDIMENT BARRIER IS REQUIRED FOR MOST INSTALLATIONS. COMPOST BERM OR COMPOST FILTER SOCK SHALL BE INSTALLED BELOW BAGS LOCATED IN TMDL WATERSHEDS, CLASS V AND VI TROUT STREAMS AND STREAMS IN STATE AND FEDERAL FORESTS, WITHIN 50 FEET OF ANY RECEIVING SURFACE WATER OR WHERE GRASSY AREA IS NOT AVAILABLE.

THE PUMP DISCHARGE HOSE SHALL BE INSERTED INTO THE BAGS IN THE MANNER SPECIFIED BY THE MANUFACTURER AND SECURELY CLAMPED. A PIECE OF PVC PIPE IS RECOMMENDED FOR THIS PURPOSE.

THE PUMPING RATE SHALL BE NO GREATER THAN 750 GPM OR 1/2 THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHALL BE FLOATING AND SCREENED.

FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED, PUMPING SHALL CEASE IMMEDIATELY AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.

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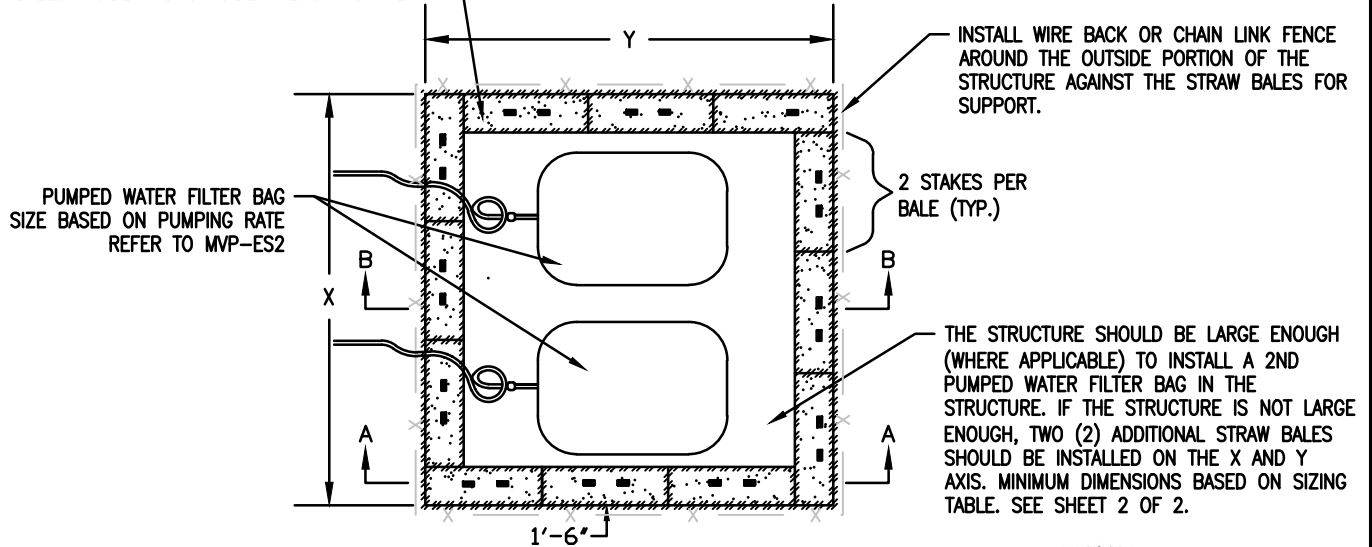
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
PUMPED WATER FILTER BAG	
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MVP-ES2	0

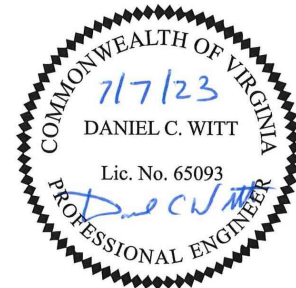
# STRAW BALE CONTAINMENT STRUCTURE FOR PUMPED WATER FILTER BAG

GEOTEXTILE FABRIC TO BE PLACED ON THE BOTTOM OF THE STRAW BALE CONTAINMENT STRUCTURE AND EXTEND OVER THE TOP OF THE FIRST LAYER OF STRAW BALES AND EXTEND TO THE GROUND ON THE OUTSIDE OF THE STRUCTURE. THE GEOTEXTILE FABRIC SHOULD BE ANCHORED TO THE STRAW BALES INSIDE AND OUTSIDE THE STRUCTURE.

STRAW BALES SHOULD BE STACKED AT A MINIMUM OF TWO BALES.



PLAN VIEW



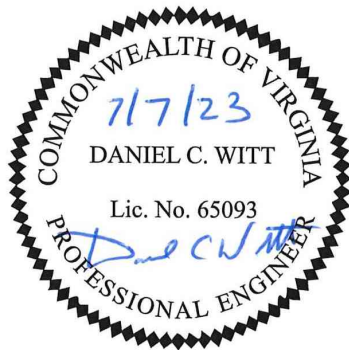
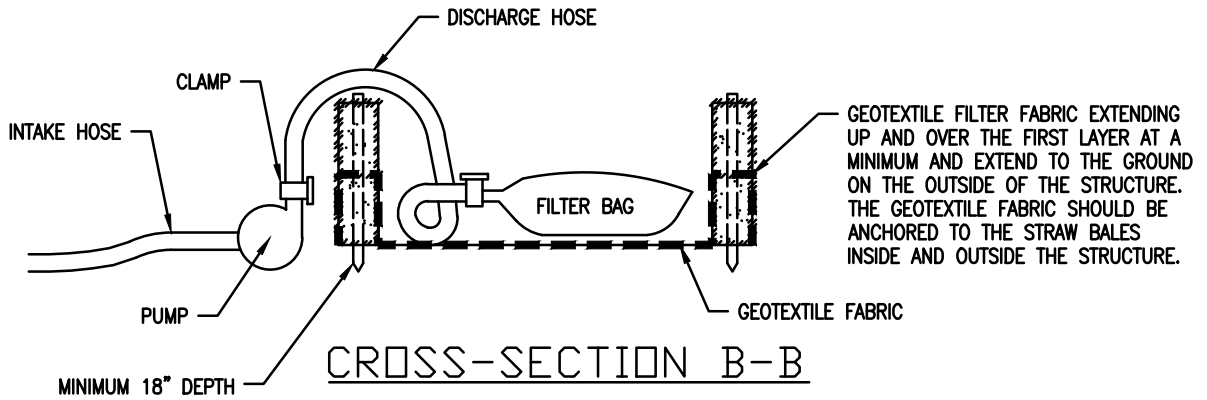
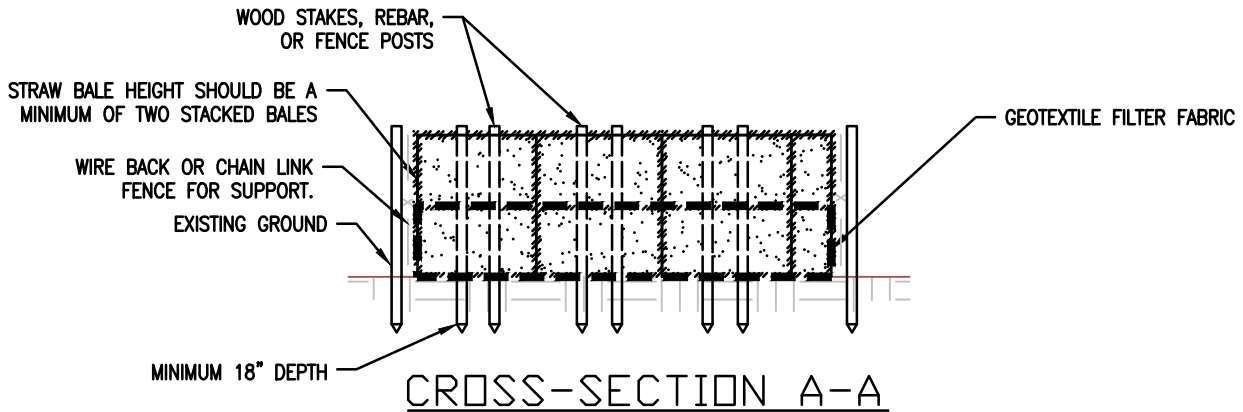
THIS DETAIL SERVES AS AN ENHANCED OPTION BASED OFF OF VESCH STD & SPEC 3.26-3

**NOTES:**

1. WELL VEGETATED LOCATIONS SHOULD BE LOCATED FOR STRUCTURE AND DOWNSLOPE DISCHARGE LOCATIONS. REFER TO MVP-ES2. SOIL STABILIZATION BLANKET (SSB) SHALL BE INSTALLED WHERE THE DOWNSLOPE DISCHARGE LOCATION(S) ARE NOT WELL VEGETATED.
2. STRAW BALE STRUCTURE SIZING SHALL BE BASED ON PUMPED WATER FILTER BAG SIZE AND SHALL BE CONSTRUCTED TO ALLOW SUFFICIENT SPACE FOR INSTALLATION AND REPAIR/MAINTENANCE OPERATIONS.
3. MINIMAL HEIGHT FOR STRAW BALES SHALL BE TWO LAYERS. ADDITIONAL HEIGHT MAY BE NECESSARY BASED ON PUMPING RATE AND TO ALLOW FOR INCREASED STORAGE DUE FINE SOIL PARTICULATE MATTER.
4. THE GEOTEXTILE FABRIC SHALL BE PROPERLY INSTALLED TO ENCOMPASS THE ENTIRE BOTTOM PORTION OF THE STRAW BALE STRUCTURE AND AT A MINIMUM EXTEND UNDER THE FIRST LAYER AND WRAP OVER THE TOP FIRST LAYER OF STRAW BALES.
5. PUMPED WATER FILTER BAG SHALL BE REPAIRED/ MAINTAINED PER MVP-ES2. THE STRAW BALE STRUCTURE SHALL BE REPAIRED/MAINTAINED AS NECESSARY DURING PUMPING ACTIVITIES. STRAW BALES SHALL BE REPLACED AS NECESSARY TO MAINTAIN PROPER FUNCTIONING.
6. INSTALL SEDIMENT CONTROL MEASURES AS NEEDED WITHIN THE FLOWPATH AT INTERVALS DOWNSLOPE FROM THE DEWATERING STRUCTURE.
7. DEWATERING ACTIVITY SHALL BE ACTIVELY MONITORED FOR THE DURATION THE ACTIVITY IS ONGOING. ANY REVISIONS OR MAINTENANCE ACTIVITIES SHALL BE PERFORMED IMMEDIATELY.

<b>DRAWN</b>	<b>DATE</b>	 <b>Mountain Valley</b> PIPELINE DESIGN ENGINEERING	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		PUMPED WATER FILTER BAG STRAW BALE CONTAINMENT	
<b>APP'D</b>	<b>DATE 07/07/23</b>			
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 2</b>			
<b>JOB NO.</b>			<b>DRAWING NO.</b>	<b>REV.</b>
<b>PROJECT ID:</b>		MVP-ES2.1	P	

# STRAW BALE CONTAINMENT STRUCTURE FOR PUMPED WATER FILTER BAG



MINIMUM SUMP DIMENSIONS (FEET)		MAXIMUM PUMPING RATE (GPM)
X	Y	
10	20	300
15	20	350
20	20	400
20	25	450
25	25	500
25	30	550
30	30	600

**NOTES:**

1. PLACE LOOSE STRAW (OR WOOD CHIPS IF AVAILABLE) AS CHINKING AT THE INSIDE OF THE STRUCTURE BETWEEN THE STRAW BALES, GROUND AND GEOTEXTILE FILTER FABRIC.
2. IF REBAR OR METAL POST WILL BE UTILIZED, THE EXPOSED TOPS SHOULD BE CAPPED.

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 06/07/23</b>
<b>SCALE N.T.S.</b>	<b>SHEET 2 OF 2</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	

**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

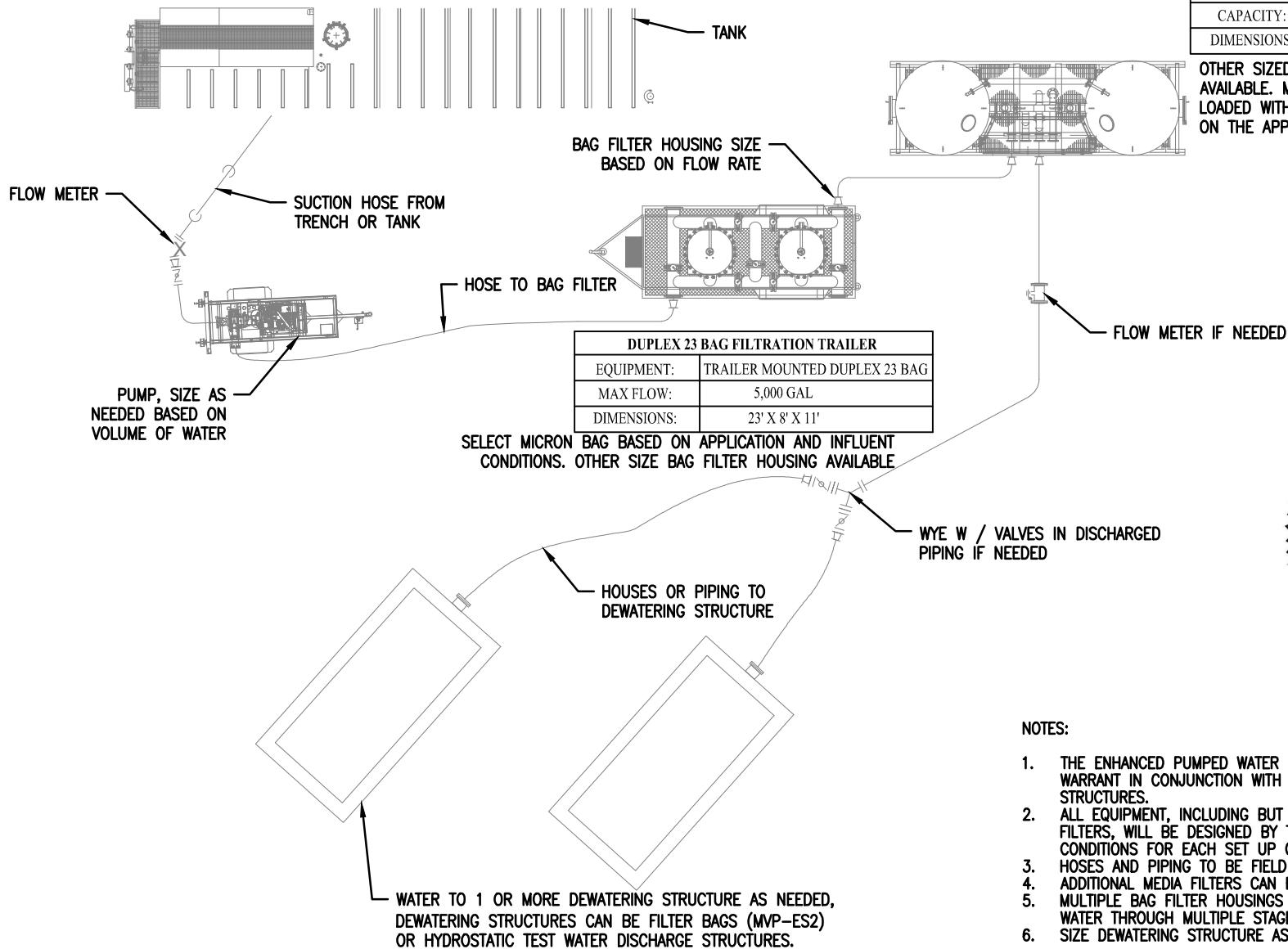
**ENVIRONMENTAL DETAIL**

PUMPED WATER FILTER BAG  
STRAW BALE CONTAINMENT

<b>DRAWING NO.</b> MVP-ES2.1	<b>REV.</b> P
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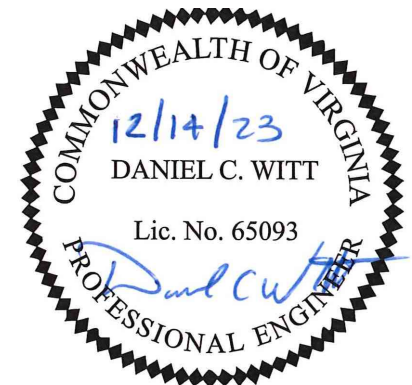
10K MEDIA FILTER UNIT	
FLOW RATE:	600 TO 1,200 GPM
CAPACITY:	320 CU. FT. / VESSEL
DIMENSIONS:	25'X8'X11'

OTHER SIZED OF MEDIA VESSELS AVAILABLE. MEDIA VESSELS CAN BE LOADED WITH DIFFERENT MEDIAS BASED ON THE APPLICATION.



DUPLIX 23 BAG FILTRATION TRAILER	
EQUIPMENT:	TRAILER MOUNTED DUPLIX 23 BAG
MAX FLOW:	5,000 GAL
DIMENSIONS:	23' X 8' X 11'

SELECT MICRON BAG BASED ON APPLICATION AND INFLUENT CONDITIONS. OTHER SIZE BAG FILTER HOUSING AVAILABLE



**NOTES:**

1. THE ENHANCED PUMPED WATER FILTRATION SYSTEM WILL BE USED IF CONDITIONS WARRANT IN CONJUNCTION WITH DETAIL MVP-ES2 OR HYDROSTATIC DISCHARGE STRUCTURES.
2. ALL EQUIPMENT, INCLUDING BUT NOT LIMITED TO PIPING, CONNECTIONS AND FILTERS, WILL BE DESIGNED BY THE CONTRACTOR DEPENDING ON FIELD CONDITIONS FOR EACH SET UP OF THE FILTRATION SYSTEM.
3. HOSES AND PIPING TO BE FIELD ADJUSTED BASED ON THE SITE.
4. ADDITIONAL MEDIA FILTERS CAN BE ADDED FOR INCREASED FLOW RATES.
5. MULTIPLE BAG FILTER HOUSINGS CAN BE USED TO INCREASE FLOW OR TO FILTER WATER THROUGH MULTIPLE STAGES OF BAGS.
6. SIZE DEWATERING STRUCTURE AS NEEDED BASED ON FLOW AND SITE CONDITIONS.

DRAWN	JZ	DATE	12/14/2023
CHECKED	IHH	DATE	12/14/2023
APP'D	DCW	DATE	12/14/2023
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

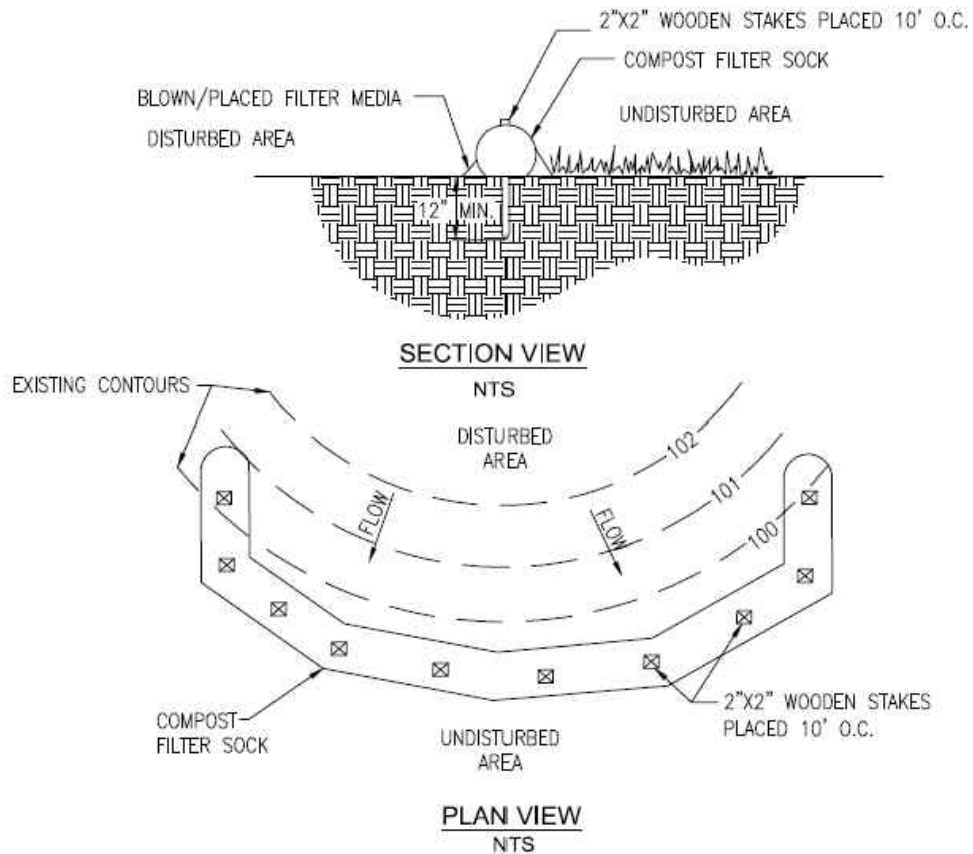


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

ENHANCED PUMPED WATER  
FILTRATION SYSTEM

DRAWING NO.	REV.
MVP-ES2.2	0



SOCK FABRIC SHALL MEET STANDARDS OF TABLE 4.1. COMPOST SHALL MEET THE STANDARDS OF TABLE 4.2.

COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE SOCK SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN SOCK ALIGNMENT. MAXIMUM SLOPE LENGTH ABOVE ANY SOCK SHALL NOT EXCEED MAXIMUM PERMISSIBLE SLOPE LENGTH ABOVE COMPOST FILTER SOCKS. STAKES MAY BE INSTALLED IMMEDIATELY DOWNSLOPE OF THE SOCK IF SO SPECIFIED BY THE MANUFACTURER.

TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.

ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE ABOVEGROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.

SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.

BIODEGRADABLE FILTER SOCKS SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
COMPOST FILTER SOCK	
DRAWING NO.	REV.
MVP-ES3	0

TABLE 4.1					
Compost Sock Fabric Minimum Specifications					
Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters		12"	12"	12"	12"
	12"	18"	18"	18"	18"
	18"	24"	24"	24"	24"
		32"	32"	32"	32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years
Two-ply systems					
Inner Containment Netting	HDPE biaxial net				
	Continuously wound				
	Fusion-welded junctures				
	3/4" X 3/4" Max. aperture size				
Outer Filtration Mesh	Composite Polypropylene Fabric (Woven layer and non-woven fleece mechanically fused via needle punch)				
	3/16" Max. aperture size				
Sock fabrics composed of burlap may be used on projects lasting 6 months or less.					

TABLE 4.2	
Compost Standards	
Organic Matter Content	80% - 100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5 - 8.0
Moisture Content	35% - 55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) Maximum

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	



ENVIRONMENTAL DETAIL	
COMPOST FILTER SOCK TABLES	
DRAWING NO. MVP-ES3.1	REV. 0



Slope Percent	Maximum Slope Length for Compost Filter Sock in Feet				
	8 in	12 in	18 in	24 in	32 in
2 (or less)	600	750	1000	1300	1650
5	400	500	550	650	750
10	200	250	300	400	500
15	140	170	200	325	450
20	100	125	140	260	400
25	80	100	110	200	275
30	60	75	90	130	200
35	60	75	80	115	150
40	60	75	80	100	125
45	40	50	60	80	100
50	40	50	55	65	75

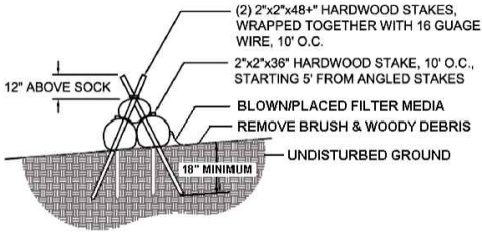
**MAXIMUM SLOPE LENGTH ABOVE COMPOST FILTER SOCK AND RECOMMENDED DIAMETER**

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	

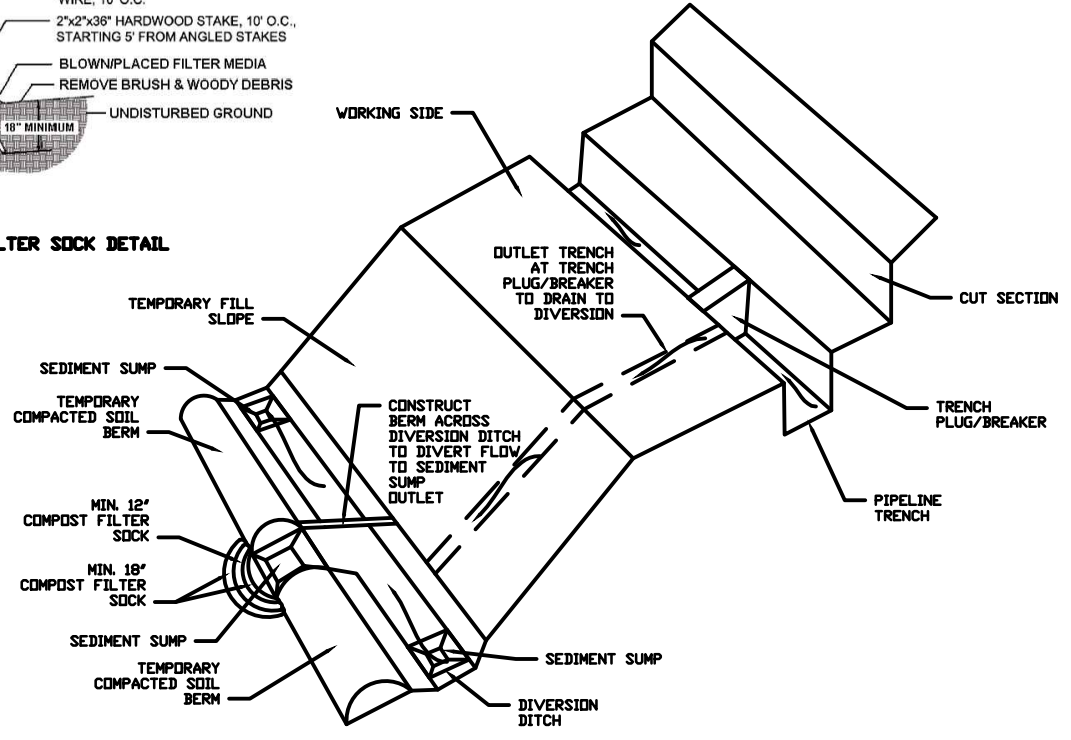


**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
COMPOST FILTER SOCK TABLES	
DRAWING NO. MVP-ES3.2	REV. 0



**STACKED COMPOST FILTER SOCK DETAIL**



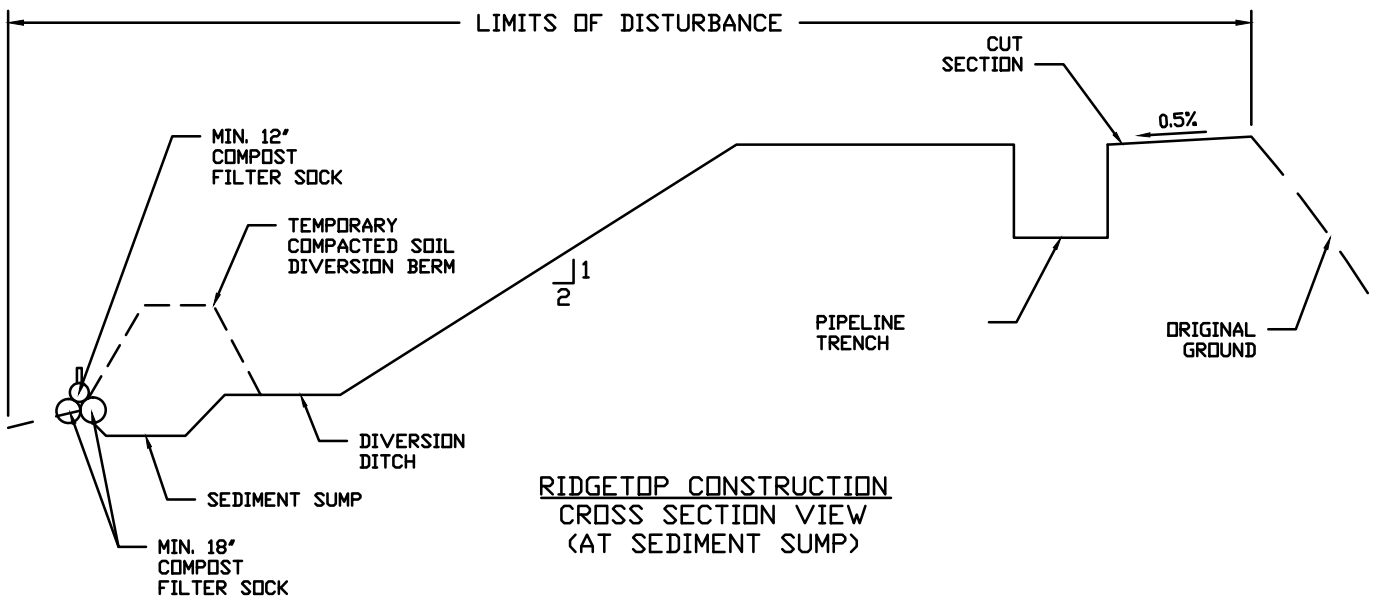
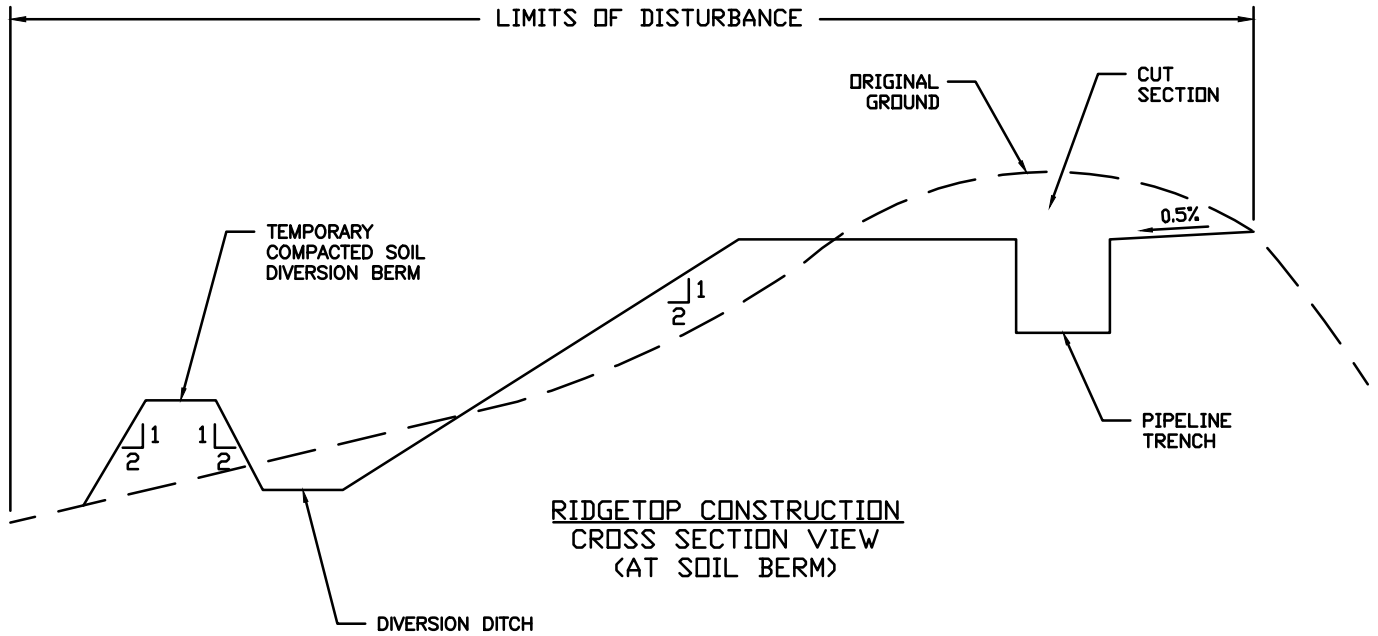
**NOTES:**

1. TEMPORARY RIGHT OF WAY DIVERSION AND OUTLET INTENDED FOR USE IN LIEU OF SILT FENCING OR COMPOST FILTER SOCK ALONG STRAIGHT SECTIONS OF RIGHT OF WAY LOCATED NEAR RIDGE LINES OR OTHER UPLAND AREAS WHICH ARE 200 FT OR MORE UPSLOPE OF IDENTIFIED STREAMS OR WETLANDS.
2. ROLLED EROSION CONTROL PRODUCT AND/OR MULCHING SHALL BE USED TO STABILIZE THE TEMPORARY COMPACTED SOIL BERM, DIVERSION DITCH, AND TEMPORARY FILL SLOPE.
3. THE DIVERSION DITCH SHALL BE SIZED BASED ON THE DRAINAGE AREA AND STD & SPEC 3.12 (DIVERSION) DETAILED IN THE VESCH.
4. SPOIL FROM THE PIPELINE TRENCH TO BE USED TO CONSTRUCT THE TEMPORARY SOIL BERM.
5. OUTLET TRENCH TO BE CUT FROM THE PIPELINE TRENCH TO THE DIVERSION DITCH AT TRENCH PLUGS/BREAKERS AND AT LOW POINTS IN THE PIPELINE TRENCH.
6. TEMPORARY FILL SLOPE TO BE CONSTRUCTED NO STEEPER THAN 2H:1V.
7. SIDE SLOPES OF TEMPORARY SOIL BERM AND DIVERSION DITCH SHALL BE NO STEEPER THAN 2H:1V.
8. ENDS OF COMPOST FILTER SOCK AT SUMP OUTLET TO BE TURNED UPSLOPE AND BUTTED UP AGAINST THE BERM TO PREVENT FLOW FROM PASSING AROUND COMPOST FILTER SOCK.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TEMPORARY RIGHT OF WAY DIVERSION AND OUTLET DETAIL	
DRAWING NO.	REV.
MVP-ES4	0



DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

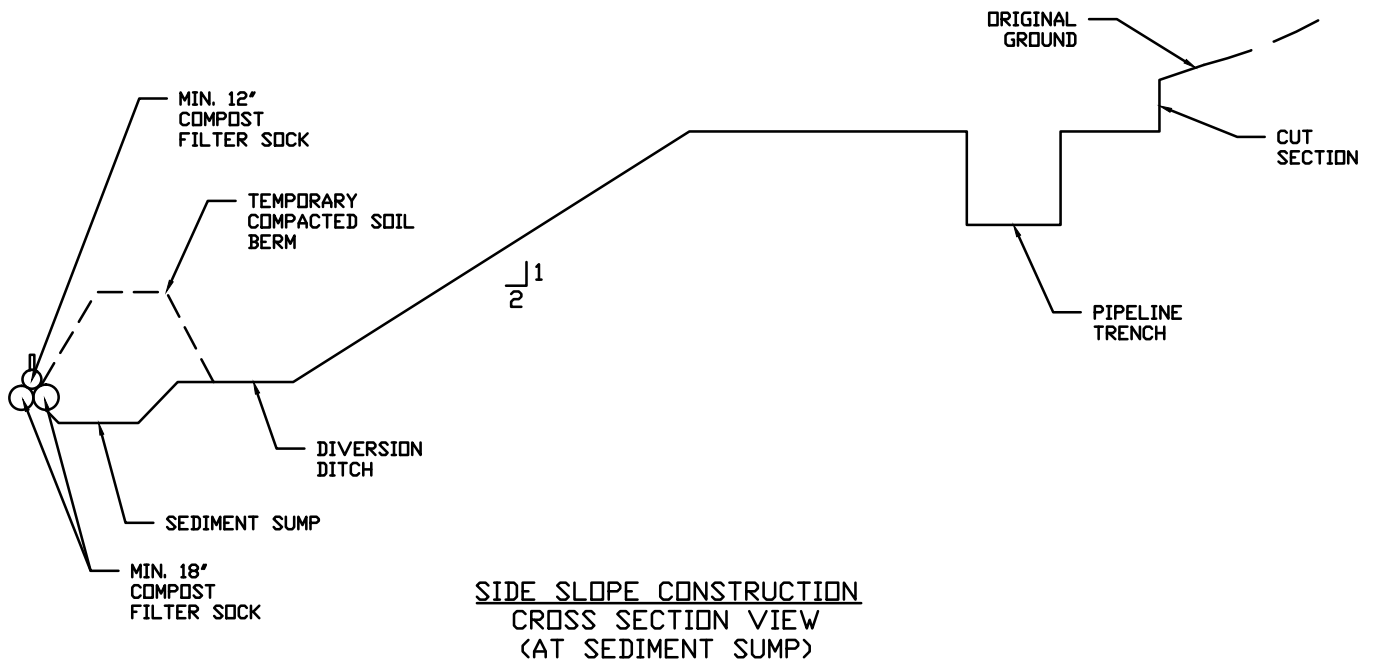
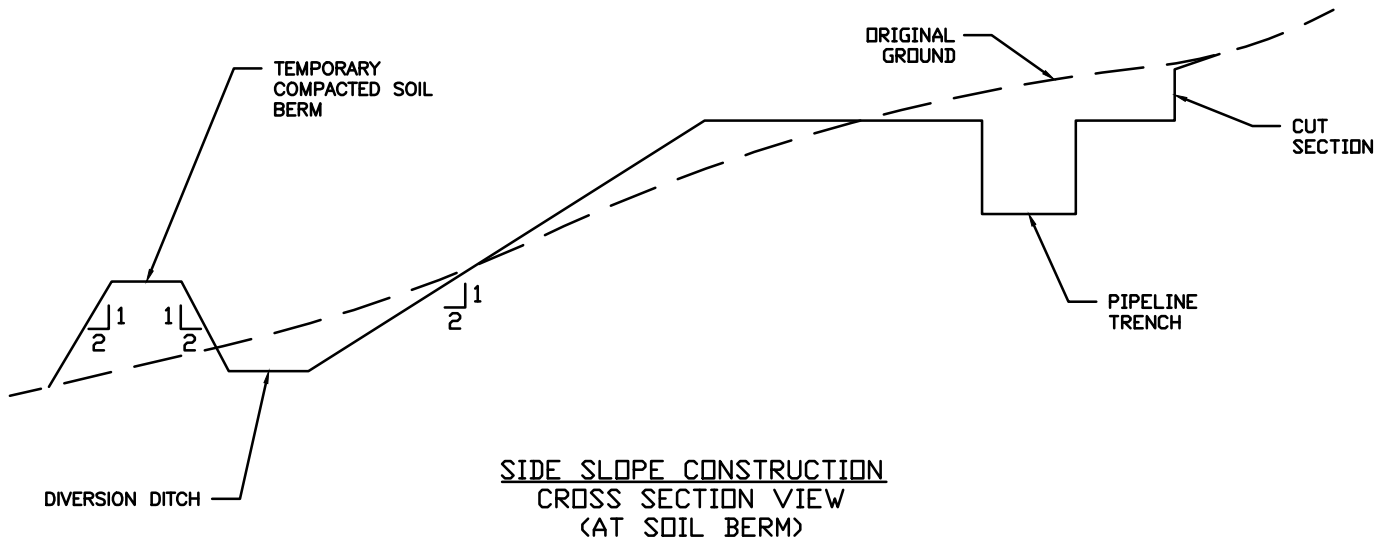
**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

TEMPORARY RIGHT OF WAY  
DIVERSION AND OUTLET NOTES

DRAWING NO.  
MVP-ES4.1

REV.  
0

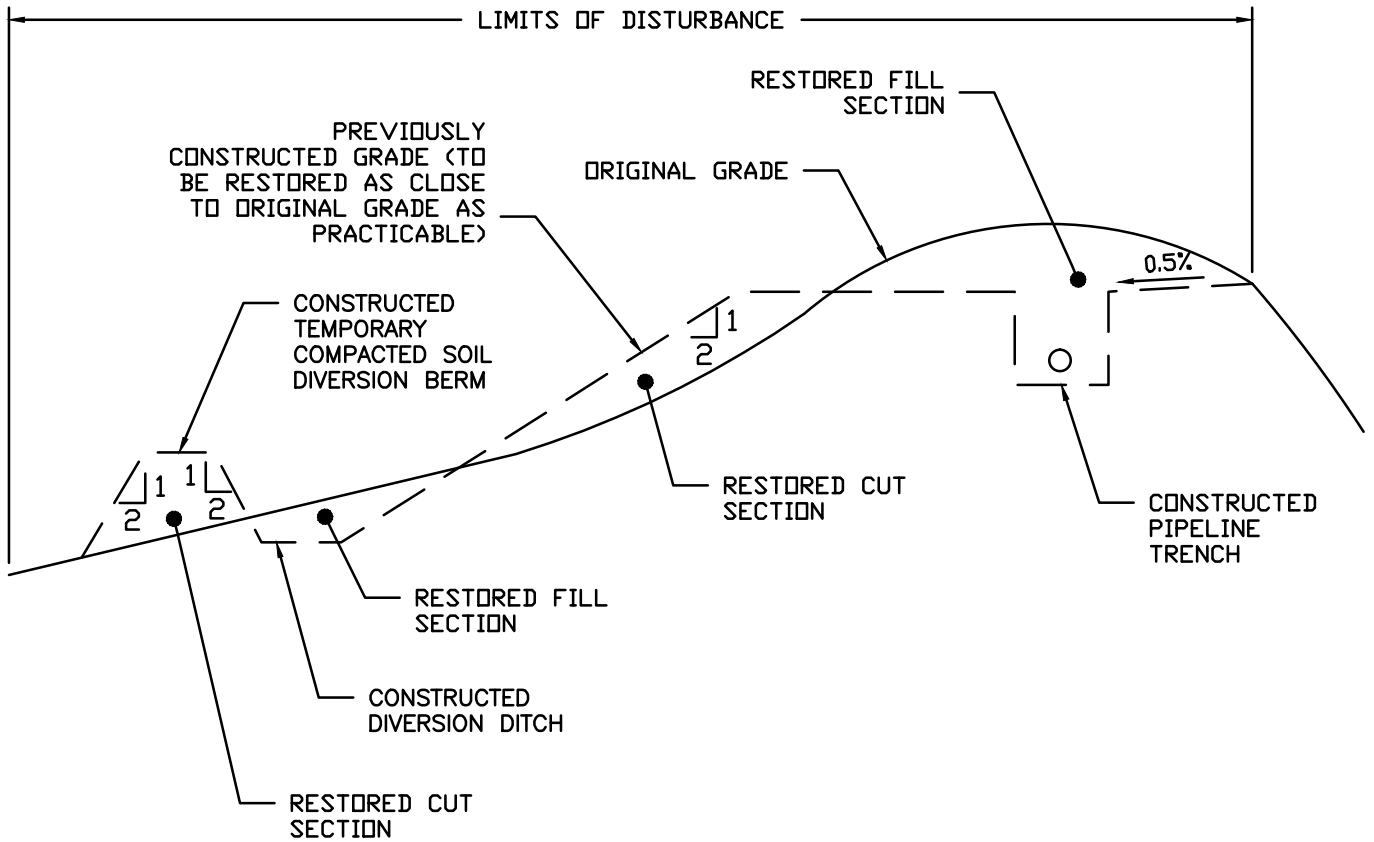


DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
TEMPORARY RIGHT OF WAY DIVERSION AND OUTLET NOTES	
DRAWING NO. MVP-ES4.2	REV. 0



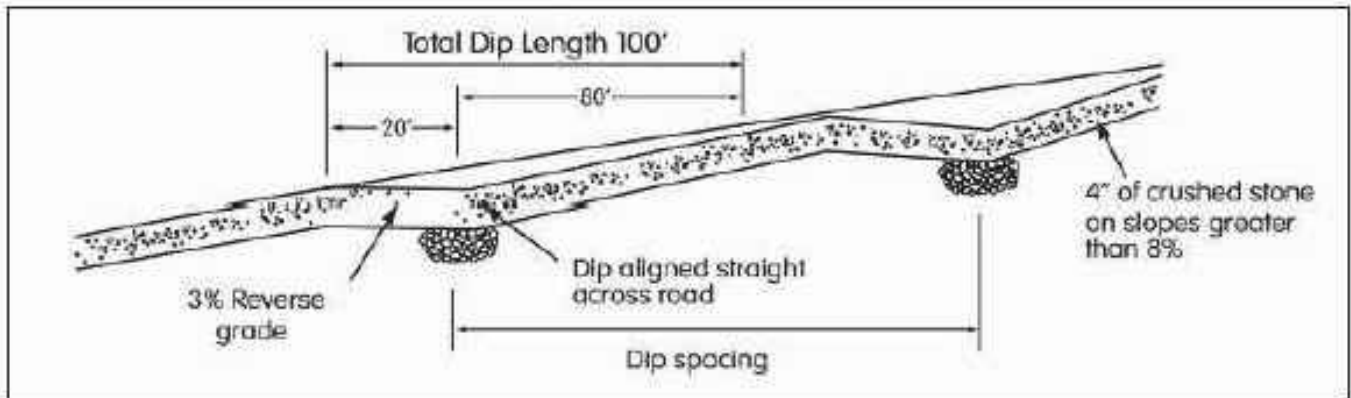
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
POST CONSTRUCTION RIDGETOP RECLAMATION DETAIL	
DRAWING NO.	REV.
MVP-ES4.3	0



**Table II-4 Spacing of Broad-Based Dips**

Road Grade (%)	Distance Between Drains (Ft)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140

**DESIGN CRITERIA:**

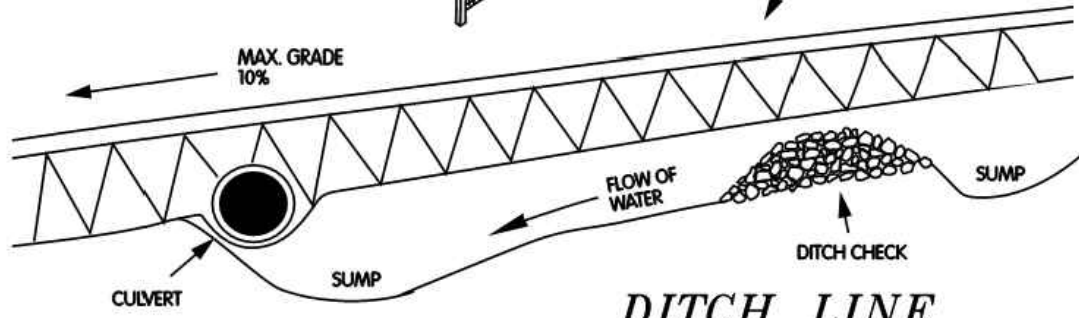
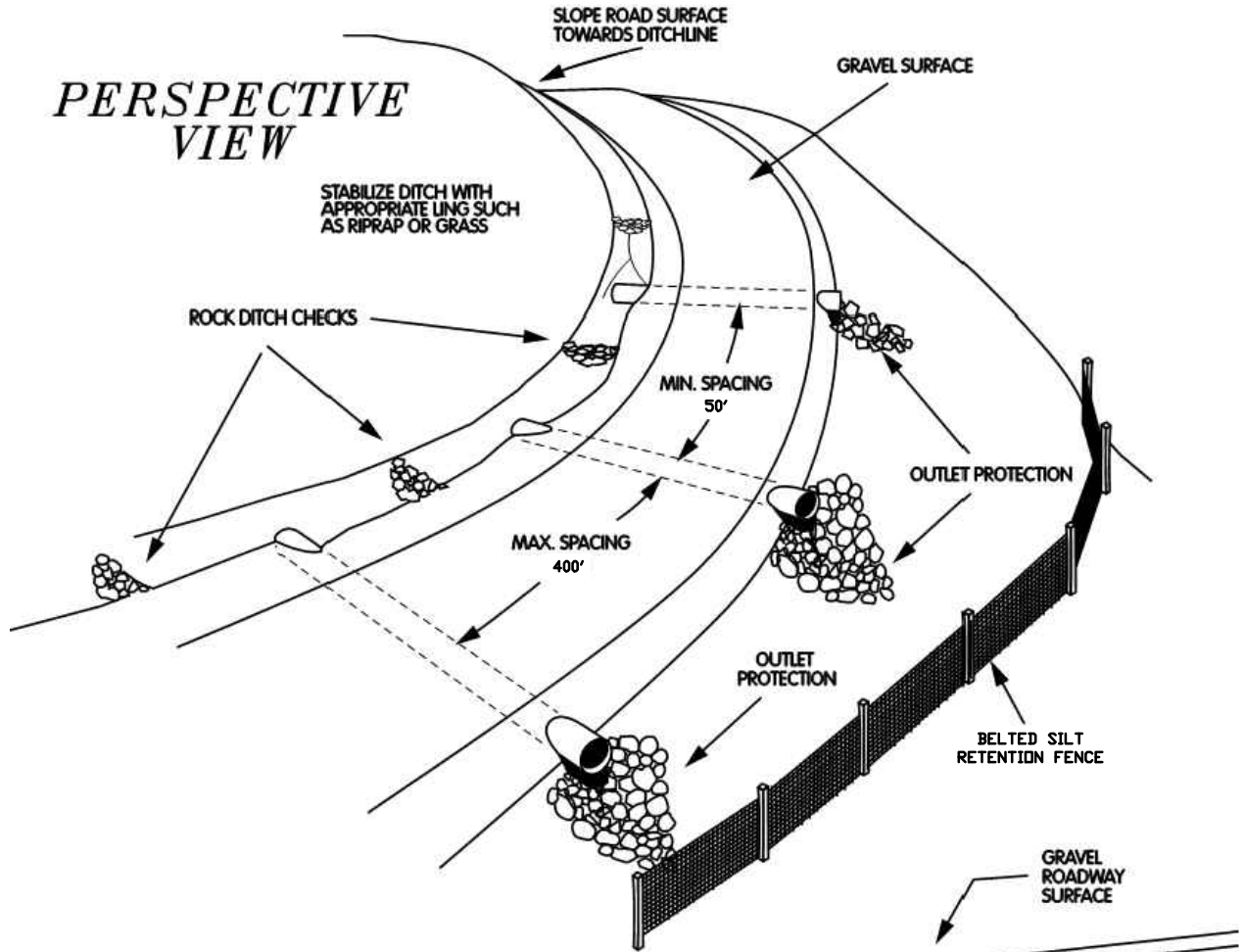
1. MAXIMUM ROAD GRADE ON WHICH DIPS CAN BE CONSTRUCTED IS 10%
2. A 3% REVERSE GRADE SHOULD BE CONSTRUCTED IN THE EXISTING ROADBED, BY CUTTING UPGRADE OF THE DIP LOCATION.
3. BROADBASED DIP SHOULD BE ARMORED WITH STONE TO WITHSTAND EXPECTED TRAFFIC.
4. DRAINAGE OUTLET PROTECTION SHALL BE PROVIDED WITH APPROPRIATE SEDIMENT BARRIER STRUCTURES.
5. SPACING: REFER TO TABLE II-4.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
BROAD BASED DIP	
DRAWING NO.	REV.
MVP-ES5	0

# PERSPECTIVE VIEW



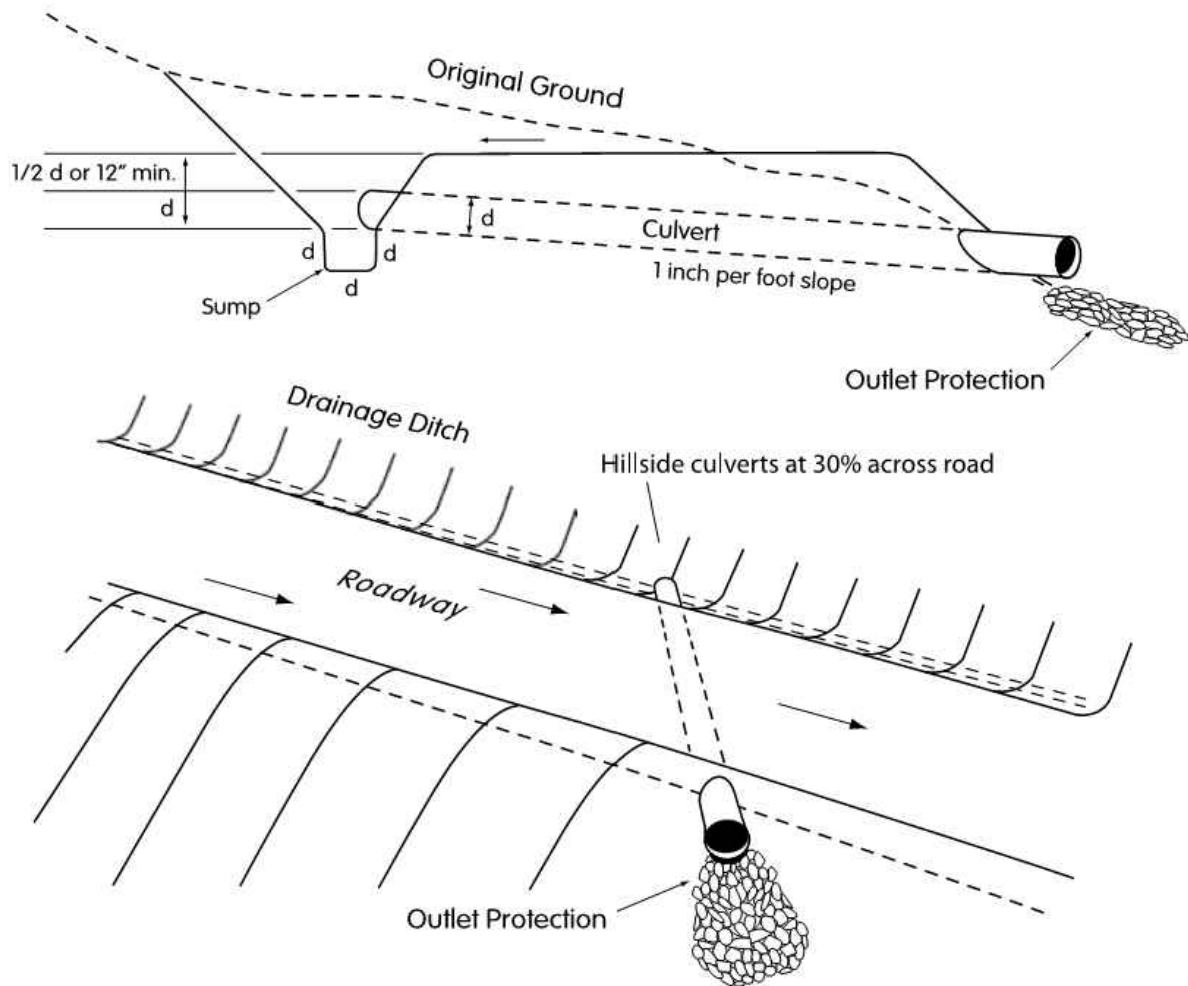
# DITCH LINE CROSS SECTION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
PROPOSED ACCESS ROAD TYPICAL LAYOUT	
DRAWING NO.	REV.
MVP-ES6	



**NOTE:**

CULVERTS TO BE INSTALLED ON NEW OR PERMANENTLY WIDENED EXISTING ACCESS ROADS. ALL DITCH RELIEF CULVERTS WILL BE INSTALLED PER THE TABLES CONTAINED ON MVP-ES7.1.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
DITCH RELIEF CULVERT	
DRAWING NO.	REV.
MVP-ES7	0



TABLE 3.3- Sizing and Spacing of Ditch Relief Culverts for Temporart Access Roads

Road Grade (%)	Culvert Spacing* (ft)	Length of Upslope Drainage (ft)				
		<300	300-400	400-500	500-600	>600
		Minimum Culvert Size (in)				
2	300	12	15	15	15	18
3	235	12	15	15	15	18
4	200	12	15	15	15	18
5	180	12	12	15	15	15
6	165	12	12	12	15	15
7	155	12	12	12	12	15
8	150	12	12	12	12	15
9	145	12	12	12	12	15
10	140	12	12	12	12	15
12	135	12	12	12	12	15

\*Culvert spacing may be adjusted slightly to take advantage of natural drainage courses

TABLE 3.4 - Recommended Maximum Spacing of Ditch Relief Culverts (18" dia. CMP)  
For Permanent Access Roads

Road Grade Percent	Soil Type in Ditch				
	Gravel, Sandy Gravels, Aggregate Surfacing	Silty Gravels, Clayey Gravels	Plastic and Nonplastic Inorganic Clays	Inorganic Silts, Silty or Clayey Sands	Sands, Silty Sands, and Gravelly Sands
	Culvert Spacing Feet*				
2	390	315	245	170	95
4	335	275	210	145	85
6	285	230	180	125	75
8	240	195	150	105	65
10	200	160	125	90	55
12	160	130	105	75	45
14	135	110	85	60	35

\*Culvert spacing may be adjusted slightly to take advantage of natural drainage courses

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

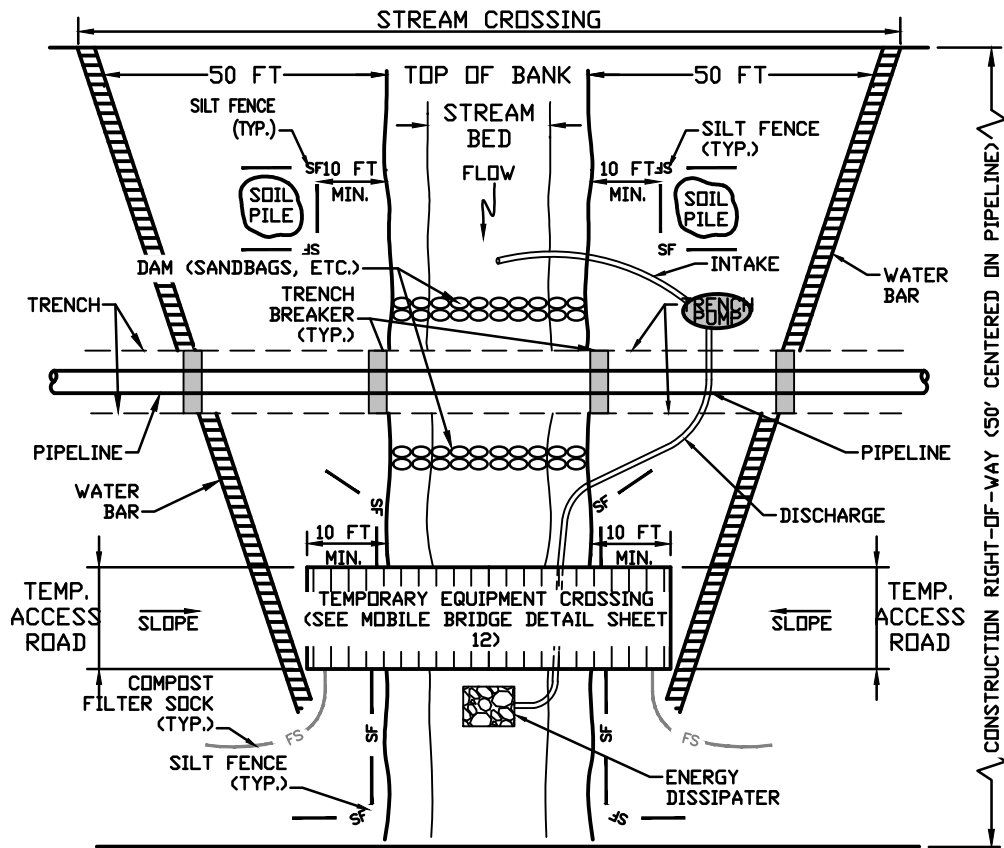


**ENVIRONMENTAL DETAIL**

DITCH RELIEF CULVERT SPACING

DRAWING NO. MVP-ES7.1

REV. 0



**PLAN VIEW**

**NOTES:**

1. INSTALL COMPOST FILTER SOCKS, TRENCH BREAKERS, PUMP, ENERGY DISSIPATER, AND DAMS BEFORE TRENCHING STREAM.
2. PUMP MUST BE OF SUFFICIENT CAPACITY TO CONVEY NORMAL AND/OR EXISTING STREAM FLOW OVER TRENCH. A BACK-UP PUMP OF EQUAL CAPACITY MUST BE AVAILABLE ON-SITE DURING CONSTRUCTION OF THE PIPELINE CROSSING.
3. PLACE SOIL PILES A MINIMUM OF 10 FEET FROM TOP OF BANK.
4. INSTALL WATER BARS AT APPROACHES TO STREAM CROSSING AND COMPOST FILTER SOCKS, SILT FENCE, OR SUPER SILT FENCE (AS INDICATED ON PLAN SHEETS).
5. MAINTAIN SURFACE OF TEMPORARY EQUIPMENT CROSSING TO PREVENT SOIL DISCHARGES TO STREAM.
6. APPROACHES TO CROSSINGS ARE NOT TO EXCEED A DEPTH OF 6 INCHES ABOVE ORIGINAL GRADE.
7. RESTORE AREA TO ORIGINAL CONTOURS.

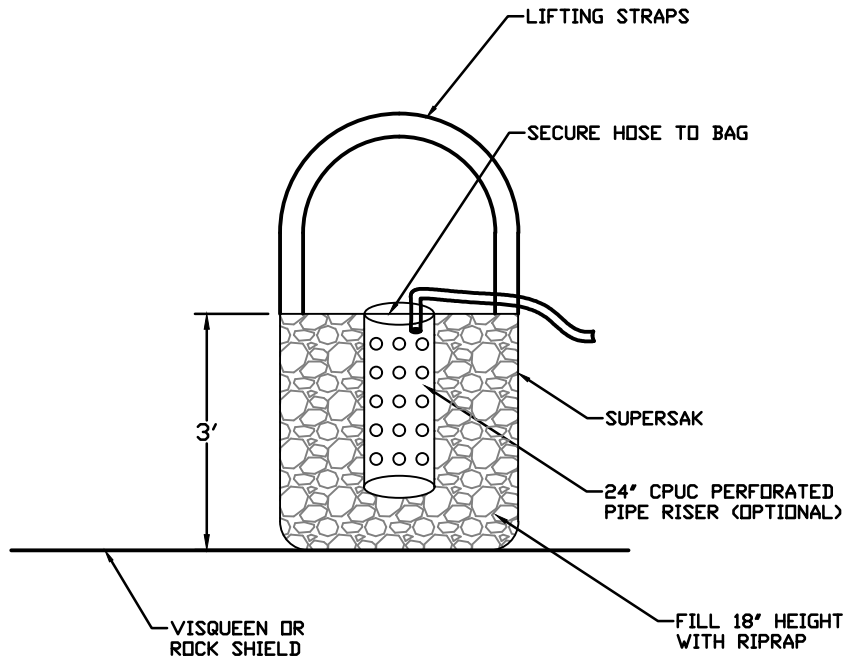
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

STREAM CROSSING  
PUMP STATION

DRAWING NO.	REV.
MVP-ES8	0



**NOTE:**

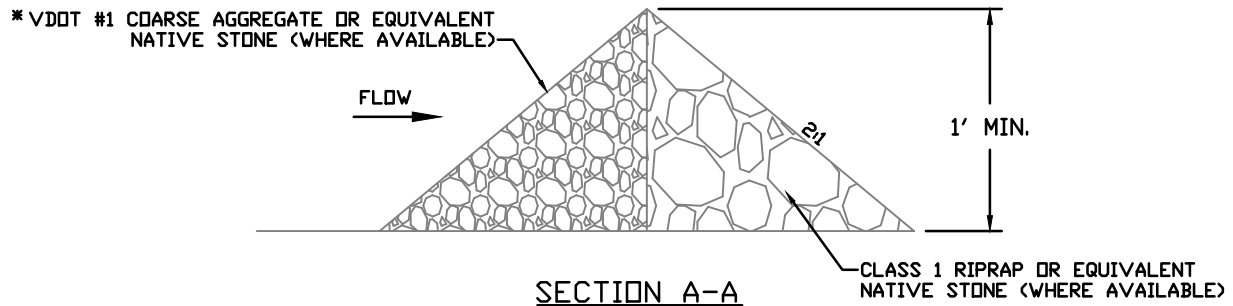
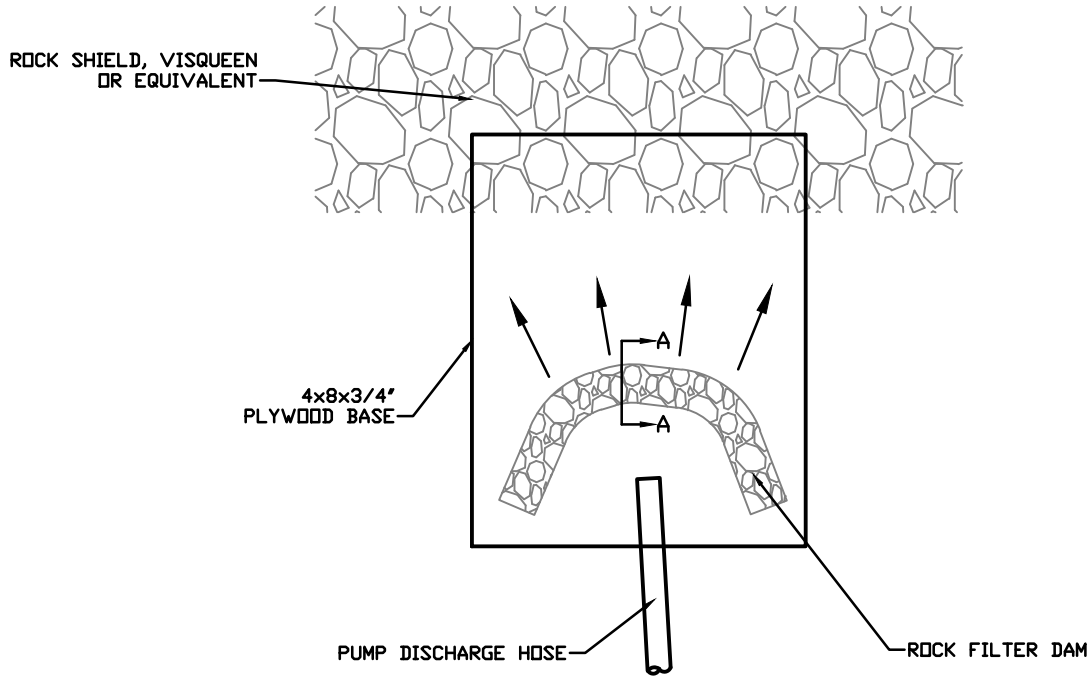
SUPERSACK WILL BE PLACED WITHIN THE STREAMBED DOWNSTREAM OF THE ACTIVITY AND OUTSIDE THE COFFERDAM AREA. FLOW WILL BE MONITORED TO PREVENT SCOUR.

DRAWN	JWK	DATE	01/14/19
CHECKED	RJE	DATE	01/14/19
APP'D	DJW	DATE	01/14/19
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
DAM AND PUMP ENERGY DISSIPATER – CONFIGURATION A	
DRAWING NO.	REV.
MVP-ES8.1	0



**NOTES:**

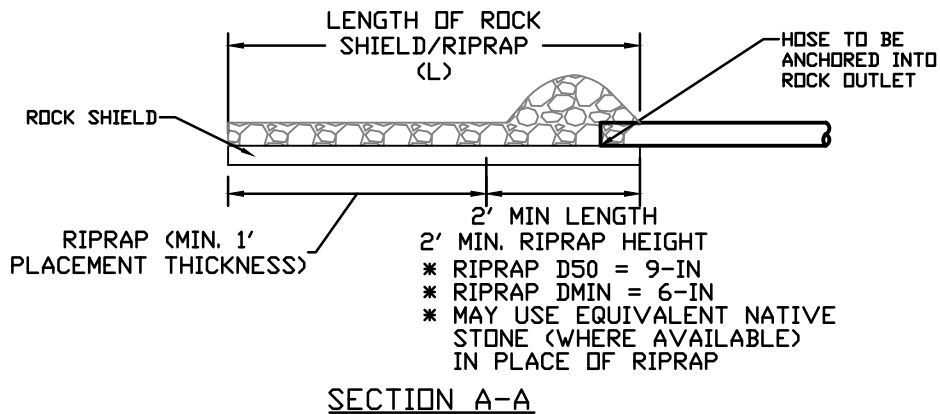
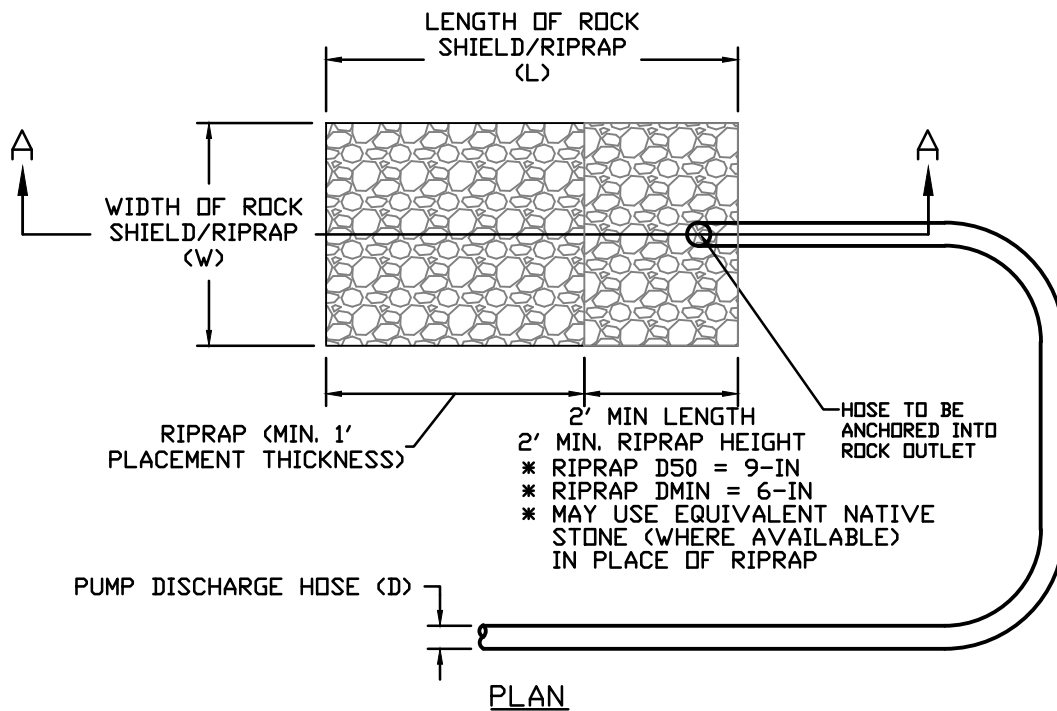
1. MVP TO DETERMINE WHETHER THE ROCK FILTER DAM SHOULD BE EXTENDED ACROSS MULTIPLE PLYWOOD BASES BASED ON STREAMFLOW AND PUMP DISCHARGE HOSE CONFIGURATION.
2. THIS DESIGN IS NOT SUFFICIENT FOR THE MAGGODEE CREEK (MP 269.4) AND BLACKWATER RIVER (MP 269.7) CROSSINGS.

DRAWN	GAR	DATE	01/11/21
CHECKED	RJE	DATE	01/11/21
APP'D	DJW	DATE	01/11/21
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
DAM AND PUMP ENERGY DISSIPATER – CONFIGURATION B	
DRAWING NO.	REV.
MVP-ES8.2	2



Tailwater Condition	Energy Dissipater for Typical Pump Discharge Condition			Energy Dissipater for Max. Pump Discharge Condition		
	Assumed Typical Pump Discharge (gpm)	Min. Length, L (ft)	Min. Width, W (ft)	Assumed Max. Pump Discharge (gpm)	Min. Length, L (ft)	Min. Width, W (ft)
Minimum (< 0.5D)	500	6	7	3,200	12	13
Maximum (≥ 0.5D)	500	6	4	3,200	22	10

**NOTE:**

THIS DESIGN IS NOT SUFFICIENT FOR THE MAGGODEE CREEK (MP 269.4) AND BLACKWATER RIVER (MP 269.7) CROSSINGS.

DRAWN	JWK	DATE	01/11/21
CHECKED	RJE	DATE	01/11/21
APP'D	DJW	DATE	01/11/21
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			

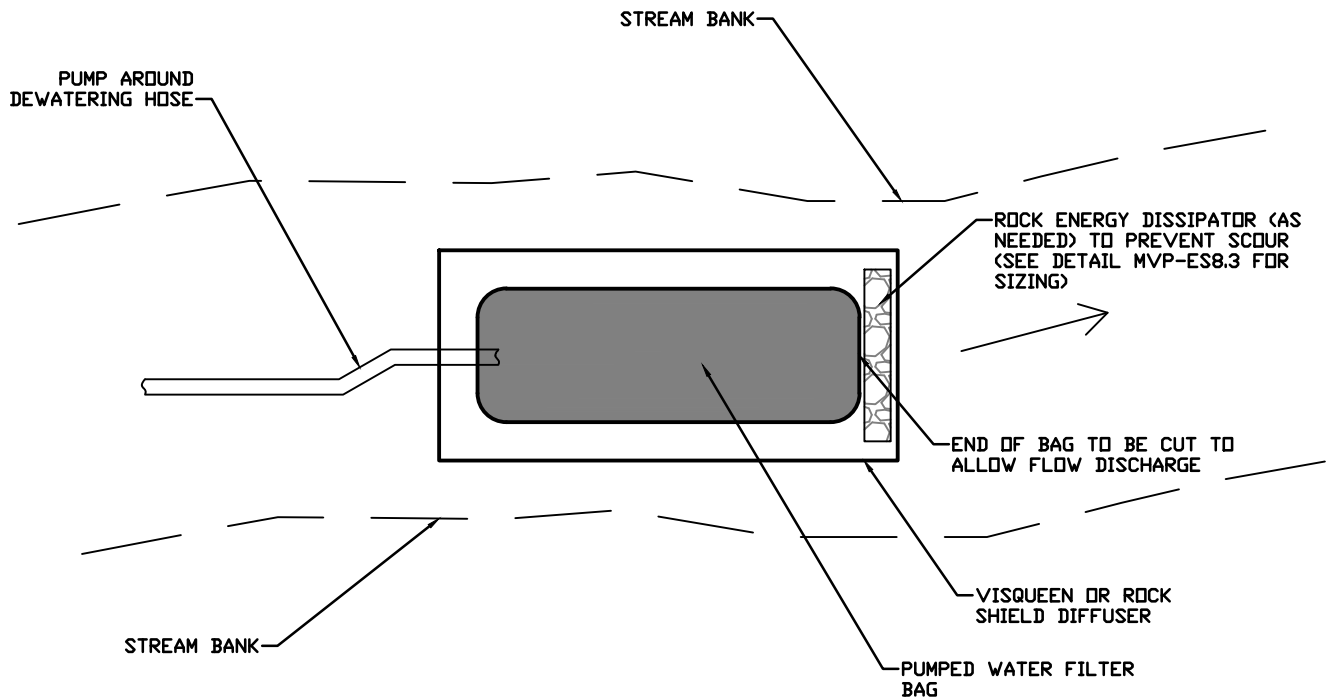
**Mountain Valley PIPELINE**

DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

DAM AND PUMP ENERGY DISSIPATER – CONFIGURATION C

DRAWING NO.	REV.
MVP-ES8.3	2



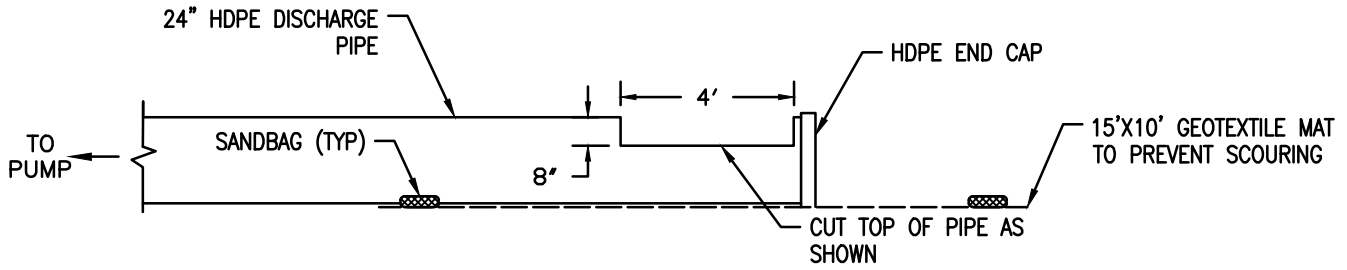
**NOTE:**  
 THIS DETAIL ONLY APPLIES TO DEWATERING ACTIVITIES AT STREAM CROSSINGS WHERE THE PUMP-AROUND (DAM AND PUMP) METHOD IS SPECIFIED. THIS DETAIL DOES NOT APPLY TO THE HANDLING OF SEDIMENT LADEN WATER.

DRAWN	JWK	DATE	01/11/21
CHECKED	RJE	DATE	01/11/21
APP'D	DJW	DATE	01/11/21
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			

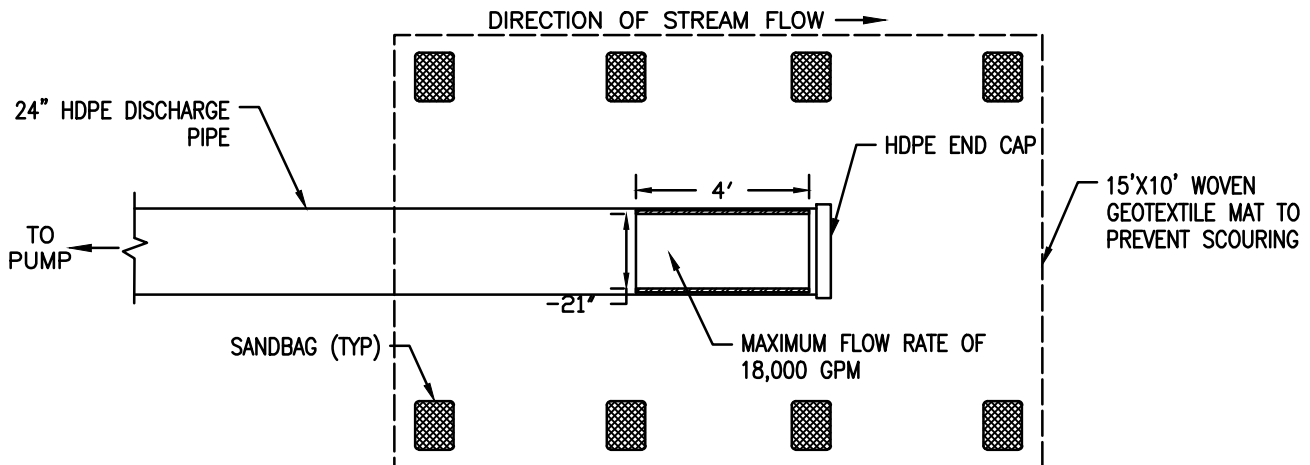


**Mountain Valley**  
 PIPELINE  
 DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
DAM AND PUMP ENERGY DISSIPATOR – CONFIGURATION D	
DRAWING NO.	REV.
MVP-ES8.4	1



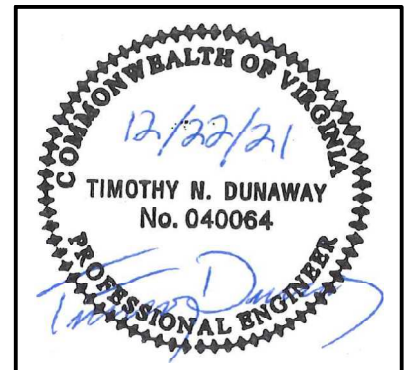
DIFFUSER ELEVATION VIEW



DIFFUSER PLAN VIEW

NOTES:

1. DIFFUSER AND GEOTEXTILE SHALL BE PLACED ON THE STREAM BED IN A FLAT AREA WITHOUT LARGE ROCKS AND BOULDERS
2. PUMP DISCHARGE SHALL BE CONNECTED TO THE 24-INCH HDPE DIFFUSER PIPE WITH A WATER TIGHT REDUCER FITTING.
3. MAXIMUM FLOW RATE PER DIFFUSER IS 18,000 GPM. MULTIPLE DIFFUSERS MAY BE PLACED ADJACENT TO EACH OTHER TO BYPASS STREAMS WITH LARGER FLOW RATES.



DRAWN	DATE
CHECKED	DATE
APP'D	DATE 12/16/21
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	



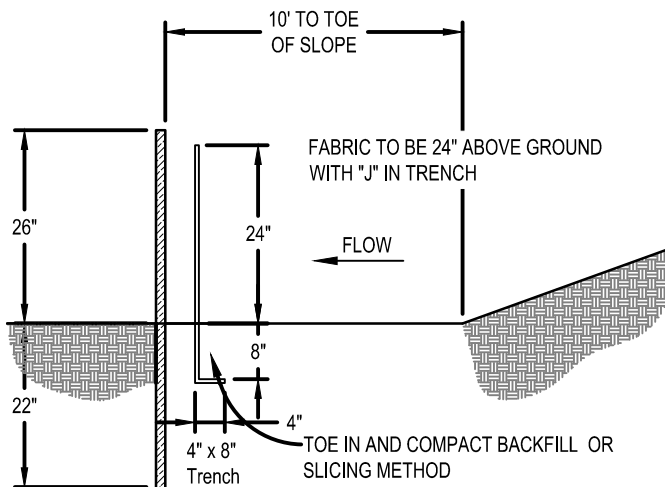
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

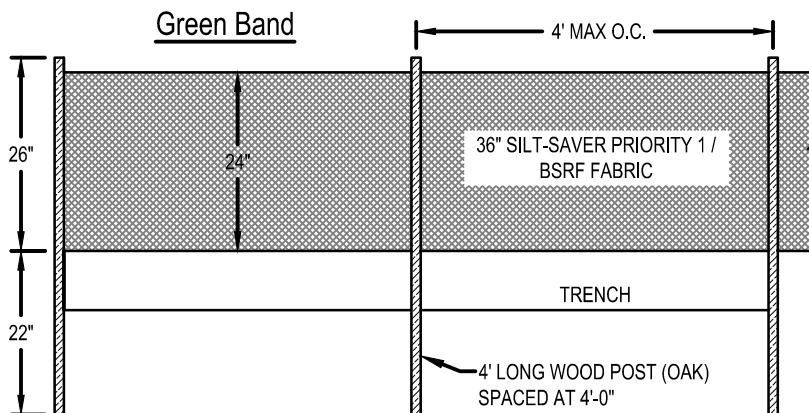
DAM AND PUMP ENERGY DISSIPATER—CONFIGURATION E

DRAWING NO.  
MVP—ES8.5

REV.  
0



SIDE VIEW



FRONT ELEVATION

PRIORITY 1

TAKEN FROM SILT-SAVER, INC OR EQUAL

NOTES:

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

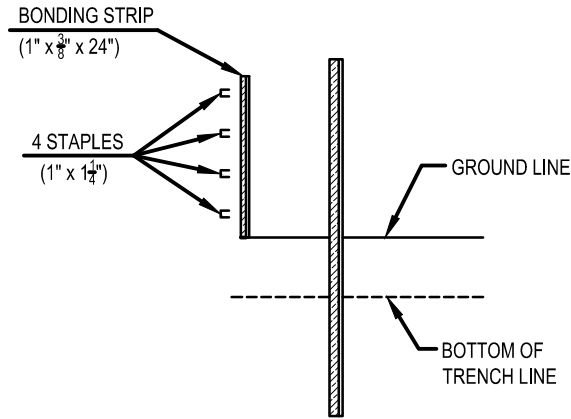
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



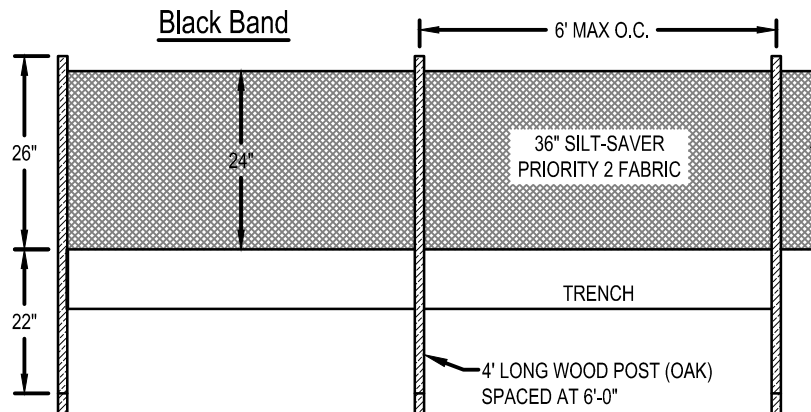
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
BELTED SILT RETENTION FENCE (BSRF)	
DRAWING NO.	REV.
MVP-ES9	0





POST (OAK)  
(1-3/4" X 1-1/4" X 48")



FRONT ELEVATION

PRIORITY 2  
TAKEN FROM SILT-SAVER, INC OR EQUAL

NOTES:

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

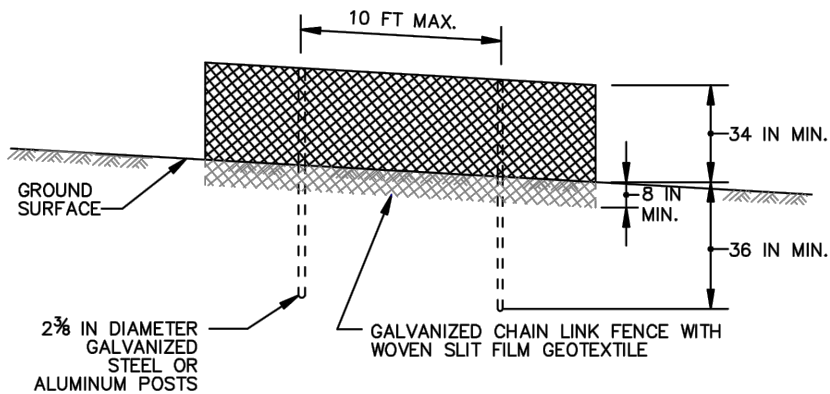
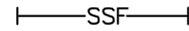
BELTED SILT RETENTION  
FENCE (BSRF)

DRAWING NO.  
MVP-ES9.1

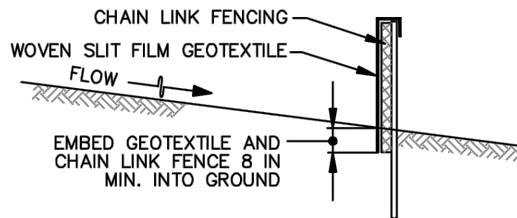
REV.  
0

# DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL



ELEVATION



CROSS SECTION

## CONSTRUCTION SPECIFICATIONS

1. INSTALL 2<sup>3</sup>/<sub>8</sub> INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2<sup>3</sup>/<sub>8</sub> INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HUG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

2011

MARYLAND DEPARTMENT OF ENVIRONMENT  
WATER MANAGEMENT ADMINISTRATION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

## ENVIRONMENTAL DETAIL

SUPER SILT FENCE

DRAWING NO.

MVP-ES9.2

REV.

0

**Table E.3: Super Silt Fence Design Constraints**

Average Slope Steepness	Maximum Slope Length	Maximum Super Silt Fence Length
Flatter than 10:1 (0 - <10%)	Unlimited	Unlimited
10:1 to 5:1 (10 - 20%)	200 feet	1,500 feet
<5:1 to 3:1 (>20 - 33%)	150 feet	1,000 feet
<3:1 to 2:1 (>33 - 50%)	100 feet	500 feet
Steeper than 2:1 (>50%)	50 feet	250 feet

1. Super silt fence should be placed on the contour. No section of super silt fence is to exceed a grade of 5% for a distance of more than 50 feet.
2. Super silt fence should be used with caution in areas where rocky soils may prevent trenching.
3. The use of super silt fence must conform to the design constraints listed in Table E.3 above.
4. Extend both ends of the silt fence a minimum five (5) feet horizontally upslope at 45 degrees to the main fence alignment to prevent runoff from going around the ends of the silt fence.

Maintenance

Accumulated sediment and debris must be removed when bulges develop in the fence or when sediment reaches 25 percent of the fence height. The geotextile must be replaced if torn. If undermining occurs, reinstall chain link fencing and geotextile.

**Table H.1: Geotextile Fabrics**

PROPERTY	TEST METHOD	WOVEN SLIT FILM GEOTEXTILE		WOVEN MONOFILAMENT GEOTEXTILE		NONWOVEN GEOTEXTILE	
		MD	CD	MD	CD	MD	CD
Grab Tensile Strength	ASTM D-4632	200 lb	200 lb	370 lb	250 lb	200 lb	200 lb
Grab Tensile Elongation	ASTM D-4632	15%	10%	15%	15%	50%	50%
Trapezoidal Tear Strength	ASTM D-4533	75 lb	75 lb	100 lb	60 lb	80 lb	80 lb
Puncture Strength	ASTM D-6241	450 lb		900 lb		450 lb	
Apparent Opening Size <sup>2</sup>	ASTM D-4751	U.S. Sieve 30 (0.59 mm)		U.S. Sieve 70 (0.21 mm)		U.S. Sieve 70 (0.21 mm)	
Permittivity	ASTM D-4491	0.05 sec <sup>-1</sup>		0.28 sec <sup>-1</sup>		1.1 sec <sup>-1</sup>	
Ultraviolet Resistance Retained at 500 hours	ASTM D-4355	70% strength		70% strength		70% strength	

<sup>1</sup> All numeric values except apparent opening size (AOS) represent minimum average roll values (MARV). MARV is calculated as the typical minus two standard deviations. MD is machine direction; CD is cross direction.

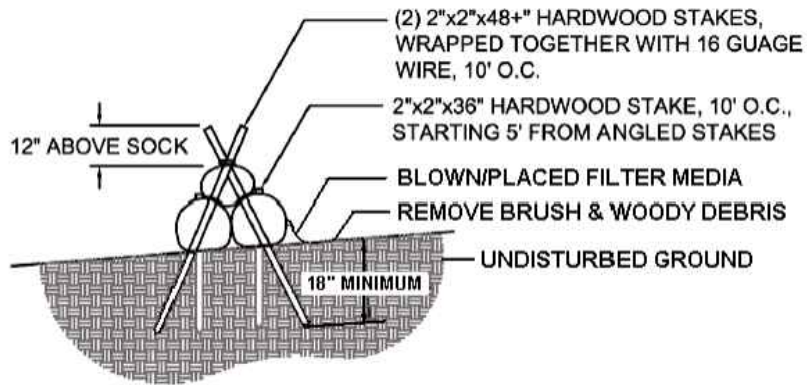
<sup>2</sup> Values for AOS represent the average maximum opening.

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
SUPER SILT FENCE	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES9.2A	0



**NOTES:**

THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
STACKED COMPOST FILTER SOCK DETAIL CROSS SECTION VIEW	
DRAWING NO. MVP-ES9.3	REV. 0

## Forest Regeneration Woody Seed Mix and Application Rates.

Species	Common Name	Seeding Rate (lbs/acre)
<b>Oak-Hickory Forest a)</b>		
<i>Fagus grandifolia</i>	American Beech	0.3
<i>Liriodendron tulipifera</i>	Tulip Poplar	0.3
<i>Pinus strobus</i>	White Pine	0.3
<i>Pinus virginiana</i>	Virginia Pine	0.3
<i>Prunus serotina</i>	Black Cherry	0.3
<i>Amelanchier canadensis</i>	Canadian Serviceberry	0.3
<i>Cercis canadensis</i>	Eastern Redbud	0.3
<i>Cornus florida</i>	Flowering Dogwood	0.3
<i>Diospyros virginiana</i>	Persimmon	0.3
<i>Ilex opaca</i>	American Holly	0.3
<i>Nyssa sylvatica</i>	Black Gum	0.3
<i>Sassafras albidum</i>	Sassafras	0.3
<i>Hamamelis virginiana</i>	Witch Hazel	0.3
<i>Lindera benzoin</i>	Spicebush	0.3
<i>Vaccinium angustifolium</i>	Lowbush Blueberry	0.3
<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	0.3
<i>Vitis aestivalis</i>	Grape	0.3

a) Oak and hickory species to be planted as bare root seedlings in addition to this mix. Refer to Section 5.9 Bare Root Seedling Planting for more information. At minimum, 3 of the 5 overstory, 4 of the 7 understory, and 2 of the 4 shrub species will comprise the woody seed mix for Oak-Hickory Forests.

**NOTE:**

WOODY SEED MIX TO BE USED IN COMBINATION WITH MVP-ES11.2 UPLAND MEADOW SEED MIX.


<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		FOREST REGENERATION WOODY SEED MIX AND APPLICATION RATES	
<b>APP'D</b>	<b>DATE 08/11/17</b>			
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>			
<b>JOB NO.</b>			<b>DRAWING NO.</b>	<b>REV.</b>
<b>PROJECT ID:</b>		MVP-ES11.1	0	
MVP – VA PORTION				

Table 1. Updated Woody Species Seed Mix

Layer	Species	Common Name	Seeding Rate (lbs/acre)
Overstory	<i>Platanus occidentalis</i>	American sycamore	0.3
	<i>Liriodendron tulipifera</i>	Tulip poplar	0.3
	<i>Pinus strobus</i>	White pine	0.3
	<i>Pinus taeda</i>	Loblolly pine	0.3
	<i>Prunus serotina</i>	Black cherry	0.3
Understory	<i>Rhus glabra</i>	Smooth sumac	0.3
	<i>Myrica cerifera</i>	Southern wax myrtle	0.3
	<i>Cornus sericea</i>	Red osier dogwood	0.3
	<i>Diospyros Virginiana</i>	Persimmon	0.3
	<i>Robinia pseudoacacia</i>	Black locust	0.3
	<i>Nyssa sylvatica</i>	Black Gum	0.3
	<i>Taxodium distichum</i>	Bald cypress	0.3
Shrubs	<i>Cephalanthus occidentalis</i>	Buttonbush	0.3
	<i>Lindera benzoin</i>	Spicebush	0.3
	<i>Prunus angustifolia</i>	Chickasaw plum	0.3
	<i>Fraxinus pennsylvanica</i>	Green ash	0.3
	<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.3

a) Oak and hickory species to be planted as bare root seedlings in addition to this mix. Refer to Section 5.9 Bare Roost Seedling Planting for more information. At minimum, 3 of the 5 overstory, 4 of the 7 understory, and 2 of the 4 shrub species will comprise the woody seed mix for Oak-Hickory Forests.

NOTE:

WOODY SEED MIX TO BE USED IN COMBINATION WITH MVP-ES11.2 UPLAND MEADOW SEED MIX.

Plotted by: Kustowski, Jim on: December 18, 2019 - 10:26 AM

DRAWN	JWK	DATE	12/17/2019
CHECKED	RJE	DATE	12/17/2019
APP'D	DJW	DATE	12/17/2019
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
UPDATED WOODY SPECIES SEED MIX AND APPLICATION RATES	
DRAWING NO.	REV.
MVP-ES11.1A	0

## Upland Meadow Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	5.0 - 7.4	June to October
<i>Schizachyrium scoparium</i>	Little Bluestem	11.68	5.0 - 8.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	1.00	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	0.10		June to August
<i>Asclepias tuberosa</i>	Butterfly Milkweed	0.10	4.8 - 6.8	June to August
<i>Chamaecrista fasciculata</i>	Partridge Pea	0.60	5.5 - 7.5	July to September
<i>Chamaecrista nictitans</i>	Sensitive Partridge Pea	0.06		June to October
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.44	6.0 - 7.0	April to July
<i>Eupatorium coelestinum</i>	Mistflower	0.04	5.5 - 7.5	July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40		July to August
<i>Lespedeza virginica</i>	Slender Bushclover	0.10		July to September
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	0.10	5.8 - 6.8	August to October
<i>Monarda fistulosa</i>	Wild Bergamot	0.10	6.0 - 8.0	June to September
<i>Penstemon laevigatus</i>	Appalachian Beardtongue	0.10		late May to late August
<i>Pycnanthemum incanum</i>	Hoary Mountainmint,	0.20		May to June
<i>Rudbeckia fulgida</i> var. <i>fulgida</i>	Orange Coneflower	0.02	< 6.8	summer
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.04		July to October

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Senna hebecarpa</i>	Wild Senna	0.60	6.0 - 7.0	May to July
<i>Solidago juncea</i>	Early Goldenrod	0.10		July to August
<i>Solidago nemoralis</i>	Gray Goldenrod	0.04		June to July
<i>Tradescantia ohiensis</i>	Ohio Spiderwort	0.04	6.5 - 7.5	August to September
<i>Tradescantia virginiana</i>	Virginia Spiderwort	0.10		late April to mid-July
		<b>20.00</b>		

TEMPORARY SEED MIX:

9/1 - 2/15: 50/50 MIX ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM) AND WINTER RYE (SECALE CEREALE) (50-100 LBS/AC)

2/16 - 4/30: ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM) (60-100 LBS/AC)

5/1 - 8/31: GERMAN MILLET (SETARIA ITALICA) (50 LBS/AC)

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

UPLAND MEADOW SEED MIX  
AND APPLICATION RATES

<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES11.2	0



## Upland Steep Slope Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Agrostis perennans</i>	Autumn Bentgrass	3.15	5.5 - 7.5	Midsummer
<i>Elymus virginicus</i>	Virginia Wildrye	9.05	5.0 - 7.4	June to October
<i>Panicum clandestinum</i>	Deertongue	4.50	4.0 - 7.5	May to September
<i>Schizachyrium scoparium</i>	Little Bluestem	11.25	5.0 - 7.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	14.40	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	0.09		June to August
<i>Aster pilosus</i>	Heath Aster	0.05	5.4 - 7.0	After fall frost
<i>Chamaecrista fasciculata</i>	Partridge Pea	0.45	5.5 - 7.5	July to September
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.45	6.0 - 7.0	April to July
<i>Eupatorium coelestinum</i>	Mistflower	0.05	5.5 - 7.5	July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.45		July to August
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	0.09	5.8 - 6.8	August to October
<i>Monarda fistulosa</i>	Wild Bergamot	0.23	6.0 - 8.0	June to September
<i>Pycnanthemum incanum</i>	Hoary Mountainmint	0.05	< 6.8	summer
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.45	6.0 - 7.0	May to July
<i>Senna hebecarpa</i>	Wild Senna	0.23		July to August
<i>Solidago nemoralis</i>	Gray Goldenrod	0.05	6.5 - 7.5	August to September
<i>Tradescantia ohiensis</i>	Ohio Spiderwort	0.05		late April to mid-July
		<b>45.00</b>		

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
UPLAND STEEP SLOPE SEED MIX AND APPLICATION RATES	
DRAWING NO.	REV.
MVP-ES11.3	0




## Wetlands Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Alisma subcordatum</i>	Mud Plantain	0.04		
<i>Carex gynandra</i>	Fringed Sedge	0.10	5.0 - 7.0	Midsummer
<i>Carex lupulina</i>	Hop Sedge	1.00		May to June
<i>Carex lurida</i>	Shallow Sedge	3.00	6.2 - 7.0	June to October
<i>Carex scoparia</i>	Blunt Broom Sedge	1.00	4.9 - 6.8	June to July
<i>Carex vulpinoidea</i>	Fox Sedge	6.90	4.6 - 6.9	July to August
<i>Cinna arundinacea</i>	Wood Reedgrass	0.40	6.8 - 8.9	June to August
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	4.0 - 8.5	August to September
<i>Juncus effusus</i>	Soft Rush	0.60	5.0 - 7.4	June to October
<i>Onoclea sensibilis</i>	Sensitive Fern	0.20	5.5 - 7.0	May to June
<i>Scirpus cyperinus</i>	Woolgrass	0.20		June to October

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Scirpus polyphyllus</i>	Many Leaved Bulrush	0.20	4.8 - 7.2	July to September
<i>Asclepias incarnata</i>	Swamp Milkweed	0.40		July to August
<i>Eupatorium coelestinum</i>	Mistflower	0.10	5.0 - 8.0	June to July
<i>Eupatorium fistulosum</i>	Joe Pye Weed	0.14	5.5 - 7.5	July to October
<i>Eupatorium perfoliatum</i>	Boneset	0.20	4.5 - 7.0	July to September
<i>Helenium autumnale</i>	Common Sneezeweed	0.10		July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40	4.0 - 7.5	August to September
<i>Ludwigia alternifolia</i>	Seedbox	0.10		July to August
<i>Mimulus ringens</i>	Square Stemmed Monkeyflower	0.10		August to September
<i>Verbena hastata</i>	Blue Vervain	0.72		June to September
<i>Vernonia noveboracensis</i>	New York Ironweed	0.10		June to October
		<b>20.00</b>		

**NOTE:**

1. ANNUAL RYEGRASS WILL BE USED AT A RATE OF 40 LBS/AC FOR STABILIZATION OF WETLANDS DISTURBED BY THE PROJECT.
2. FOLLOWING RESTORATION AND TEMPORARY STABILIZATION WITH ANNUAL RYEGRASS, SHOULD THE NATIVE SEEDBANK PRESENT IN THE TOPSOIL NOT REESTABLISH THE WETLAND, MVP WILL APPLY THIS SEED MIX TO SUPPLEMENT AND PERMANENTLY STABILIZE THE WETLAND.

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		WETLAND SEED MIX AND APPLICATION RATES	
<b>APP'D</b>	<b>DATE 08/11/17</b>			
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES11.4	0
<b>PROJECT ID:</b>				
MVP - VA PORTION				

## Riparian Seed Mix and Application Rates in Virginia.

Species	Common Name	Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Agrostis perennans</i>	Autumn Bentgrass	0.04	5.0 - 7.0	Midsummer
<i>Andropogon gerardii</i>	Big Bluestem	0.10		May to June
<i>Elymus virginicus</i>	Virginia Wildrye	1.00	6.2 - 7.0	June to October
<i>Juncus effusus</i>	Soft Rush	3.00	4.9 - 6.8	June to July
<i>Juncus tenuis</i>	Path Rush	1.00	4.6 - 6.9	July to August
<i>Panicum clandestinum</i>	Deertongue	6.90	6.8 - 8.9	June to August
<i>Sorghastrum nutans</i>	Indiangrass	0.40	4.0 - 8.5	August to September
<i>Asclepias incarnata</i>	Swamp Milkweed	4.00	5.0 - 7.4	June to October
<i>Chamaecrista fasciculata</i>	Partridge Pea	0.60	5.5 - 7.0	May to June
<i>Eupatorium coelestinum</i>	Mistflower	0.20		June to October
<i>Eupatorium fistulosum</i>	Joe Pye Weed	0.20	4.8 - 7.2	July to September
<i>Eupatorium perfoliatum</i>	Boneset	0.20		July to August
<i>Geum canadense</i>	White Avens	0.40	5.0 - 8.0	June to July
<i>Helenium autumnale</i>	Common Sneezeweed	0.10	5.5 - 7.5	July to October
<i>Helianthus annuus</i>	Oxeye Sunflower	0.14	4.5 - 7.0	July to September
<i>Monarda fistulosa</i>	Wild Bergamot	0.20		July to October
<i>Pycnanthemum tenuifolium</i>	Slender Mountainmint	0.10	4.0 - 7.5	August to September
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.40		July to August
<i>Senna hebecarpa</i>	Wild Senna	0.10		August to September
<i>Verbena hastata</i>	Blue Vervain	0.10		June to September
<i>Vernonia noveboracensis</i>	New York Ironweed	0.72		June to October
		<b>20.00</b>		


### TEMPORARY SEED MIX:

9/1 - 2/15: 50/50 MIX ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM) AND WINTER RYE (SECALE CEREALE) (50-100 LBS/AC)

2/16 - 4/30: ANNUAL RYEGRASS (LOLIUM MULTI-FLORUM) (60-100 LBS/AC)

5/1 - 8/31: GERMAN MILLET (SETARIA ITALICA) (50 LBS/AC)

Revised 1/24/18

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		RIPARIAN SEED MIX AND APPLICATION RATES	
<b>APP'D</b>	<b>DATE 08/11/17</b>			
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES11.5	0
<b>PROJECT ID:</b>				
MVP - VA PORTION				

Native tree and shrub species for bare root plantings within riparian areas and forested wetlands.

Species	Common Name	Indicator Status	Riparian Planting <sup>1</sup>	Forested Wetland Planting <sup>2</sup>
<b>Native Trees</b>				
<i>Acer rubrum</i>	Red Maple	FAC	X	X
<i>Acer saccharinum</i>	Silver Maple	FACW	X	X
<i>Betula nigra</i>	River Birch	FACW	X	X
<i>Carpinus caroliniana</i>	American Hornbeam	FAC	X	X
<i>Carya glabra</i>	Pignut Hickory	FACU	X	
<i>Carya ovata</i>	Shagbark Hickory	FACU	X	
<i>Chionanthus virginicus</i>	White Fringe Tree	FAC+	X	
<i>Diospyros virginiana</i>	Common Persimmon	FAC-	X	

Species	Common Name	Indicator Status	Riparian Planting <sup>1</sup>	Forested Wetland Planting <sup>2</sup>
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	X	X
<i>Juniperus virginiana</i>	Eastern Red Cedar	FACU	X	X
<i>Liquidambar styraciflua</i>	Sweet Gum	FAC	X	X
<i>Liriodendron tulipifera</i>	Tuliptree	FACU	X	X
<i>Nyssa sylvatica</i>	Black Gum	FAC	X	
<i>Platanus occidentalis</i>	American Sycamore	FACW-	X	X
<i>Populus deltoids</i>	Eastern Cottonwood	FAC	X	
<i>Quercus bicolor</i>	Swamp White Oak	FACW+	X	X
<i>Quercus falcata</i>	Cherrybark Red Oak	FACW	X	X
<i>Quercus phellos</i>	Willow Oak	FAC+	X	X
<i>Quercus nigra</i>	Water Oak	FAC	X	
<i>Quercus palustris</i>	Pin Oak	FACW	X	X
<i>Salix nigra</i>	Black Willow	FACW	X	X
<i>Ulmus americana</i>	American Elm	FACW-	X	X

NOTE:

1. REFER TO MVP-ES11.8 AND MVP-ES11.9 FOR LOCATIONS OF BARE ROOT PLANTINGS.

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



<b>ENVIRONMENTAL DETAIL</b>	
NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES11.6	0

**Native Shrubs**

<i>Alnus serrulata</i>	Brook-side Alder	OBL		X
<i>Amelanchier canadensis</i>	Canada Serviceberry	FAC	X	
<i>Aronia arbutifolia</i>	Red Chokecherry	FACW	X	X
<i>Baccharis halimifolia</i>	Groundsel Bush	FACW-	X	X
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL		X
<i>Cornus amomum</i>	Silky Dogwood	FACW	X	X
<i>Cornus stolonifera</i>	Red-osier Dogwood	FAC	X	X
<i>Hamamelis virginiana</i>	American Witchhazel	FAC-	X	
<i>Ilex verticillata</i>	Common Winterberry	FACW+	X	X
<i>Itea virginica</i>	Virginia Willow	OBL		X
<i>Iva frutescens</i>	Marsh Elder	FACW+	X	X
<i>Leucothoe racemosa</i>	Fetter-bush	FACW	X	X
<i>Lindera benzoin</i>	Spicebush	FACW-	X	X
<i>Lyonia ligustrina</i>	Maleberry	FACW	X	X
<i>Magnolia virginiana</i>	Sweetbay Magnolia	FACW+	X	X
<i>Physocarpus opulifolius</i>	Eastern Ninebark	FACW-	X	X
<i>Sambucus canadensis</i>	American Elder	FACW-	X	X
<i>Vaccinium corymbosum</i>	Highbush Blueberry	FACW-	X	X
<i>Virburnum dentatum</i>	Arrow-wood	FAC	X	
<i>Viburnum prunifolium</i>	Black-haw	FACU	X	

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES11.7	0

Stream crossings proposed for bare-root seedling plantings.

Waterbody Name	MP	County	State	Valuable Resource
Kimballton Branch	199.1, 199.4	Giles	VA	headwaters of wild trout stream, coldwater stream

Waterbody Name	MP	County	State	Valuable Resource
Stony Creek	200.4	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream
Little Stony Creek	204.4	Giles	VA	coldwater stream, wild trout stream
Sinking Creek	211.2	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream, non-listed mussels
UNT Craig Creek	219.2	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	219.3	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	219.7	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	219.8	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	220.0	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Mill Creek	222.2	Montgomery	VA	upstream of Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.2	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	227.4	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	230.7	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	231.5	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Roanoke River	235.4	Montgomery	VA	Roanoke logperch present, orange fin madtom, non-listed mussels present
Bottom Creek	241.1	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Bottom Creek	242.5	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	



ENVIRONMENTAL DETAIL	
STREAM CROSSINGS PROPOSED FOR BARE ROOT SEEDING PLANTINGS	
DRAWING NO. MVP-ES11.8	REV. 0

Mill Creek	245.1	Roanoke	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Green Creek	247.1	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
Green Creek	247.4	Franklin	VA	upstream of Bottom Creek Gorge, orangefin madtom, coldwater stream, wild trout
North Fork Blackwater River	249.7	Franklin	VA	Roanoke logperch suitable habitat, coldwater stream wild trout stream

Waterbody Name	MP	County	State	Valuable Resource
Teels Creek	258.2	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	260.3	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.0	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	261.8	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	262.3	Franklin	VA	Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek contributing sediment impacts
Little Creek	262.6	Franklin	VA	Roanoke logperch suitable habitat, numerous crossings upstream contributing sediment impacts
Little Creek	263.3	Franklin	VA	Roanoke logperch suitable habitat, non-listed mussels present, numerous crossings upstream contributing sediment impacts
Maggodee Creek	269.4	Franklin	VA	Roanoke logperch suitable habitat
Blackwater River	269.7	Franklin	VA	Roanoke logperch present, non-listed mussels present
UNT to Jacks Creek	278.8	Franklin	VA	orangefin madtom
Turkey Creek	280.5	Franklin	VA	orangefin madtom
Strawfield Creek	282.3	Franklin	VA	orangefin madtom
Parrot Branch	282.9	Franklin	VA	orangefin madtom
Jonnikin Creek	284.4	Pittsylvania	VA	orangefin madtom
UNT to Rocky Creek	287.1	Pittsylvania	VA	orangefin madtom
Pigg River	289.1	Pittsylvania	VA	Roanoke logperch present, orangefin madtom, mussels present including yellow lampmussel (VA threatened)
Harpen Creek	289.9	Pittsylvania	VA	Roanoke logperch suitable habitat, orangefin madtom
Harpen Creek	292.0	Pittsylvania	VA	orangefin madtom

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	




<b>ENVIRONMENTAL DETAIL</b>	
STREAM CROSSINGS PROPOSED FOR BARE ROOT SEEDING PLANTINGS	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES11.9	0

Name	Ph preference	Wetland Indicator Status
Annual Ryegrass ( <i>Lolium Multiflorum</i> (L. perenne var. italicum))	5.0–7.9	NI/moderate
German/Foxtail Millet ( <i>Setaria italica</i> )	5.3–6.9	FACU
Cereal Rye ( <i>Secale cereale</i> )	5.2–8.0	NI/damp
Browntop Millet ( <i>Panicum ramosum</i> )	5.5–6.9	FACU

NOTES:

- 1): MINIMUM SEED RATE WILL BE 50 LBS/ACRE
- 2): UTILIZE APPROPRIATE SEED FOR TIME OF YEAR

DRAWN		DATE		 <p><b>Mountain Valley</b> PIPELINE</p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			VIRGINIA TEMPORARY EROSION CONTROL SEED MIX	
APP'D		DATE				
SCALE	N.T.S.	SHEET 1 OF 1			DRAWING NO. MVP-ES11.10	
JOB NO.						
PROJECT ID:		PXXXX				



## Upland Area Seed Mixes within the Jefferson National Forest

Scientific Name	Common Name	Growth Habit	pH Preference
<b>Upland Areas - Non-native Species for Erosion Control</b>			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> ( <i>Panicum ramosum</i> )	Browntop millett	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
<b>Upland Areas - Native Species</b>			
<i>Chasmanthium laxum</i> <sup>a</sup>	Slender woodoats	Graminoid	4.5 – 7.0
<i>Eragrostis spectabilis</i> <sup>a</sup>	Purple lovegrass	Graminoid	4.0 – 7.5
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i> <sup>a</sup>	Purpletop	Graminoid	4.5 – 6.5
<i>Apocynum cannabinum</i> <sup>a</sup>	Indian hemp	Forb	4.5 – 7.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Desmodium paniculatum</i>	Panicledleaf ticktrefoil	Forb	6.0 – 7.0
<i>Elymus virginicus</i> <sup>b</sup>	Virginia wildrye	Graminoid	5.0 – 7.4
<i>Geum canadense</i> <sup>a</sup>	White avens	Forb	4.5 – 7.5
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Monarda fistulosa</i> <sup>b</sup>	Wild bergamot	Forb	6.0 – 8.0
<i>Pycnanthemum</i> spp. <sup>b</sup>	Mountain mint	Forb	unknown
<i>Rubus allegheniensis</i> <sup>a</sup>	Common blackberry; Allegheny blackberry	Forb/ Subshrub	4.6 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0
<i>Solidago canadensis</i> <sup>a</sup>	Canada goldenrod	Forb	4.8 – 7.5
<i>Tradescantia virginiana</i> <sup>a</sup>	Virginia spiderwort	Forb	4.0 – 8.0

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



Mountain  
Valley  
PIPELINE

DESIGN ENGINEERING

### ENVIRONMENTAL DETAIL

US FOREST SERVICE  
(NATIONAL FOREST) LANDS  
UPLAND AREA SEED MIX

DRAWING NO.	REV.
MVP-ES12.1	0



## Riparian Seed Mixes within Jefferson National Forest

Scientific Name	Common Name	Habit	pH Preference
<b>Non-native Species for Erosion Control</b>			
<i>Lolium perenne subsp. multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa (Panicum ramosum)</i>	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
<b>Native Species</b>			
<i>Agrostis perennans</i>	Autumn bentgrass; upland bentgrass	Graminoid	5.5 – 7.5
<i>Elymus virginicus</i>	Virginia Wildrye	Graminoid	5.0 - 7.4
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Asclepias incarnata</i>	Swamp milkweed	Forb	5.0 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Eutrochium fistulosum (Eupatorium fistulosum)</i>	Joe pye weed	Forb	4.5 – 7.0
<i>Eupatorium maculatum</i>	Spotted joe pye weed	Forb	5.5 – 7.0
<i>Eupatorium perfoliatum</i>	Boneset	Forb	unknown
<i>Helenium autumnale</i>	Common sneezeweed	Forb	4.0 – 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
<i>Senna marilandica</i>	Maryland senna	Forb / Subshrub	4.0 – 7.0
<i>Vernonia noveboracensis</i>	New York ironweed	Forb	4.5 -8.0

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



### ENVIRONMENTAL DETAIL

US FOREST SERVICE  
(NATIONAL FOREST) LANDS  
RIPARIAN SEED MIX

<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES12.2	0

Species for hydroseed mixes within the Jefferson National Forest.

Scientific Name	Common Name	Growth Habit	pH Preference
<b>Non-native Species for Temporary Erosion Control</b>			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> ( <i>Panicum ramosum</i> )	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
<b>Native – Highly Preferred</b>			
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i>	Purpletop	Graminoid	4.5 – 6.5
<b>Native – Preferred</b>			
<i>Agrostis perennans</i>	Autumn bentgrass; Upland bentgrass	Graminoid	5.5 – 7.5
<i>Dichanthelium clandestinum</i>	Deertongue	Graminoid	4.0 – 7.5
<i>Elymus canadensis</i>	Canada wildrye	Graminoid	5.0 – 7.9
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Lespedeza virginica</i>	Slender bushclover; Slender lespedeza	Forb	acid tolerant
<i>Liatris spicata</i>	Dense blazing star; Spiked gayfeather	Forb	5.6 - 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
<b>Native – Moderately Preferred</b>			
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	



**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**


US FOREST SERVICE  
(NATIONAL FOREST) LANDS  
HYDROSEED MIX

DRAWING NO. MVP-ES12.3	REV. 0
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Name	Ph preference	Wetland Indicator Status
Annual Ryegrass ( <i>Lolium Multiflorum</i> (L. perenne var. italicum))	5.0–7.9	NI/moderate
German/Foxtail Millet ( <i>Setaria italica</i> )	5.3–6.9	FACU
Cereal Rye ( <i>Secale cereale</i> )	5.2–8.0	NI/damp
Browntop Millet ( <i>Panicum ramosum</i> ) (introduced in VA & south; possibly ok for WV?)	5.5–6.9	FACU

NOTES:

- 1): A MINIMUM OF (2) OF THE ABOVE LISTED SPECIES SHALL BE UTILIZED
- 2): APPLY WHENEVER EROSION CONTROL IS NEEDED OUTSIDE OF NORMAL (PERMANENT) SEEDING SEASONS
- 3): APPLY CONCURRENT WITH PERMANENT EROSION CONTROL
- 4): APPLY PRIOR TO PERMANENT SEEDING WITH WILDLIFE MIXES

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		US FOREST SERVICE (NATIONAL FOREST) LANDS	
<b>APP'D</b>	<b>DATE 08/11/17</b>		TEMPORARY EROSION CONTROL SPECIES	
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>	<b>PROJECT ID:</b>		MVP-ES12.4	0
MVP – VA PORTION				

**Wetland/Wet Seed Mix**

<i>Scientific Name</i>	<b>Common Name</b>
<i>Baptisia australis</i>	Blue False Indigo
<i>Elymus hystrix (Hystrix patula)</i>	Bottlebrush Grass
<i>Anemone canadensis</i>	Canadian Burnet
<i>Panicum clandestinum (Dichantherium c.), 'Tioga'</i>	Deertongue, 'Tioga'
<i>Carex crinita</i>	Fringed (Nodding) Sedge
<i>Lobelia siphilitica</i>	Great Blue Lobelia
<i>Vernonia noveboracensis</i>	New York Ironweed
<i>Juncus tenuis</i>	Path Rush
<i>Eupatorium purpureum</i>	Purple Node Joe Pye Weed
<i>Panicum rigidulum (P. stipitatum))</i>	Redtop Panicgrass
<i>Juncus effusus</i>	Soft Rush
<i>Eupatorium maculatum (Eupatoriadelphus maculatus)</i>	Spotted Joe Pye Weed
<i>Carex squarrosa</i>	Squarrose Sedge
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Panicum virgatum, 'Cave-In-Rock'</i>	Switchgrass, 'Cave-In-Rock'
<i>Carex stricta</i>	Tussock Sedge
<i>Senna hebecarpa (Cassia h.)</i>	Wild Senna
<i>Scirpus cyperinus</i>	Woolgrass

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



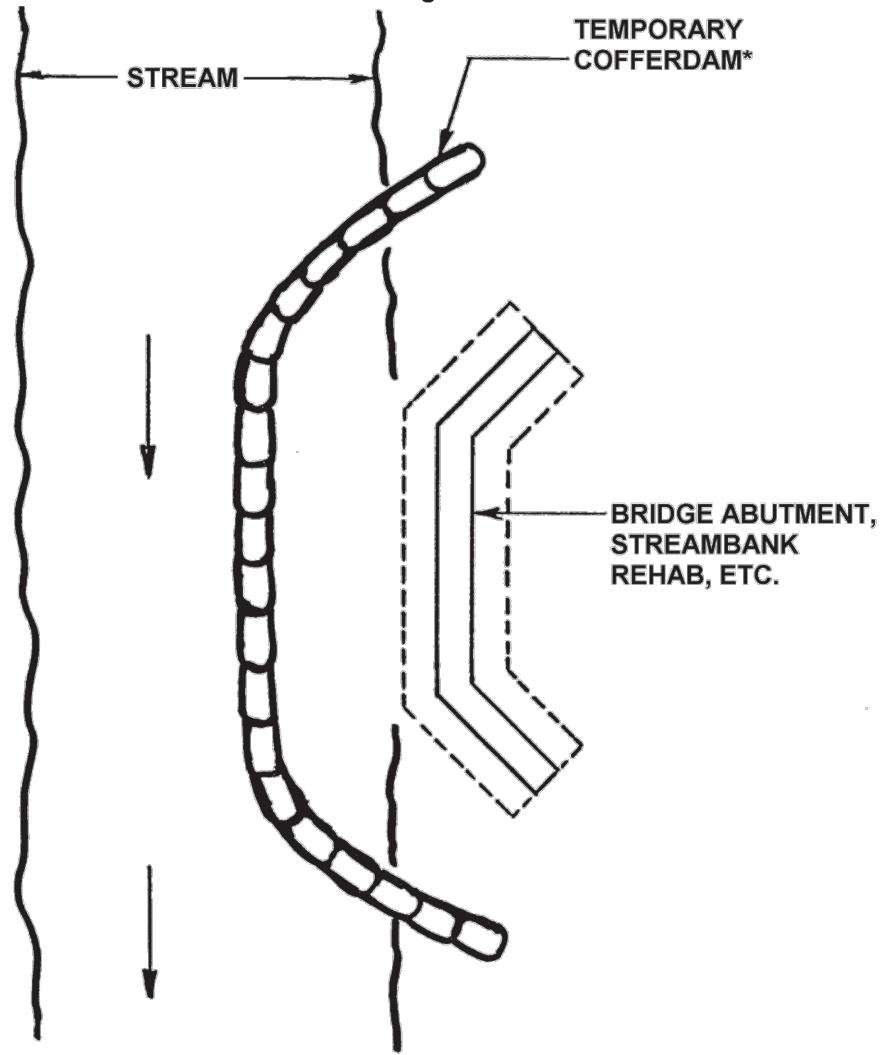
**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

US FOREST SERVICE  
(NATIONAL FOREST) LANDS  
TEMPORARY EROSION CONTROL SPECIES

<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES12.5	0

MVP-ES13 Cofferdam Stream Crossing Methodn



PA DEP

\* Sandbags (Standard Construction Detail #3-15), Jersey barriers (Figure 3.13) or other non-erosive material, no earth fill.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

COFFERDAM STREAM CROSSING METHOD

DRAWING NO.	REV.
MVP-ES13.1	P

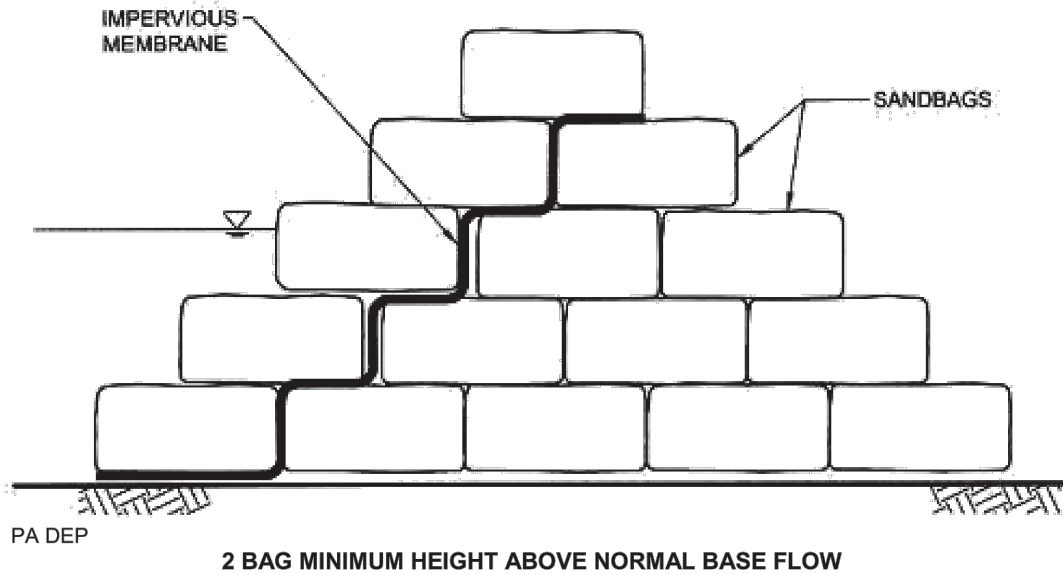
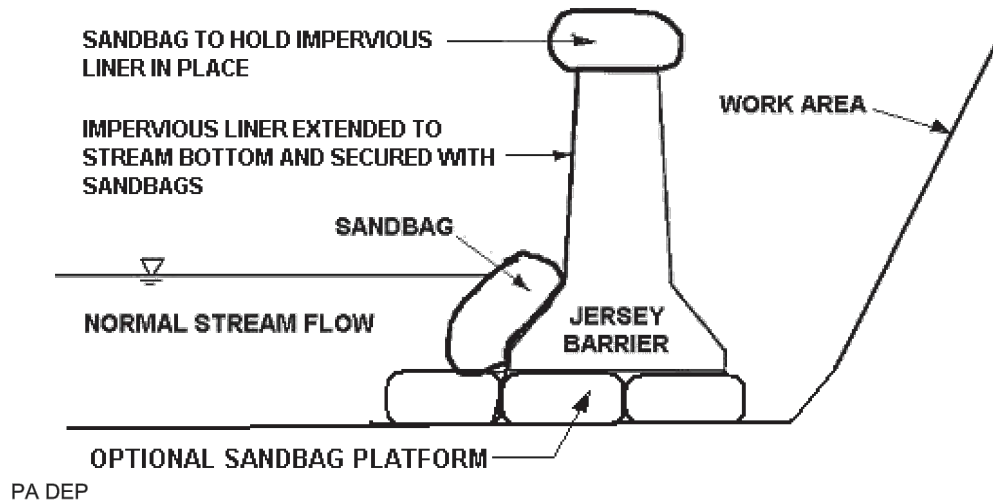


FIGURE 3.13  
Jersey Barrier Cofferdam – End View



NOTES: AT NO TIME, SHOULD MORE THE 60% OF THE STREAM CHANNEL WIDTH BE DIVERTED DURING PIPELINE INSTALLATION.

GRUBBING SHALL NOT TAKE PLACE WITHIN 50 FEET OF TOP-OF-BANK UNTIL ALL MATERIALS REQUIRED TO COMPLETE CROSSING ARE ON SITE AND PIPE IS READY FOR INSTALLATION. TRENCH BREAKERS SHALL BE INSTALLED WITHIN THE TRENCH ON BOTH SIDES OF THE STREAM CHANNEL (MVP TYPICAL DETAIL MVP-20). WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO A PUMPED WATER FILTER BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY RECEIVING SURFACE WATER. HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM THE TOP OF STREAMBANK. ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.

ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 24 HOURS OF INITIAL DISTURBANCE FOR MINOR STREAMS OR 48 HOURS OF INITIAL DISTURBANCE FOR MAJOR STREAMS UNLESS OTHERWISE AUTHORIZED.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

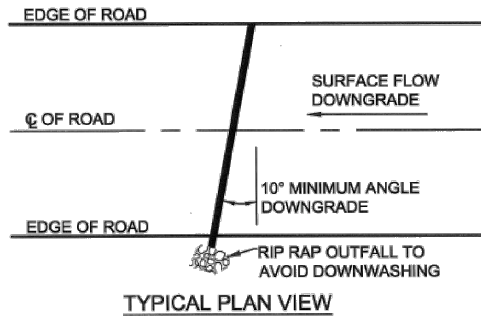
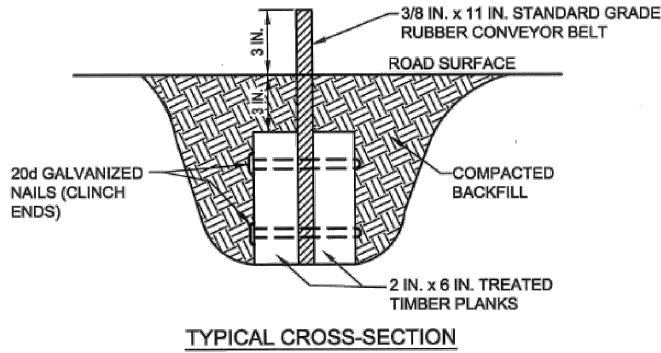
COFFERDAM STREAM  
CROSSING METHOD

DRAWING NO.  
MVP-ES13.2

REV.  
P



## STANDARD CONSTRUCTION DETAIL Water Deflector



USDA Forest Service

**Deflector shall be inspected weekly and after each runoff event.**

**Accumulated sediment shall be removed from deflector within 24 hours of inspection.**

**Belt shall be replaced when worn and no longer effective.**

**Deflectors may be used to direct runoff from an access road to a well-vegetated area or sediment removal facility.**

**A deflector is typically constructed from rubber belting ranging from 5/16" to 1/2" thick held between two 2" x 6" wooden planks.**

**This method of directing runoff from an access road works best on low traffic roads. deflectors can be used on roads with grades exceeding 10%.**

Road Grade (%)	Distance Between Drains (Ft)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140

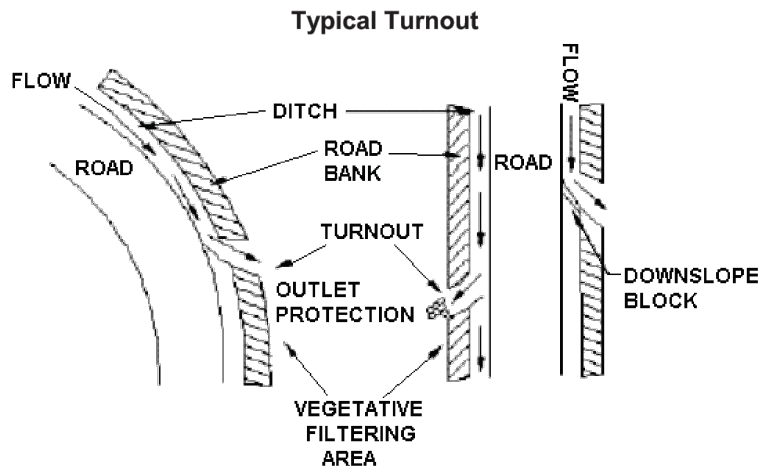
DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:  PXXXX	



**Mountain  
Valley  
PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
WATER DEFLECTOR	
DRAWING NO. MVP-ES14	REV. P



Indiana CCD

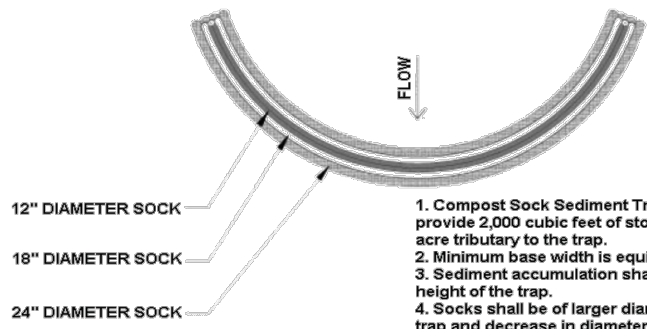
**TURNOUT - SEDIMENT REMOVAL EFFICIENCY: VERY LOW. THIS DEVICE IS NOT AN ABACT FOR SPECIAL PROTECTION WATERSHEDS, BUT MAY BE USED TO MAKE OTHER BMPS WHICH ARE ABACT WORK MORE EFFECTIVELY.** CHANNELS THAT DRAIN WATER AWAY FROM ROADS OR ROADSIDE DITCHES INTO WELL-VEGETATED AREAS ARE KNOWN AS TURNOUTS. TURNOUTS ARE TYPICALLY LOCATED ALONG CROWNED ROADWAYS WHERE RUNOFF CANNOT SHEET FLOW OFF THE ROADWAY. LIKE DITCH RELIEF CULVERTS, THE PURPOSE OF TURNOUTS IS TO MINIMIZE THE VOLUME OF WATER IN A ROADSIDE DITCH. TURNOUTS SHOULD BE LOCATED SO AS TO TAKE ADVANTAGE OF NATURAL DRAINAGE COURSES OR BUFFER AREAS WHEREVER POSSIBLE. AN EXCAVATED SUMP AT THE END OF THE TURNOUT CAN BE EFFECTIVELY USED TO POND AND SETTLE OUT SEDIMENT PRIOR TO DISCHARGING TO A VEGETATED BUFFER. WHERE A SUITABLE VEGETATIVE FILTER STRIP IS NOT AVAILABLE, A COMPOST FILTER SOCK, ROCK FILTER OR OTHER SEDIMENT REMOVAL BMP SHOULD BE INSTALLED AT THE OUTLET OF THE TURNOUT.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: PXXXX	



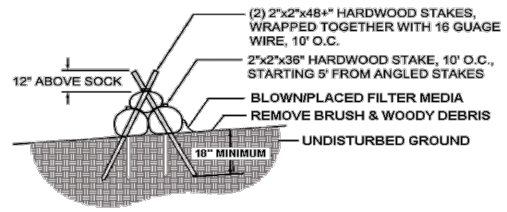
**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
ROAD TURNOUT DETAIL	
DRAWING NO. MVP-ES15	REV. P



1. Compost Sock Sediment Trap shall be sized to provide 2,000 cubic feet of storage capacity for each acre tributary to the trap.
2. Minimum base width is equivalent to the height.
3. Sediment accumulation shall not exceed 1/3 the total height of the trap.
4. Socks shall be of larger diameter at the base of the trap and decrease in diameter for successive layers as indicated to the left.
5. Ends of the trap shall be a minimum of 1 foot higher in elevation than the mid-section, which shall be located at the point of discharge.

**PLAN VIEW**



**STAKING DETAIL**

Adapted from Filtrexx


Compost sock sediment traps shall not exceed three socks in height and shall be stacked in pyramidal form as shown above. Minimum trap height is one 24" diameter sock. Additional storage may be provided by means of an excavated sump 12" deep extending 1 to 3 feet upslope of the socks along the lower side of the trap.

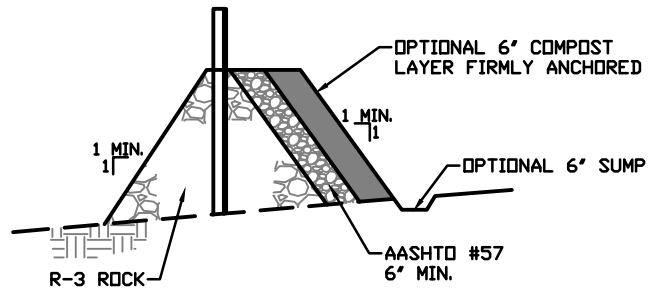
Compost sock sediment traps shall provide 2,000 cubic feet storage capacity with 12" freeboard for each tributary drainage acre. (See manufacturer for anticipated settlement.)

The maximum tributary drainage area is 5.0 acres. Since compost socks are "flow-through," no spillway is required.

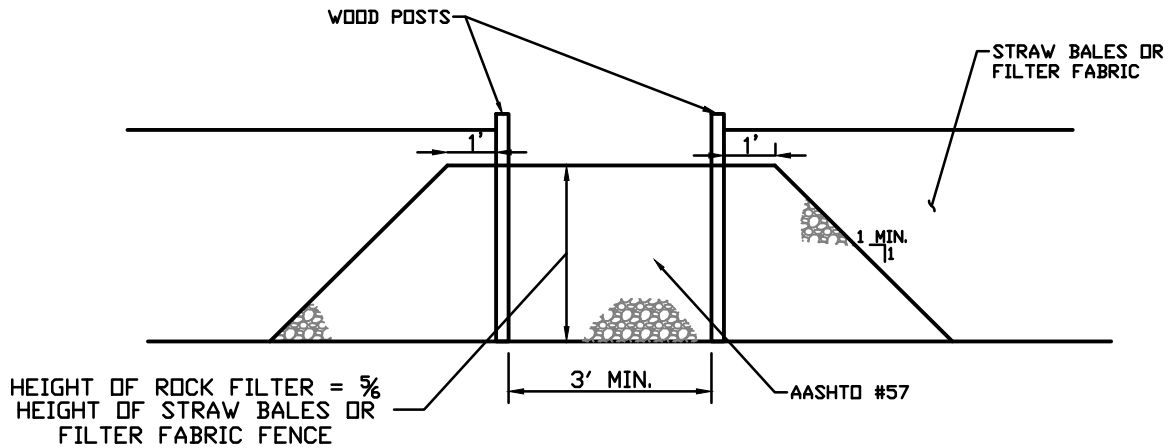
Compost sock sediment traps shall be inspected weekly and after each runoff event. Sediment shall be removed when it reaches 1/3 the height of the socks.

Photodegradable and biodegradable socks shall not be used for more than 1 year.

DRAWN		DATE		 <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			COMPOST SOCK SEDIMENT TRAP	
APP'D		DATE			DRAWING NO. MVP-ES16	
SCALE	N.T.S.	SHEET	1 OF 1			
JOB NO.						
PROJECT ID:		PXXXX				



OUTLET CROSS SECTION



UP-SLOPE FACE

A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A SILT FENCE OR STRAW BALE BARRIER HAS OCCURRED DUE TO CONCENTRATED FLOW. ANCHORED COMPOST LAYER SHALL BE USED ON UPSLOPE FACE IN HQ AND EV WATERSHEDS.

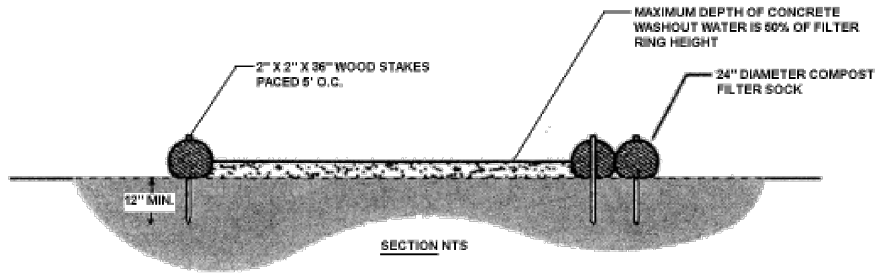
SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE HEIGHT OF THE OUTLET.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

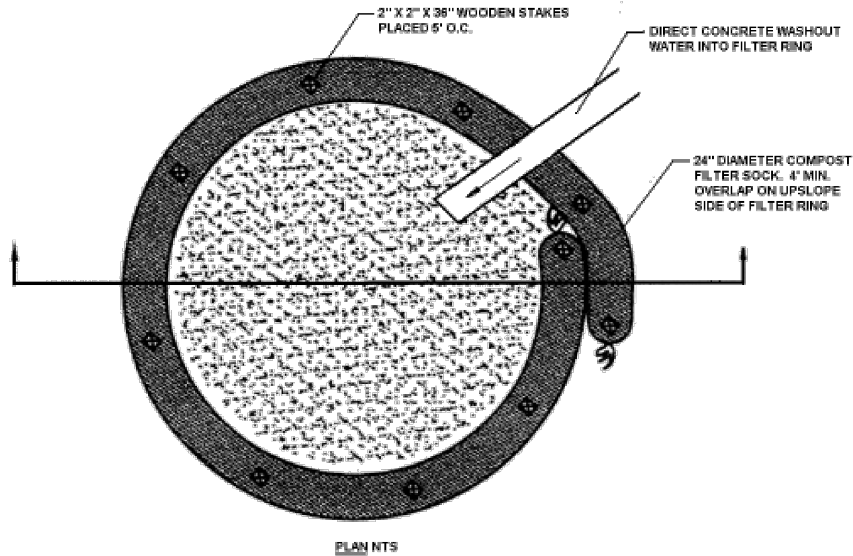


DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
ROCK FILTER OUTLET	
DRAWING NO.	REV.
MVP-ES17	P



- NOTES:  
 1. INSTALL ON FLAT GRADE FOR OPTIMUM PERFORMANCE  
 2. 18" DIAMETER FILTER SOCK MAY BE STACKED ONTO DOUBLE 24" DIAMETER SOCKS IN PYRAMIDAL CONFIGURATION FOR ADDED HEIGHT.



**A suitable impervious geomembrane shall be placed at the location of the washout prior to installing the socks.**  
 Adapted from Filtrexx

Wherever compost sock washouts are used, a suitable impervious geomembrane should be placed at the location of the washout. Compost socks should be staked in the manner recommended by the manufacturer around perimeter of the geomembrane so as to form a ring with the ends of the sock located at the upslope corner. Care should be taken to ensure continuous contact of the sock with the geomembrane at all locations. where necessary, socks may be stacked and staked so as to form a triangular cross-section.

For any project on which concrete will be poured or otherwise formed on site, a suitable washout facility must be provided for the cleaning of chutes, mixers, and hoppers of the delivery vehicles unless such a facility will be used at the source of the concrete. Under no circumstances may wash water from these vehicles be allowed to enter any surface waters. Make sure that proper signage is provided to drivers so that they are aware of the presence of washout facilities. Washout facilities should not be placed within 50 feet of storm drains, open ditches or surface waters. They should be in a convenient location for the trucks, preferably near the place where the concrete is being poured, but far enough from other vehicular traffic to minimize the potential for accidental damage or spills. Wherever possible, they should be located on slopes not exceeding a 2% grade.

**Maintenance**

All concrete washout facilities should be inspected daily. Damaged or leaking washouts should be deactivated and repaired or replaced immediately. Accumulated materials should be removed when they reach 75% capacity. Plastic liners should be replaced with each cleaning of the washout facility.

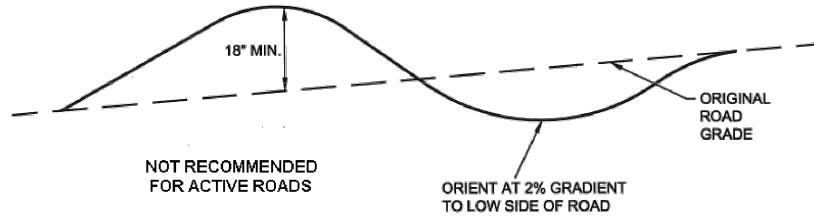
DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
COMPOST SOCK WASHOUT PIT TYPICAL	
DRAWING NO.	REV.
MVP-ES18	P

**STANDARD CONSTRUCTION DETAIL #3-5  
Waterbar**



Adapted from USDA Forest Service

**Waterbars shall discharge to a stable area.**

**Waterbars shall be inspected weekly (daily on active roads) and after each runoff event. Damaged or eroded waterbars shall be restored to original dimensions within 24 hours of inspection.**


**Maintenance of waterbars shall be provided until roadway, skidtrail, or right-of-way has achieved permanent stabilization.**

**Waterbars on retired roadways, skidtrails, and right-of-ways shall be left in place after permanent stabilization has been achieved.**

**TABLE 3.1 – Maximum Waterbar Spacing**

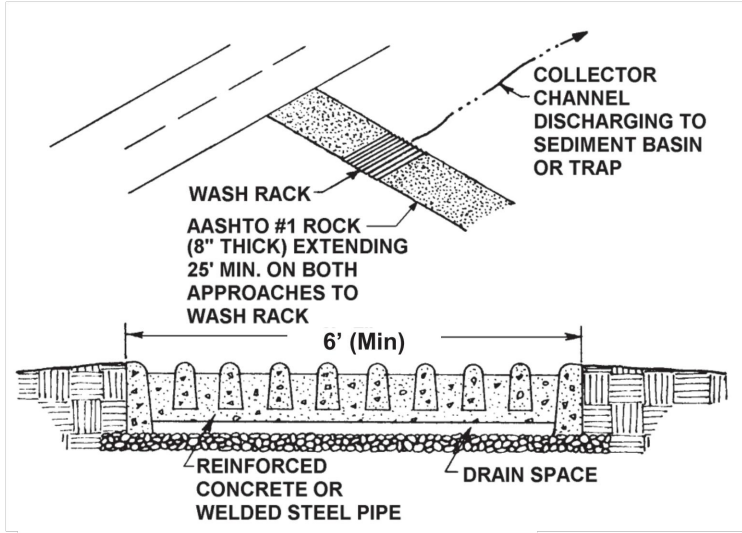
PERCENT SLOPE	SPACING (FT)
<5	250
5 - 15	150
15 - 30	100
> 30	50

Adapted from USDA Forest Service

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		WATERBAR	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES19	P
<b>PROJECT ID:</b>				
PXXXX				



**Rock Construction Entrance with Wash Rack**



Modified from Smith Cattleguard Company

IF EXCESSIVE AMOUNTS OF SEDIMENT ARE BEING DEPOSITED ON ROADWAY, EXTEND LENGTH OF ROCK CONSTRUCTION ENTRANCE BY 70 FOOT INCREMENTS UNTIL CONDITION IS ALLEVIATED OR INSTALL WASH RACK.

Wash rack shall be 20 feet (min.) wide or total width of access.

Wash rack shall be designed and constructed to accommodate anticipated construction vehicular traffic.


A water supply shall be made available to wash the wheels of all vehicles exiting the site.

**MAINTENANCE:** Rock construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. A stockpile of rock material shall be maintained on site for this purpose. Drain space under wash rack shall be kept open at all times. Damage to the wash rack shall be repaired prior to further use of the rack. All sediment deposited on roadways shall be removed and returned to the construction site immediately. Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.

A metal wash rack or livestock grate is an acceptable alternative to the reinforced concrete one shown in the standard detail. Approaches to the wash rack should be lined with aashto #1 at a minimum of 25' on both sides. The wash rack should discharge to a sediment removal facility, such as a vegetated filter strip or into a channel leading to a sediment removal device (e.g. a sediment trap or sediment basin). Rock construction entrances with wash racks should be maintained to the specified dimensions by adding rock when necessary at the end of each workday. A stockpile of rock material should be maintained on site for this purpose. Sediment deposited on paved roadways should be removed and returned to the construction site.

**NOTE:** Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable. Damaged wash racks should be repaired as necessary to maintain their effectiveness. In lieu of washrack installation, MVP will extend the RCE by 70' increments until mud tracking condition is alleviated.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
ROCK CONSTRUCTION ENTRANCE WITH WASH RACK	
DRAWING NO.	REV.
MVP-ES20	P

**ROCK FILTER - Sediment Removal Efficiency: LOW. This device is not an ABACT for special protection watersheds. However, the efficiency may be raised to moderate (ABACT for HQ watersheds) by anchoring a 6" layer of compost on the upgradient side.** Rock filters may be used to control runoff within constructed channels — at the downstream end of the channel, during construction — until the protective lining is installed or during a temporary disturbance within the channel. They may also be used below construction work within an existing channel while flow is being diverted past the work area . In such cases, the filter should be located between the work area and the discharge from the bypass system. In no case are rock filters to be placed within a channel meeting the definition of a waterbody.

Rock filters may not be used instead of appropriate channel linings. This practice often results in overtopping of the channel during storm events, scouring of the channel bottom below the filter, or erosion of the channel side slopes as sediment deposits build up behind the filter. Rock filters may not be used in roadside ditches instead of a suitable temporary protective liner until vegetation is established except at the inflows to ditch relief culverts on dirt or gravel roads or on temporary or permanent access roads.

Rock filters may not be used instead of an adequate protective lining in sediment basin emergency spillways. This can reduce the effective discharge capacity of the spillway and, in so doing, increase the possibility of embankment failure.

Rock filters should be constructed according to the specifications shown in Standard Construction Detail # 4-14.


Rock filters should be constructed with riprap sized as follows:

For channels with total depth > 3 feet, use R-4.

For channels with total depth between 2 and 3 feet, use R-3.

Rock filters should not be used in channels of less than 2 feet total depth.

The filter should be equal in height to **half** the total channel depth with a 6" depression in the center.

DRAWN		DATE		 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			ROCK FILTER	
APP'D		DATE				
SCALE	N.T.S.	SHEET	1 OF 1		DRAWING NO. MVP-ES21.1	
JOB NO.		PROJECT ID: PXXXX				

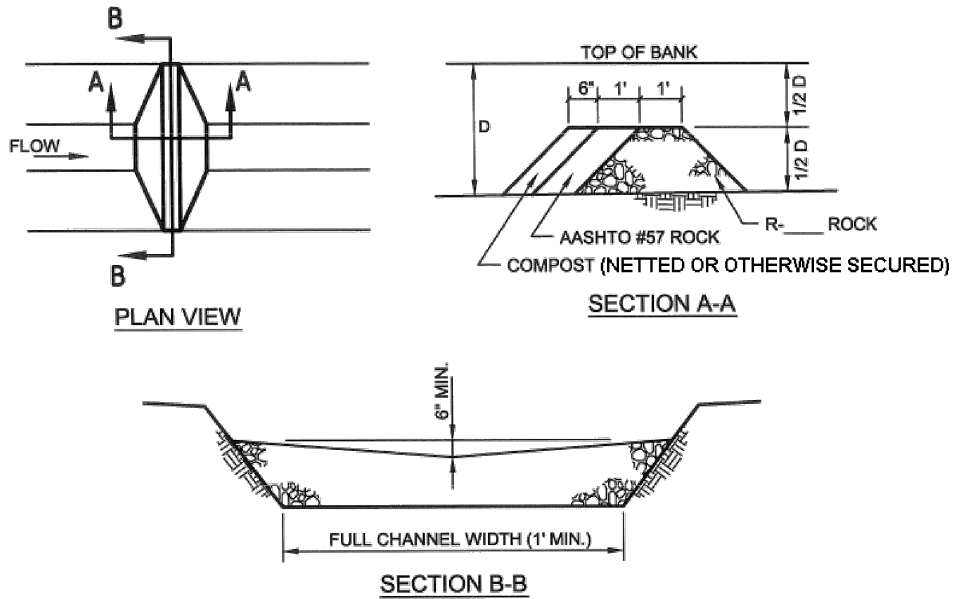
A one foot thick layer of AASHTO #57 (or smaller) stone should be placed on the upstream side of the filter. In special protection watersheds, a 6" layer of compost should be placed and anchored on top of the filter stone. NOTE: Filter fabric and straw bales should not be used in rock filters!

Rock filters should be inspected weekly and after each runoff event.

Clogged filter stone (AASHTO # 57) should be replaced.

Needed repairs should be initiated immediately after the inspection.

**STANDARD CONSTRUCTION DETAIL # 4-14  
Rock Filter**



PA DEP

FOR  $3' \leq D$  USE R-4  
 FOR  $2' \leq D < 3'$  USE R-3  
 NOT APPLICABLE FOR  $D < 2'$

**NOTE: This table is intentionally blank and should be filled in by the plan preparer.**

ROCK FILTER NO.	LOCATION	D (FT.)	RIPRAP SIZE

Sediment shall be removed when accumulations reach 1/2 the height of the filter.

Immediately upon stabilization of each channel, installer shall remove accumulated sediment, remove rock filter, and stabilize disturbed areas.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley PIPELINE**  
 DESIGN ENGINEERING


<b>ENVIRONMENTAL DETAIL</b>	
ROCK FILTER	
DRAWING NO. MVP-ES21.2	REV. P

**VEGETATIVE FILTER STRIP - Sediment Removal Efficiency: MODERATE when used in series with another sediment removal BMP that does not result in a concentrated discharge onto the vegetative filter strip. This device, when used in this way, is an ABACT for HQ but not for EV watersheds.** A vegetative filter strip consists of a well-vegetated, grassy area below a disturbed area that can be used to remove sediment from runoff prior to its reaching surface waters.

To be effective, runoff should be in the form of sheet flow, and the vegetative cover should be established prior to the disturbance. Due to the time required to establish vegetation and the need to control runoff from the areas disturbed while constructing filter strips, constructed vegetative filter strips are not recommended. The suitability of natural vegetative filter strips should be either field verified by the Department or conservation district or documented by photo(s) submitted by the applicant prior to approval. Vegetative filter strips on neighboring properties should not be proposed unless permission to use that area as a vegetative filter strip has been obtained from the owner of the property along with an agreement to leave the filter strip area undisturbed for as long as it is needed. Where control of the filter strip cannot be assured throughout its intended use, a substitute BMP that will be installed should the filter strip no longer be available should be specified in the E&S Plan.

Vegetative filter strips may be used to remove sediment from project runoff that is directed to the strip as sheet flow. The minimum filter strip width should be determined from Table 4.6.

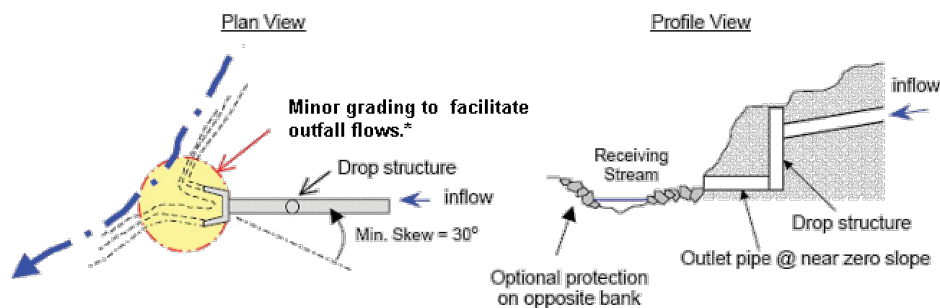
Vegetation should be an existing, well-established, perennial grass. Wooded and brushy areas are not acceptable for purposes of sediment removal.

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		VEGETATIVE FILTER STRIP	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES22	P
<b>PROJECT ID:</b>				
PXXXX				

**RIPRAP APRON** - Riprap aprons may be used to prevent scour at pipe or channel outfalls where anticipated discharge velocities do not exceed 17.0 feet per second, there is sufficient room to construct the apron, and where the aprons can be installed on a level grade. In cases where discharge velocities exceed 17.0 fps, a suitable means of velocity reduction (e.g. drop structure) should be used prior to discharging significant flows onto a riprap apron.


Aprons should be oriented so that the discharge enters the receiving channel at less than 90 degrees to the channel flow direction, as shown in Figure 9.2. In no case should the discharge enter the channel at an angle greater than 90 degrees to the channel flow direction.

**FIGURE 9.2  
PROPER OUTFALL ORIENTATION TO RECEIVING STREAM**



**\*Chapter 105 permit(s) required. Provide sediment barrier to protect stream and outfall channels.**

Riprap aprons should be constructed according to the dimensions shown in Standard Construction Detail # 9-1 for outfalls having an endwall, or Standard Construction Detail #9-2 for outfalls with no endwall.

<b>DRAWN</b>	<b>DATE</b>	 <b>DESIGN ENGINEERING</b>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		RIPRAP APRON	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES23.1	P
<b>PROJECT ID:</b>	PXXXX			

They should be constructed at or near zero grade from back to front and side to side. Where aprons are constructed with a gradient back to front, the rock size and/or apron length should be adjusted upwards to compensate. **In no case should riprap aprons be constructed with a back to front gradient exceeding 0.05 ft/ft.**

Determine whether the maximum or minimum tailwater conditions exist at the outfall for the design discharge.

Minimum tailwater exists when the depth of the flow in the receiving watercourse, as calculated by Manning's equation, is less than ½ the diameter of the discharge pipe, or where no channel or swale exists at the point of discharge. Where this condition exists, use Figure 9.3. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as shown in Standard Construction Detail # 9-3, use the channel width as the width of the apron.


Maximum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is greater than ½ the diameter of the discharge pipe. Where this condition exists, use figure 9.4. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail # 9-3, use the channel width as the width of the apron.

**Note: Figure 9.3 and 9.4 should not be used for designing outlet protection below box culverts.**

If the anticipated discharge velocity exceeds the maximum allowable in Table 6.6 for the riprap size taken from Figure 9.3 or 9.4, the size of the riprap should be increased to a size whose permissible velocity is not exceeded. If the velocity exceeds the maximum permissible for riprap, a suitable method of reducing the velocity prior to discharge onto the rock (e.g. drop structure or dissipater) should be incorporated into the design. Should a design discharge not intersect the curve corresponding to the pipe diameter, use the lowest point on that curve to determine apron dimensions.

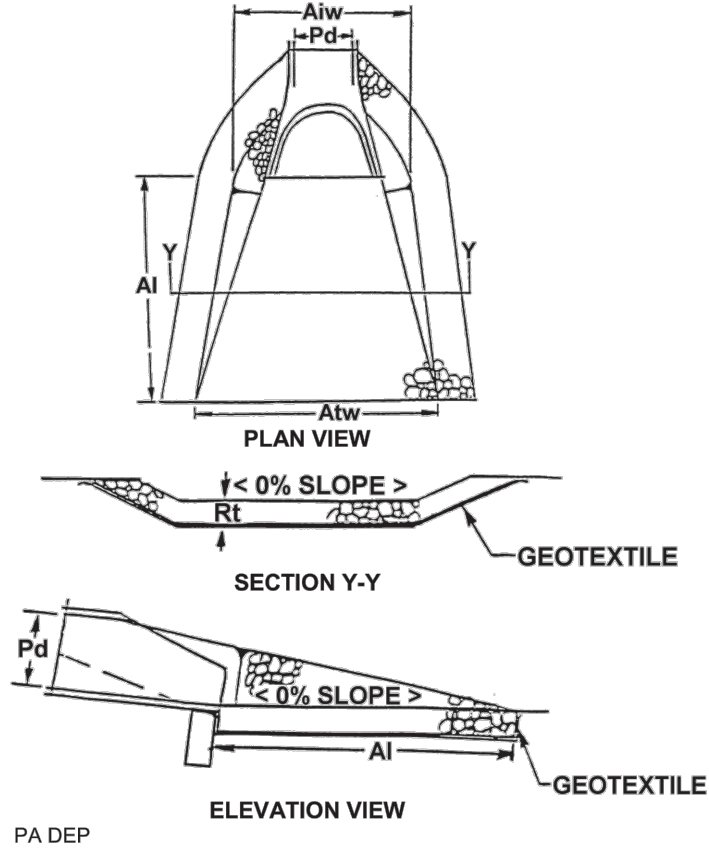
Grouting of riprap is not recommended for most installations. Where riprap is grouted, the following applies:

1. Precautions must be taken to prevent uncured concrete from coming in contact with any surface waters.
2. Grout should be placed in a layer with thickness equivalent to the d50 stone size over the entire extent of the apron prior to rock placement.
3. After stone placement, void spaces should be filled with grout.

DRAWN		DATE		 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			RIPRAP APRON	
APP'D		DATE				
SCALE	N.T.S.	SHEET	1 OF 1			
JOB NO.						
PROJECT ID:		PXXXX		DRAWING NO.		REV.
				MVP-ES23.2		P



**STANDARD CONSTRUCTION DETAIL # 9-1**  
**Riprap Apron at Pipe Outlet with Flared End Section or Endwall**



NOTE: This table is intentionally blank and should be filled in by the plan preparer.

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP			APRON	
		SIZE (R- )	THICK. Rt (IN)	LENGTH Al (FT)	INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)

All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

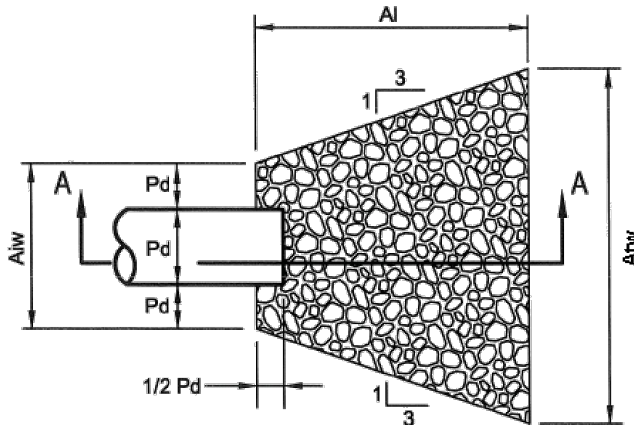


**Mountain Valley PIPELINE**

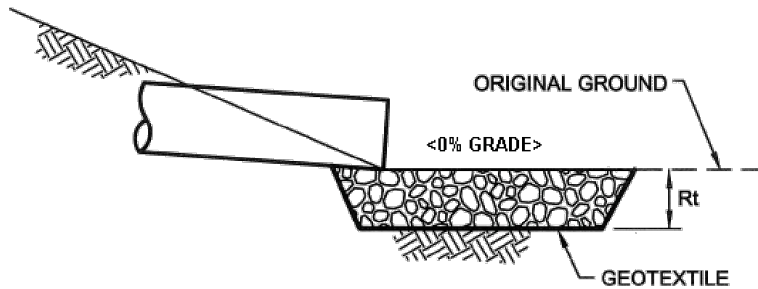
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
RIPRAP APRON	
DRAWING NO.	REV.
MVP-ES23.3	P

**STANDARD CONSTRUCTION DETAIL # 9-2  
Riprap Apron at Pipe Outlet without Flared Endwall**



**PLAN VIEW**



**SECTION A - A**

Adapted from USDOT, FHA HEC-14

NOTE: This table is intentionally blank and should be filled in by the plan preparer.

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP		LENGTH Al (FT)	APRON	
		SIZE (R-___)	THICK. Rt (IN)		INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)

All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.

Extend riprap on back side of apron to at least 1/2 depth of pipe on both sides to prevent scour around the pipe.

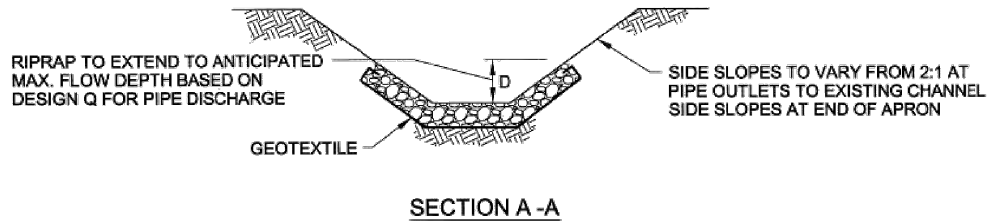
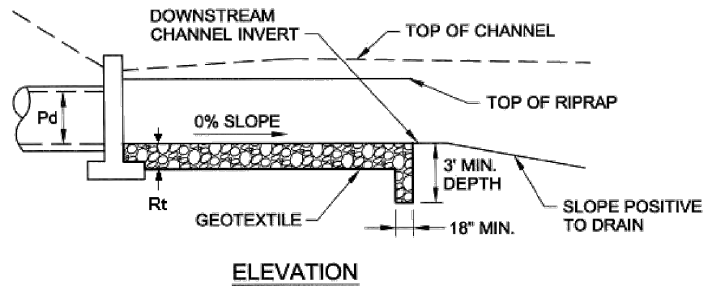
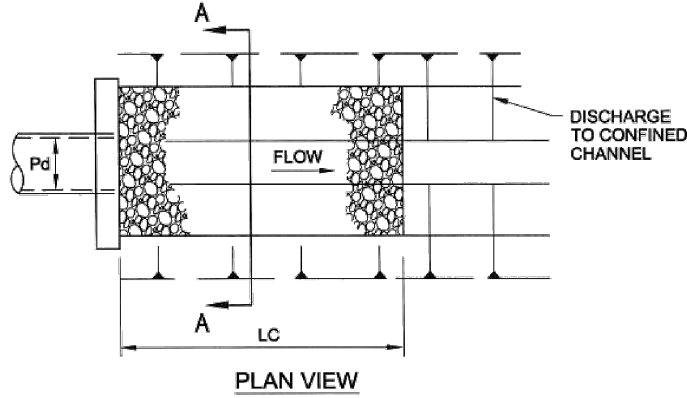
DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
RIPRAP APRON	
DRAWING NO. MVP-ES23.4	REV. P

**STANDARD CONSTRUCTION DETAIL # 9-3**  
**Riprap Apron at Pipe Outlet to an Existing Channel**



Adapted from USDA NRCS

NOTE: This table is intentionally blank and should be filled in by the plan preparer.

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP			APRON					
		SIZE (R-...)	THICK. Rt (IN)	LENGTH LC (FT)	INITIAL BOTTOM WIDTH (at Endwall)(FT)	END WIDTH (FT)	INITIAL TOP WIDTH (at Endwall) (FT)	END TOP WIDTH (FT)	SIDE SLOPES H:V	

All aprons shall be constructed to the dimensions shown. Terminal widths shall be adjusted as necessary to match receiving channels.

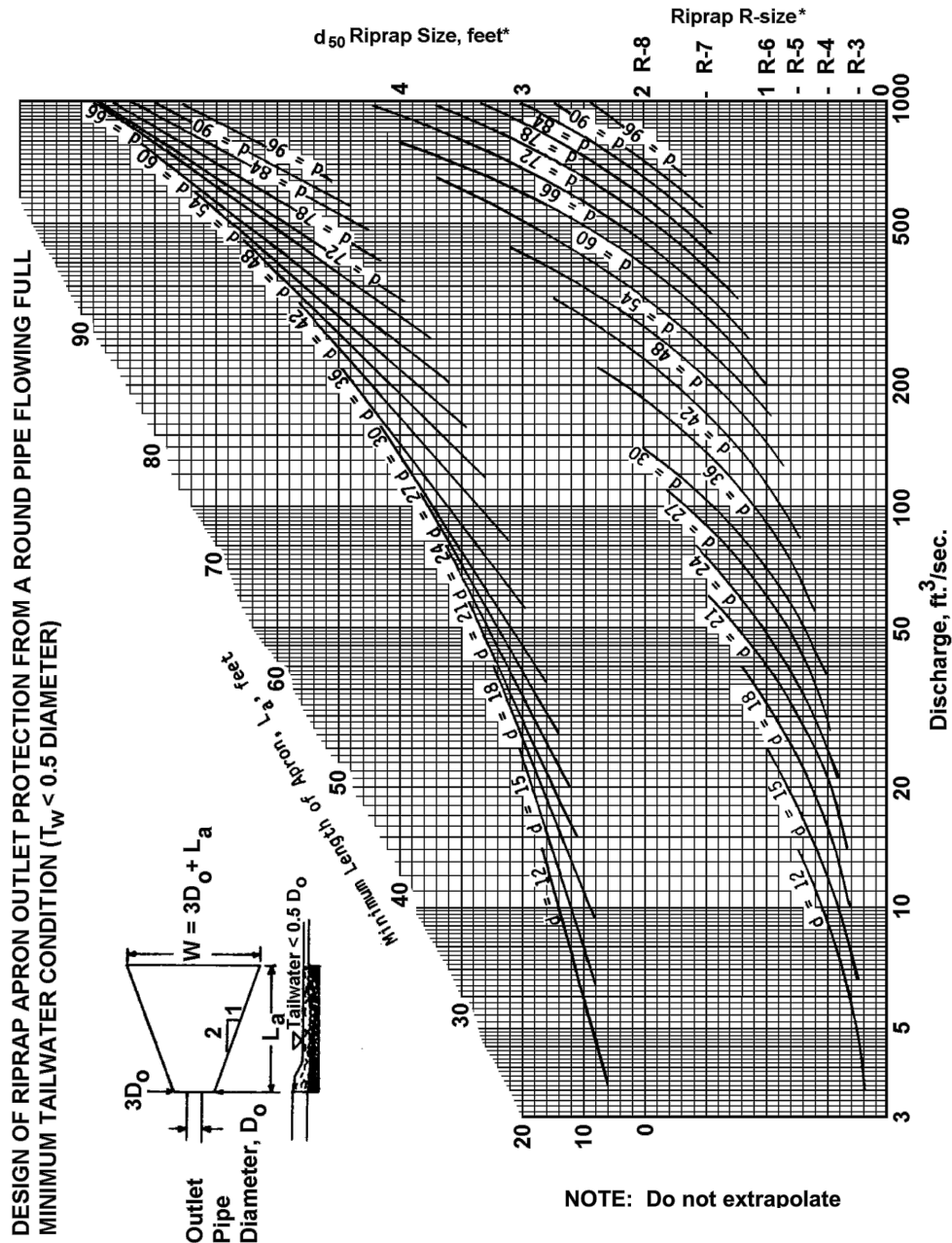
All aprons shall be inspected at least weekly and after each runoff event. Displaced riprap within the apron shall be replaced immediately.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley PIPELINE**  
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
RIPRAP APRON	
DRAWING NO. MVP-ES23.5	REV. P

**FIGURE 9.3**  
**Riprap Apron Design, Minimum Tailwater Condition**



DESIGN OF RIPRAP APRON OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MINIMUM TAILWATER CONDITION ( $T_w < 0.5$  DIAMETER)

Adapted from USDA - NRCS

NOTE: Do not extrapolate

Not to be used for Box Culverts

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley PIPELINE**  
 DESIGN ENGINEERING

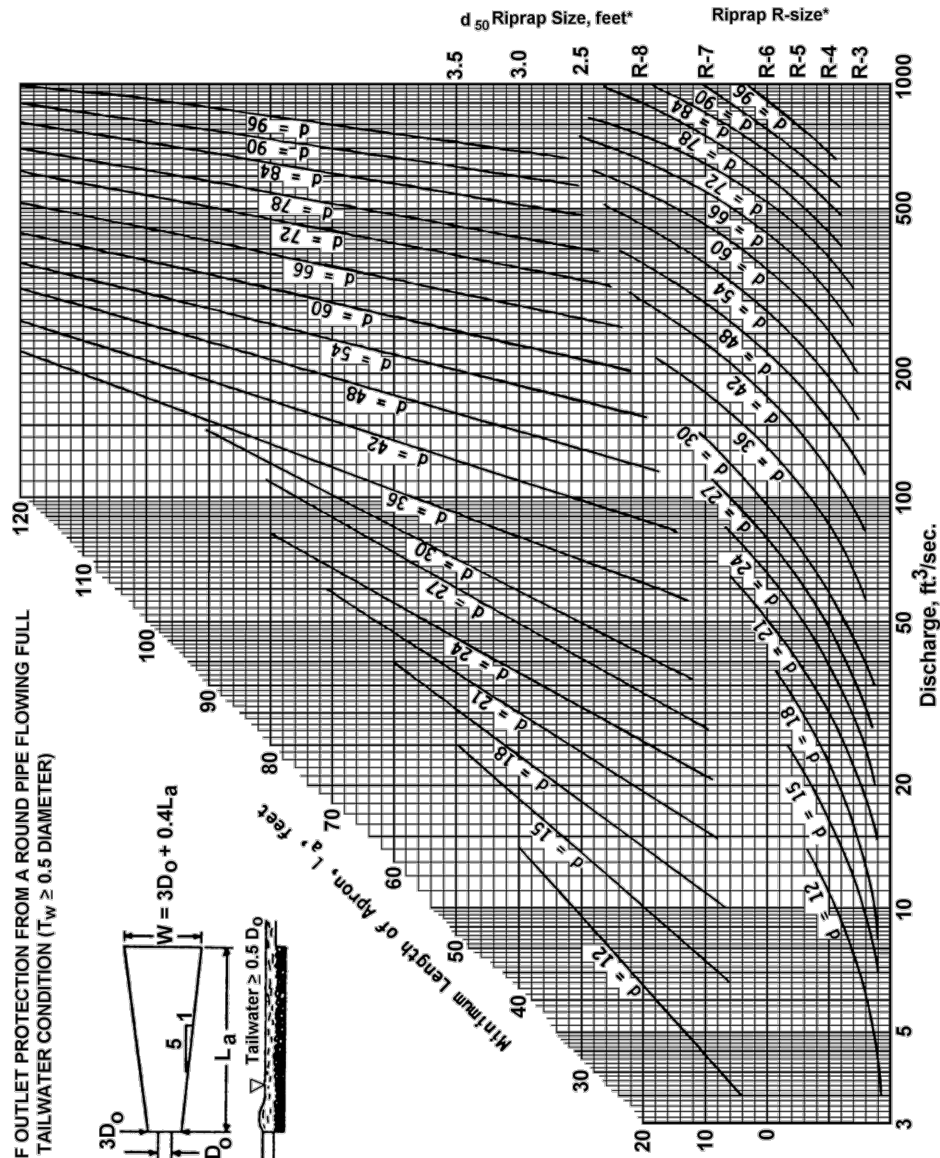
**ENVIRONMENTAL DETAIL**

RIPRAP APRON

DRAWING NO. MVP-ES23.6

REV. P

**FIGURE 9.4**  
**Riprap Apron Design, Maximum Tailwater Condition**



DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL  
 MAXIMUM TAILWATER CONDITION ( $T_w \geq 0.5$  DIAMETER)

Adapted from USDA - NRCS

NOTE: Do not extrapolate

\* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase  $d_{50}$  stone size and/or provide velocity reduction device.

Not to be used for Box Culverts

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley PIPELINE**  
 DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

RIPRAP APRON

DRAWING NO.  
 MVP-ES23.7

REV.  
 P



Determine whether maximum or minimum tailwater conditions exist at the outfall for the design discharge.

Minimum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is less than 1/2 the diameter of the discharge pipe, or where no channel or swale exists at the point of discharge. Where this condition exists, use Figure 9.3. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail #9-3, use the channel width as the width of the apron.

Maximum tailwater exists when the depth of flow in the receiving watercourse, as calculated by Manning's equation, is greater than 1/2 the diameter of the discharge pipe. Where this condition exists, use Figure 9.4. If the resulting apron width is wider than the existing channel width and discharge is directly into a downslope channel, as in Standard Construction Detail #9-3, use the channel width as the width of the apron.

For less than full-pipe flow conditions, calculate anticipated velocity as described at the beginning of this chapter and adjust riprap size where necessary to comply with Table 6.6. Locate the design discharge along the bottom of Figure 9.3 or 9.4. Follow a vertical line to the point where it intersects the first curve corresponding to the diameter of the discharge pipe. From that point follow a horizontal line to the right to determine the minimum R-size of the riprap. **Do not extrapolate the curve lines.** Where flows fall below the curve for a specific size of pipe, use the minimum rock size and apron dimensions indicated at the lower ends of the curves for the proposed pipe size.

Check Table 6.6 to make sure that the anticipated discharge velocity does not exceed the maximum permissible velocity for the size of riprap obtained in this step. If the anticipated discharge velocity exceeds the maximum permissible velocity, increase the size of the riprap to a size whose permissible velocity is not exceeded.

Follow the same vertical line mentioned above to the point where it intersects the second curve corresponding to the diameter of the discharge pipe. From that point, follow a horizontal line to the left and read the minimum length of the apron (L<sub>a</sub>) in feet.

For minimum tailwater conditions, the apron width (W) may be calculated by the formula:

$$W = 3D_o + L_a$$

where D<sub>o</sub> = Outlet pipe diameter  
L<sub>a</sub> = Length of the apron


For maximum tailwater conditions, the apron width (W) may be calculated by the formula:

$$W = 3D_o + 0.4 L_a$$

Where the apron design width (W) exceeds the downstream watercourse bottom width and the apron is directly in line with the channel, the maximum width of the apron should be the channel width.

Grouting of riprap is not recommended for most installations. Where riprap is grouted, the following applies:

1. Precautions must be taken to prevent uncured concrete from coming into contact with any surface waters.
2. Grout should be placed in a layer with thickness equivalent to the d50 stone size over the entire extent of the apron prior to rock placement.
3. After stone placement, void spaces should be filled with grout.

DRAWN	DATE	 <b>DESIGN ENGINEERING</b>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED	DATE		RIPRAP APRON	
APP'D	DATE			
SCALE	N.T.S.		SHEET	1 OF 1
JOB NO.				
PROJECT ID:			DRAWING NO.	REV.
PXXXX			MVP-ES23.8	P



EARTHEN LEVEL SPREADER

**LOCATION** - Earthen level spreaders are normally used where diversion ditches or dikes outlet onto areas of established vegetation — grass, typically not brush or forested. They are **not** to be used below sediment traps, sediment basins, or stormwater pipes.

Earthen level spreaders may be used for drainage areas less than or equal to 1 acre where sediment-free stormwater runoff can be released in sheet flow down a stabilized slope without causing erosion. Where the downstream slope is stabilized with grass, a minimum uniform cover of 90% is required. Wooded areas, with little or no grass cover, are not considered stabilized areas for this purpose. Earthen level spreaders should only be used where there will be no construction traffic over the level spreader.

To avoid reconcentrating flow downstream of the spreader, the maximum distance from the earthen level spreader to an existing or constructed defined drainage course is 100 feet with a 6% maximum slope and where very uniform and very stable site conditions exist. Greater distances may be considered on a case-by-case basis for very mild slopes and heavily vegetated areas but should not normally exceed 150 feet.

Earthen level spreaders should be constructed on soil, not on fill.

**MAXIMUM DRAINAGE AREA** - Maximum drainage area to an earthen level spreader should not exceed 1 acre.


**MAXIMUM DISCHARGE and MINIMUM LENGTH** - The maximum discharge for earthen level spreaders should be 1 cfs per foot of length based on the peak rate of flow from a ten-year frequency rainfall event. An acceptable simplified method to determine the length ( $L_{min}$ ) is that  $L_{min}$  is equal to five feet per acre of drainage area.

**DESIGN** - The grade of the last 20 feet of the diversion channel that feeds the earthen level spreader should create a smooth transition from the channel grade to the earthen level spreader and, where possible, should be less than or equal to 1 percent. Construct earthen level spreaders on zero percent grades to insure uniform spreading of sediment-free runoff. Minimum width of earthen level spreaders should be 6 feet. A transition section should be constructed between the diversion channel and the earthen level spreader if the widths are different.

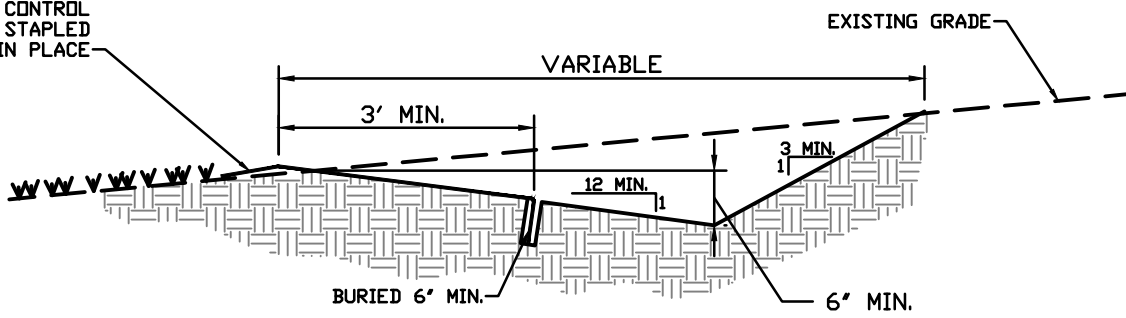
Protect the lip of an earthen level spreader with an erosion-resistant material, such as a reinforced erosion control blanket or TRM, to prevent erosion and enable vegetation to become established. For a permanent installation, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, should be used. A smooth transition should be provided between the level spreader and the native ground downslope.

For a vegetated lip, the erosion-control matting should be a minimum of 4 feet wide and extend 6 inches over the level lip. The upstream edge should be buried at least six inches deep in a vertical trench. The downstream edge should be securely held in place with closely spaced, heavy-duty staples, at least 12 inches long. A rigid level lip should be entrenched at least 2 inches below the ground surface and securely anchored to prevent displacement. Immediately after the earthen level spreader is constructed, the entire area of the spreader should be appropriately seeded and mulched.

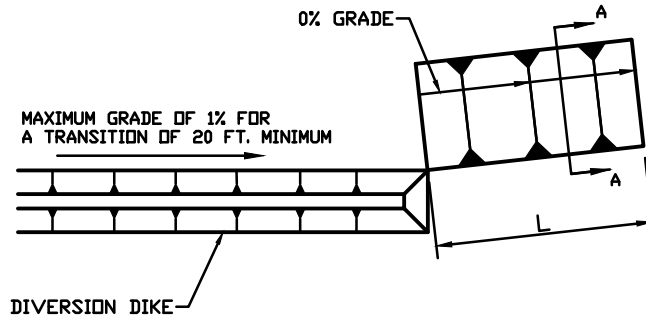
Typical details of earthen level spreaders are shown on Standard Construction Detail MVP-ES24.2.

DRAWN		DATE		 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			EARTHEN LEVEL SPREADER	
APP'D		DATE 08/11/17				
SCALE	N.T.S.	SHEET 1 OF 1			DRAWING NO. MVP-ES24.1	
JOB NO.						
PROJECT ID:		MVP - VA PORTION				

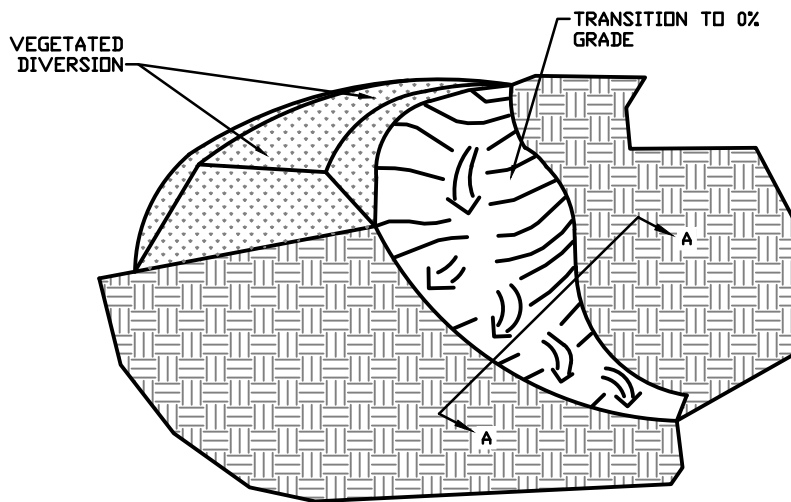
EROSION CONTROL  
BLANKET STAPLED  
IN PLACE



SECTION A-A



PLAN VIEW



ISOMETRIC VIEW

Level Spreader Schedule		
Drainage Area	ID No.	Design Length (ft)
DA-GI-021	LS-GI8-001	14

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

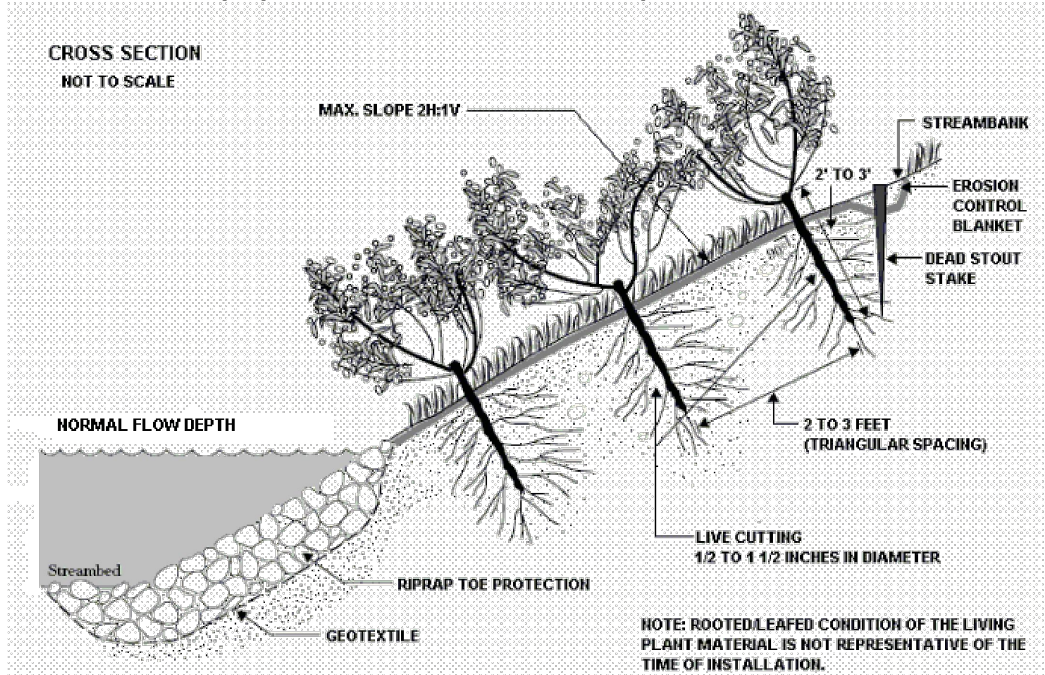
**ENVIRONMENTAL DETAIL**

EARTHEN LEVEL SPREADER

DRAWING NO.  
MVP-ES24.2

REV.  
P

### Riprap Streambank Protection with Optional Live Stakes



Adapted from USDA NRCS, *Engineering Field Handbook*, Chapter 16

Filter stone may be substituted for the geotextile where site and soil conditions warrant.

**NOTE:** Extend riprap into streambed only as far as required to provide proper toe support.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

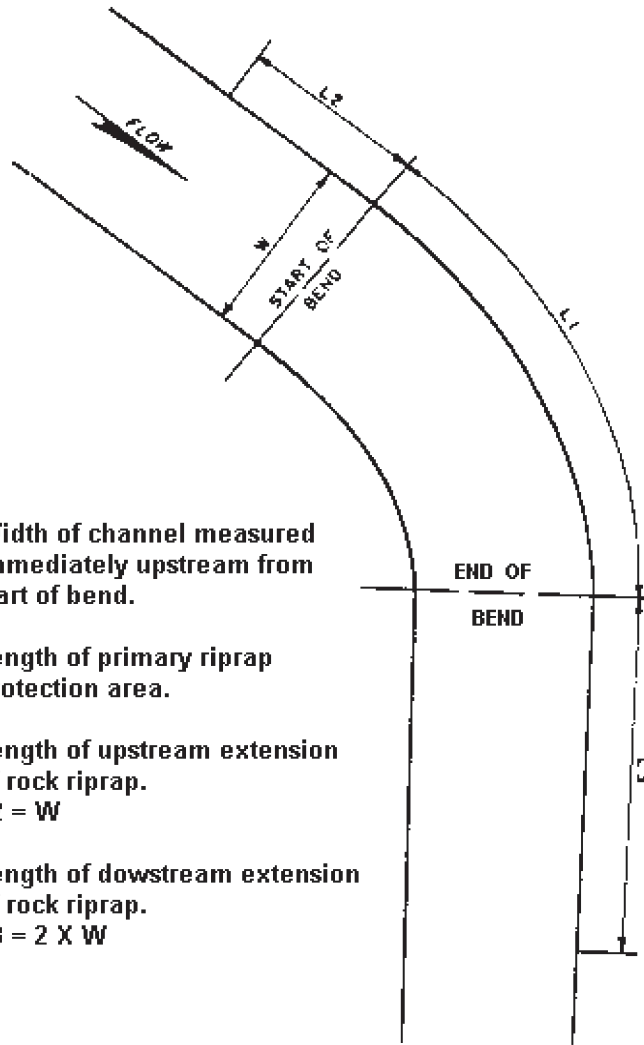


**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
RIPRAP STREAMBANK PROTECTION WITH OPTIONAL LIVE STAKES	
DRAWING NO.	REV.
MVP-ES25	P

**Extension of Primary Rock Riprap Protection Area**



**W** = Width of channel measured immediately upstream from start of bend.

**L1** = Length of primary riprap protection area.

**L2** = Length of upstream extension of rock riprap.  
 $L2 = W$

**L3** = Length of downstream extension of rock riprap.  
 $L3 = 2 \times W$

PA DEP

NOTE:

UPSTREAM AND DOWNSTREAM ENDS MUST BE KEYED INTO THE BANK AS PER PERMIT REQUIREMENTS

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

ROCK RIPRAP PROTECTION AREA

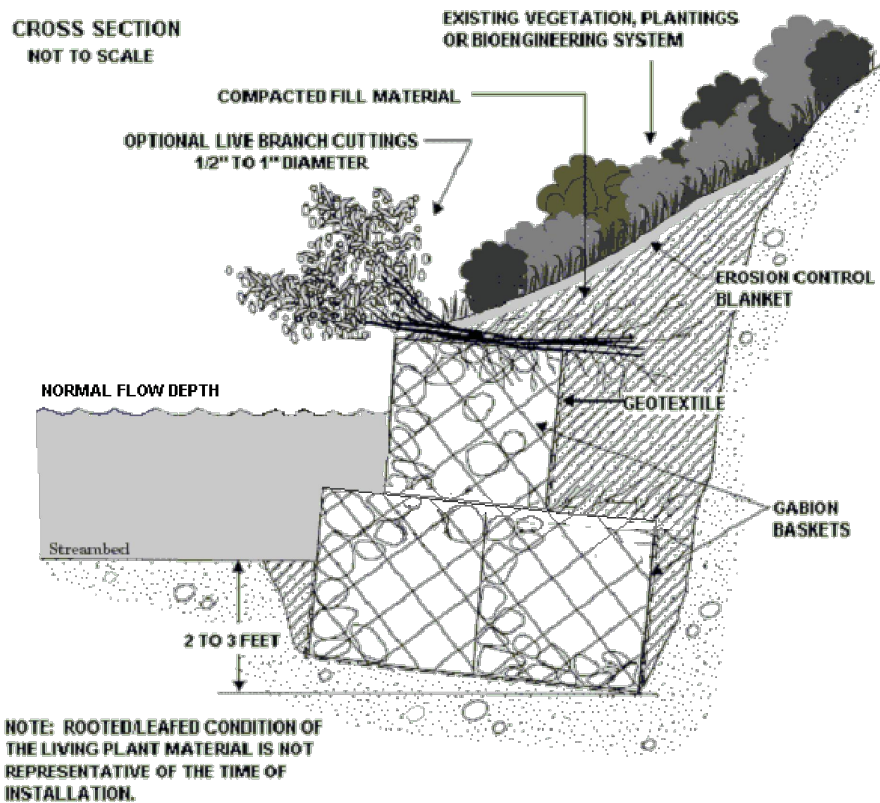
DRAWING NO.	REV.
MVP-ES26	P

**GABIONS** and Reno mattress have been used to stabilize stream banks for many years. Results have been mixed. While successful in many locations, gabions have failed where undermined or where the wire baskets have been damaged by abrasion or corrosion. Therefore, before specifying gabions for streambank stabilization, consideration should be given to the available substrate, pH, and anticipated sediment transport of the water. If these are not suitable, another form of stabilization should be considered.

Where gabions or Reno mattresses are proposed, they are typically installed as shown in Figure 15.3 or 15.4. As with other types of stabilization, sufficient details should be provided on the detail sheets to ensure their proper installation, and supporting calculations should be included in the narrative to show they are properly sized. Gabion and Reno mattress installations should be designed according to manufacturers' specifications.

Special attention should be given to preventing scour at the upstream and downstream ends of the baskets. Appropriate means to prevent undermining should also be taken.

**FIGURE 15.3  
Gabion Streambank Protection**



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



**Mountain  
Valley  
PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
GABION STREAMBANK PROTECTION	
DRAWING NO. MVP-ES27	REV. P

## BIOENGINEERING


A number of bioengineering techniques have been developed in recent years that effectively stabilize streambanks while providing a more natural appearance than is afforded by hard armor. The following are a few examples:

**Live stakes** are woody vegetative cuttings, typically willow, dogwood or other species tolerant of occasional flooding, that are capable of rooting when inserted into the ground. When properly prepared, handled, and placed, the stakes will root, grow, and form a stabilizing root mat. This mat reinforces the soil by binding soil particles, extracting excess moisture, and providing a protective cover.

Stakes should be freshly cut, healthy, straight, and at least 1 year old with side branches removed and bark intact. Cuttings should be ½" to 1 ½" diameter and 2 to 3 feet long. Bases should be cut cleanly at an angle to facilitate insertion into the soil. Tops should be square to aid in tamping.

### APPLICATIONS

- Live Stakes should be installed during the dormant period.
- They are an effective streambank protection where site conditions are uncomplicated, construction time is limited, and an inexpensive method is desired.
- Live Stakes can be used to repair small earth slips and slumps in frequently wet areas.
- They can be used to peg down some erosion control blankets.

DRAWN	DATE	 <b>Mountain Valley</b> PIPELINE	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED	DATE		BIOENGINEERING	
APP'D	DATE		DRAWING NO.	
SCALE N.T.S.	SHEET 1 OF 1		MVP-ES28.1	
JOB NO.	PROJECT ID:		REV.	
	PXXXX	P		
		DESIGN ENGINEERING		

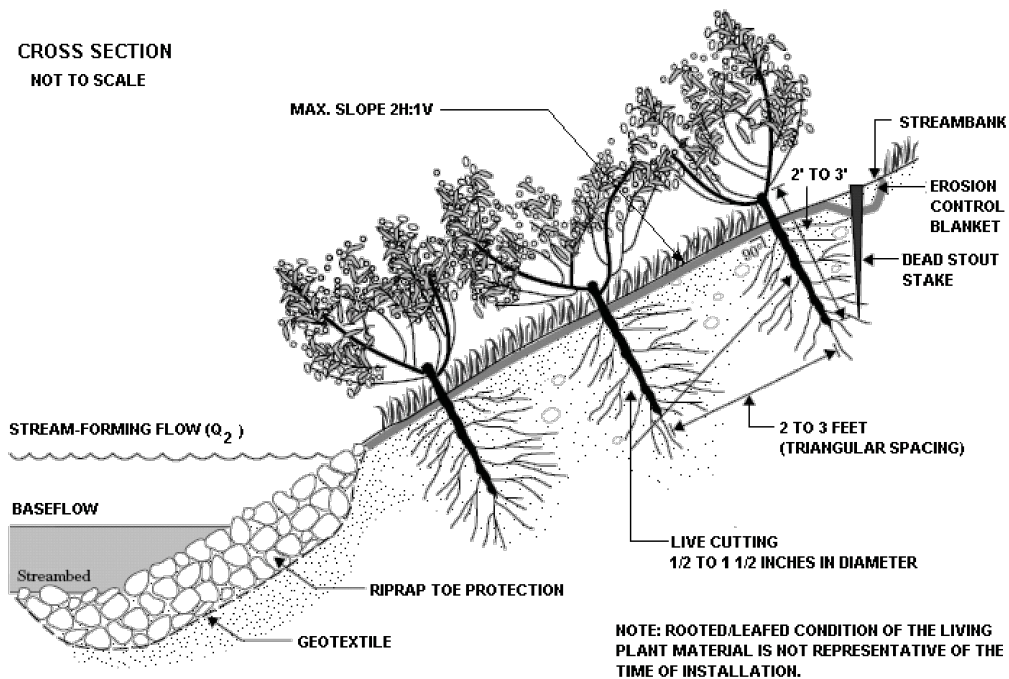


- Natural colonization by surrounding plant communities can be enhanced by the installation of live stakes.
- Intervening areas between other bioengineering techniques can be stabilized with live stakes.
- Live stakes enhance natural habitat.

**INSTALLATION GUIDELINES**


- Grade slopes to 2H:1V, or flatter for less cohesive soils or presence of sand lenses. Install suitable toe protection, such as properly sized riprap, below the stream-forming flow elevation (2-year storm =  $Q_2$ , often marked by a lack of vegetation).
- Erodible slopes should be blanketed prior to inserting cuttings.
- Keep cuttings fresh and moist after they have been cut into appropriate lengths. Cuttings should be installed the same day that they are prepared. If this is not possible, it is recommended that they be soaked 24 hours prior to installation.
- Tamp cuttings into the ground at 90 degrees to the slope and angled downstream. Approximately 4/5 of the cutting should be inserted into the ground. 2 to 5 bud scars should remain above ground. Buds should be oriented up, and soil should be firmly packed around the stake.
- Care should be taken to avoid splitting the stakes during installation. Split stakes should be replaced. If there is difficulty in tamping the stakes, an iron bar can be used to make a pilot hole.
- Stakes should be placed 2 to 3 feet apart using triangular spacing.

**FIGURE 15.6  
Live Stakes**



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
BIOENGINEERING	
DRAWING NO.	REV.
MVP-ES28.2	P

**Live fascines** are long bundles of branch cuttings bound together. They are typically placed in shallow trenches on slopes and streambanks to reduce erosion and shallow sliding.

Cuttings should be ¼" to 1" in diameter cut from species that root easily and have long, straight branches, such as willow or dogwood. They should be tied together with untreated twine to form a live fascine ranging from 5 to 10 feet long depending upon site conditions and handling limitations. Diameters of the bundles should be 6 to 8 inches. All buds should be oriented in the same direction. Cuttings should be staggered so that tops are evenly distributed length wise along the bundle.

**APPLICATIONS**

- Live fascines are an effective streambank stabilization technique. When properly installed, there is a minimum of site disturbance.
- Live fascines can be used to protect slopes from shallow — 1 to 2 foot depth — slides.
- Typically, live fascines are placed above the bankfull elevation, although for small watersheds (< 2,000 acres) they may be placed below the bankfull elevation.
- Live fascines offer immediate protection from surface erosion.
- Conditions for native plant colonization are enhanced.

**INSTALLATION GUIDELINES**


- Prepare the live fascine bundle and live stakes immediately prior to installation.
- Dig a 10" X 10" trench along contour at the base of the slope just above stream-forming flow, 2-year-24-hour peak flow elevation =  $Q_2$ . Note: A suitable toe protection such as, properly sized riprap, should be installed below the trench. See Figure 15.7.
- Additional trenches should be spaced on the slope at intervals shown in Table 15.1.
- Intervals between trenches should be seeded, mulched, and covered with a suitable erosion control blanket.
- Place live fascine into the trench as shown in Figure 15.7.
- Drive dead stakes directly through the live fascine until flush with the top of the bundle. Use extra stakes at bundle overlaps.
- Tamp in live stakes immediately downslope (adjacent to) the bundle leaving the top 3" of the live stake exposed.
- Place moist soil along the sides of the bundles leaving the top of the live fascine slightly exposed.

**TABLE 15.1  
Live Fascine Spacing (ft)**

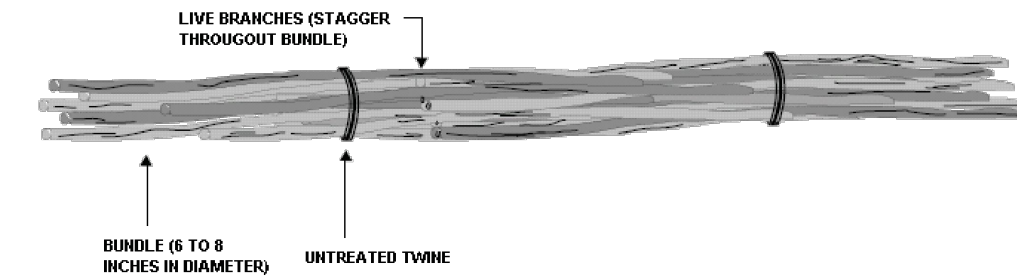
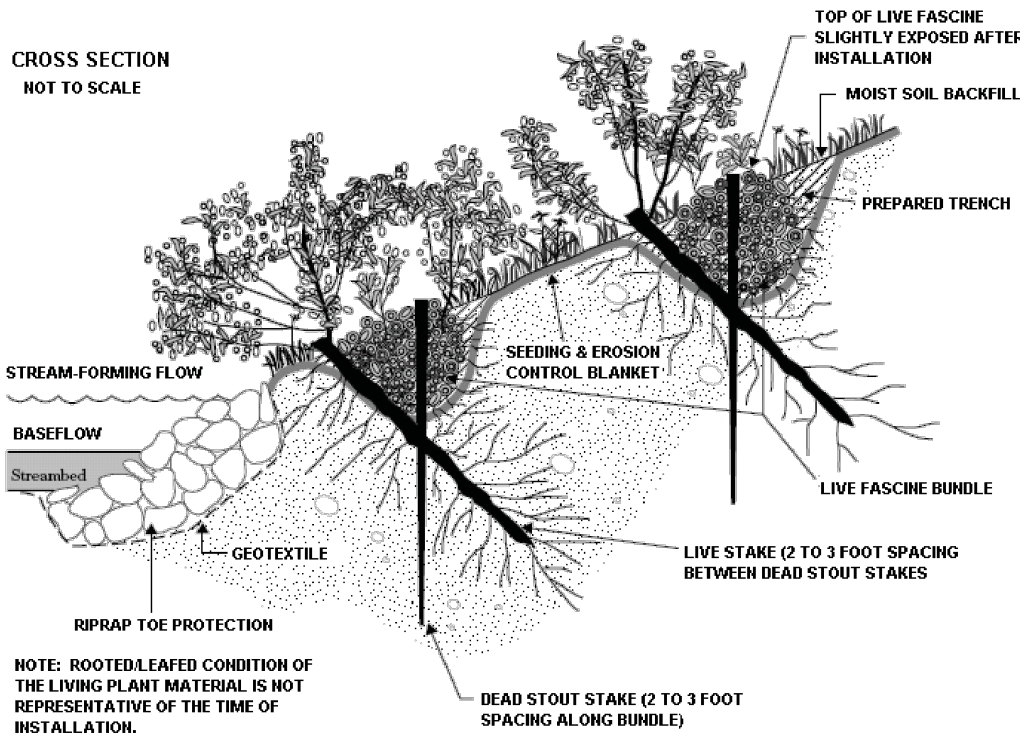
Slope Steepness	Predominant Soils		
	Erosive	Non-erosive	Fill
3H:1V or flatter	3 to 5	5 to 7	3 to 5 *
Up to 1H:1V	3*	3 to 5	Not recommended

\* Not recommended alone

Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

<b>DRAWN</b>	<b>DATE</b>	 <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		LIVE FASCINES	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b> MVP-ES29.1	<b>REV.</b> P
<b>JOB NO.</b>				
<b>PROJECT ID:</b> PXXXX				

**FIGURE 15.7**  
**Live Fascines**



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
LIVE FASCINES	
DRAWING NO.	REV.
MVP-ES29.2	P

**Branchpacking** is the alternating of layers of live branches and compacted backfill to repair small scour holes and slips in streambanks. It provides a filter barrier that prevents erosion from bankfull and overbank flows. Branchpacking rapidly establishes a vegetated streambank and enhances colonization by native vegetation.

Soil is immediately reinforced. The live branches serve as tensile reinforcement. Once the plant tops begin to grow, the branchpacking system becomes increasingly effective in retarding runoff and minimizing erosion. Sediment trapped by the vegetation refills the hole, while the roots spread throughout the surrounding soil to form a unified mass.


The live branches should range from ½” to 2” in diameter and be long enough to reach from the undisturbed soil at the back of the trench and extend slightly from the rebuilt streambank.

**APPLICATIONS**

- Branchpacking is an effective means of repairing holes in streambanks ranging from 2 to 4 feet in height and depth.
- It is typically not effective in repairing slump areas greater than 4 feet high or 4 feet deep.

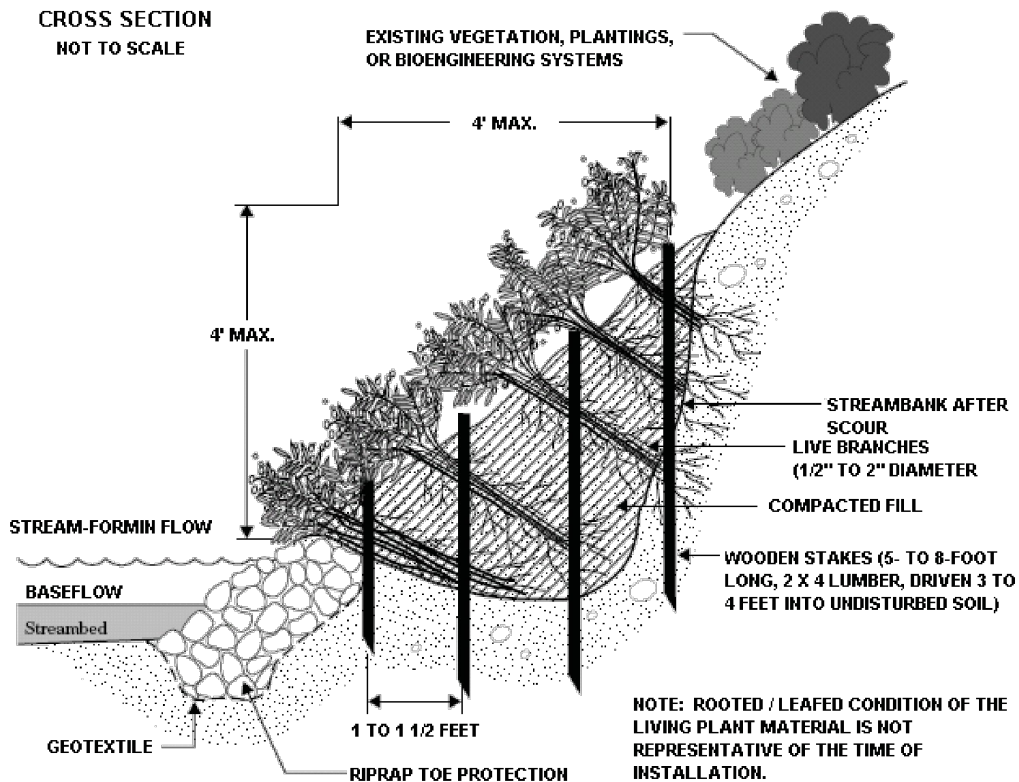
**INSTALLATION GUIDELINES**

- Divert any concentrated upslope runoff away from the repair area.
- Prepare the cuttings immediately prior to installation.
- Install suitable toe protection, such as properly sized riprap or fiber log, below the stream-forming flow elevation (2-year storm elevation =  $Q_2$ ).

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		BRANCHPACKING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES30.1	P
<b>PROJECT ID:</b>				
PXXXX				

- Beginning at the lowest point just above the  $Q_2$  elevation, drive wooden stakes vertically 3 to 4 feet into the ground. Stakes should be spaced 1 to 1 ½ feet apart as shown in Figure 15.8.
- Place initial layer of branches 4" to 6" thick in the bottom of the hole, between the vertical stakes and perpendicular to the slope face. Branches should be placed in a crisscross pattern with buds generally pointing toward the slope face. Basal ends of the branches should touch the undisturbed soil at the back of the hole.
- Cover each layer of branches with a layer of compacted soil to ensure soil contact with the branches.
- Subsequent layers of branches should be installed with the basal ends lower than the growing tips.
- The final layer should conform to the existing slope.

**FIGURE 15.8**  
**Branchpacking**



Adapted from USDA, NRCS, *Engineering Field Handbook*, Chapter 16

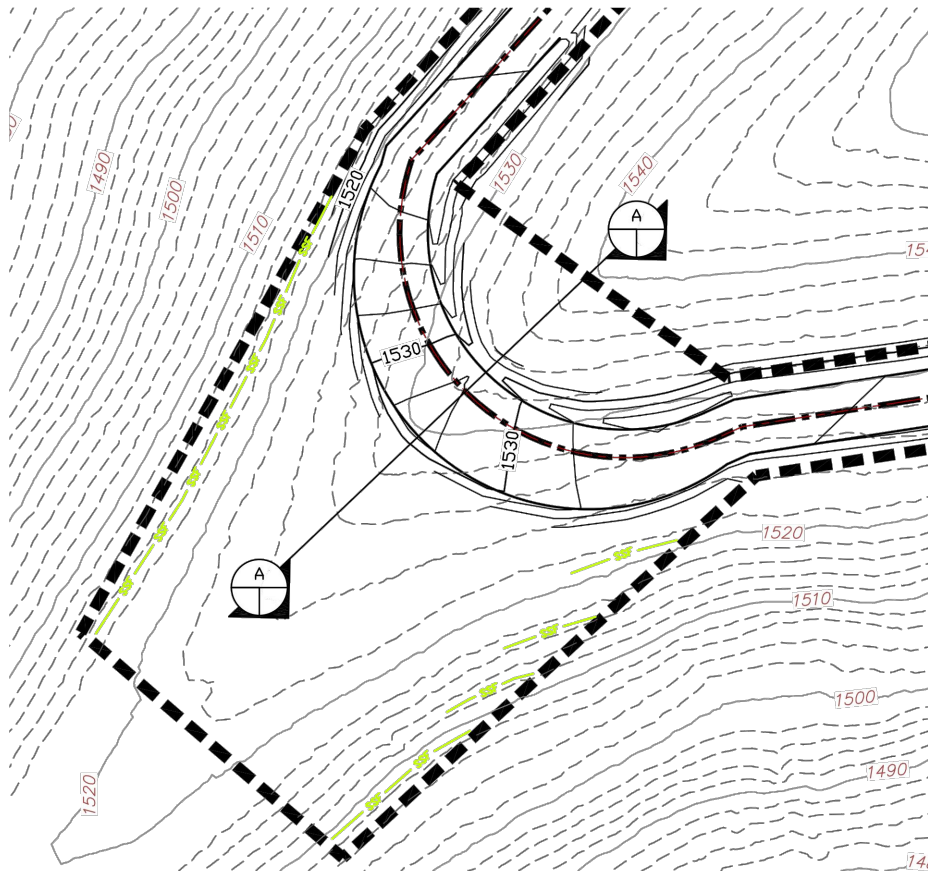
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SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX

**Mountain Valley PIPELINE**

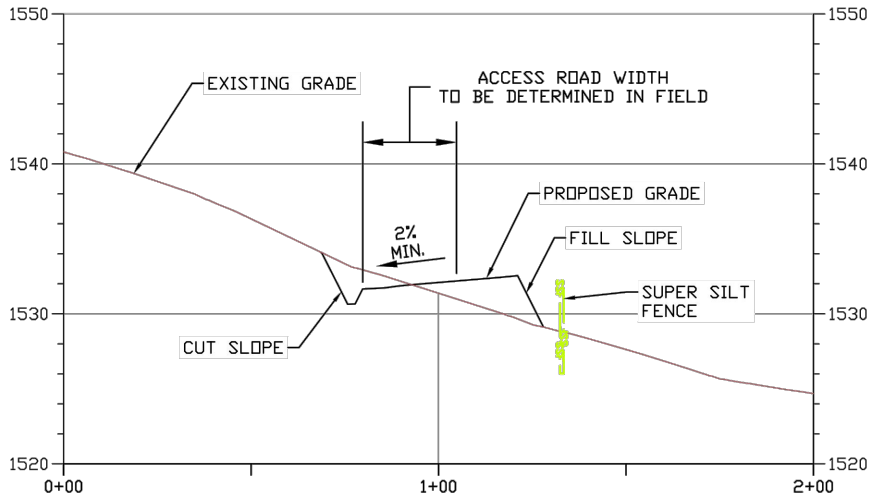
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
BRANCHPACKING	
DRAWING NO.	REV.
MVP-ES30.2	P





PLAN VIEW  
SCALE: 1" = 50'



PROFILE VIEW A-A  
SCALE: N.T.S.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

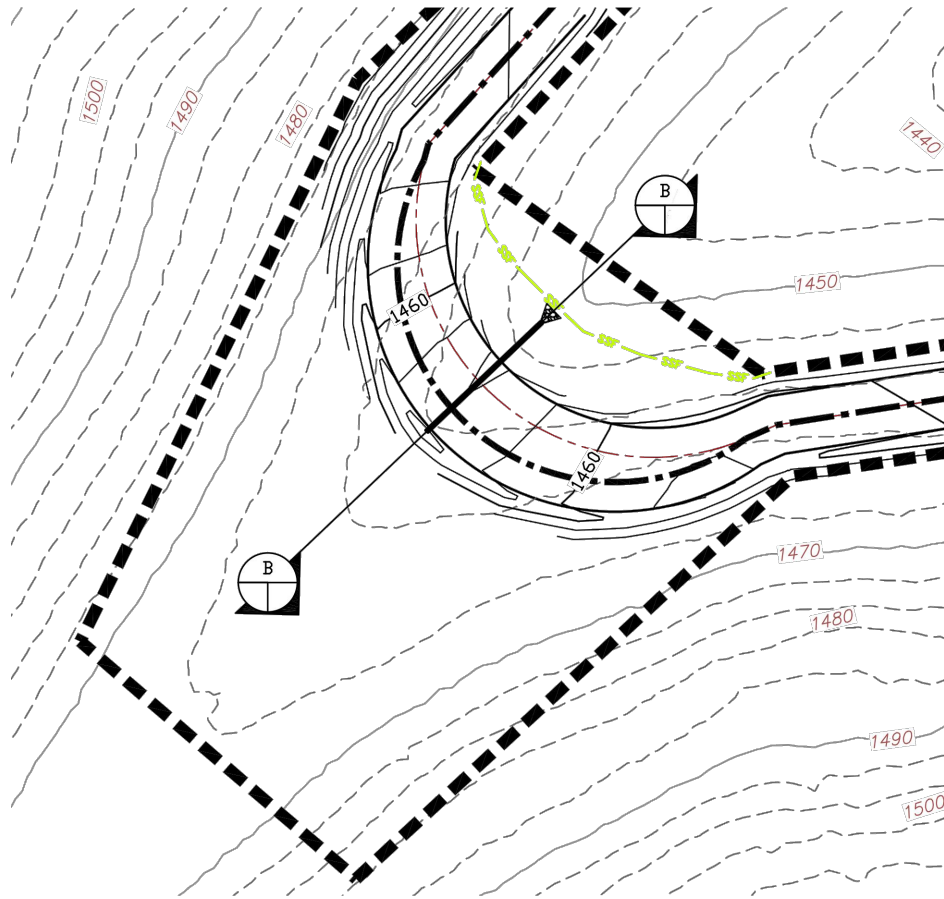
**ENVIRONMENTAL DETAIL**

ATWS VEHICLE TURNING  
RADIUS NOSE DETAIL

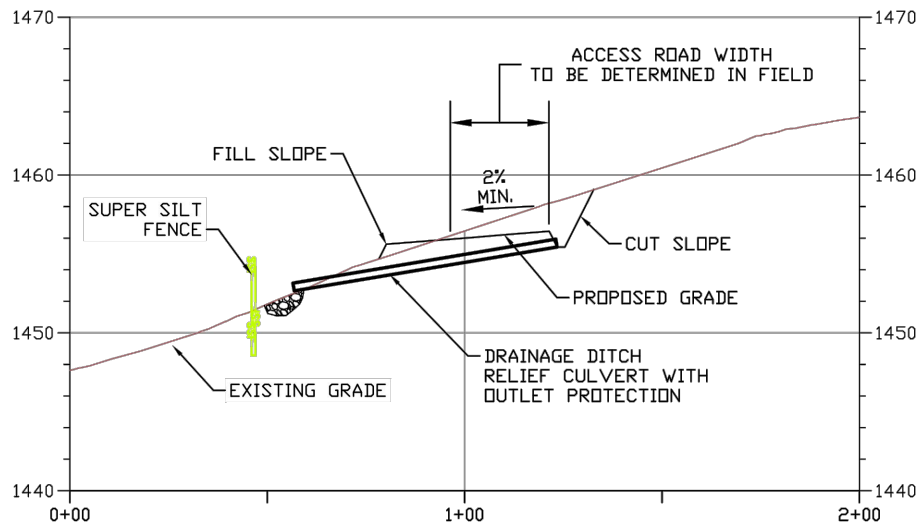
DRAWING NO.  
MVP-ES31

REV.  
P





PLAN VIEW  
SCALE: 1" = 50'



PROFILE VIEW B-B  
SCALE: N.T.S.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE

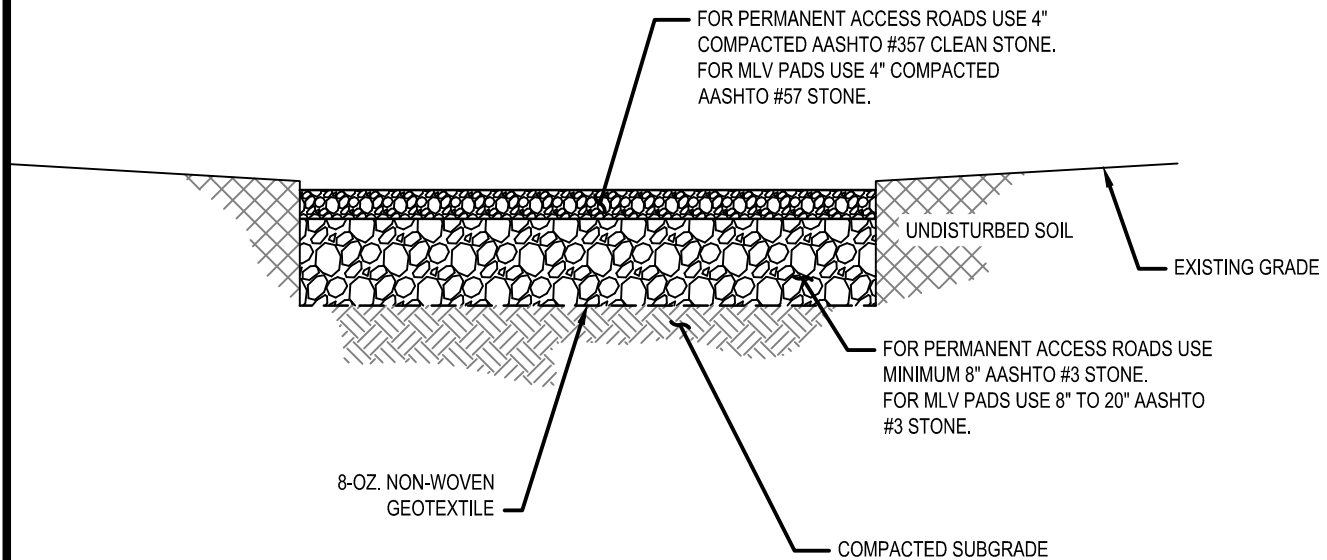
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

ATWS VEHICLE TURNING  
RADIUS VALLEY DETAIL

DRAWING NO.  
MVP-ES32

REV.  
P



**NOTES:**

1. THICKNESS OF AASHTO #3 STONE/AGGREGATE LAYER FOR MLV PADS TO BE BETWEEN 8" AND 20" DEPENDING ON THE STORAGE VOLUME NEEDED TO MEET STORMWATER QUANTITY REQUIREMENTS.
2. THICKNESS OF AASHTO #3 STONE/AGGREGATE LAYER FOR ACCESS ROADS TO BE A MINIMUM OF 8" OR MORE AS DIRECTED.
3. COMPACT SUBGRADE PRIOR TO BACKFILL PLACEMENT. FOR BACKFILL, A MIN. 95% COMPACTION (ASTM D 698) IS REQUIRED.
4. UNSUITABLE MATERIAL SHALL BE REMOVED PRIOR TO SUBGRADE COMPACTION AND BACKFILL PLACEMENT. ADDITIONAL SUBGRADE COMPACTION NOT REQUIRED FOR MLV PADS.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



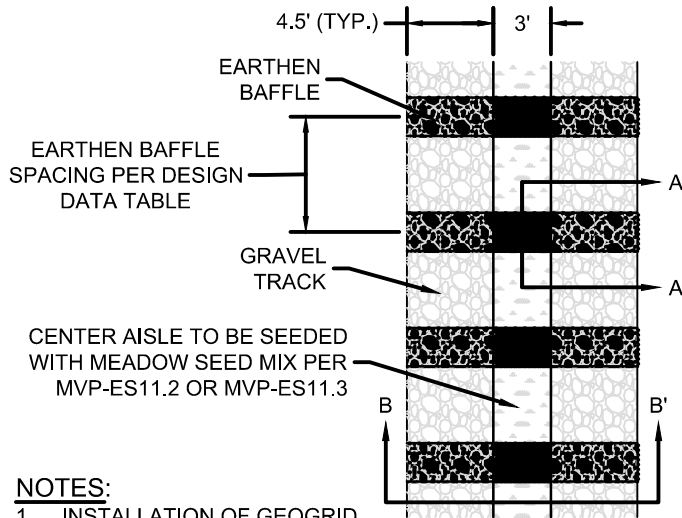
**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

GAP GRADED GRAVEL DETAIL  
FOR MAINLINE VALVE PADS &  
PERMANENT ACCESS ROADS

DRAWING NO.  
MVP-ES33

REV.  
P



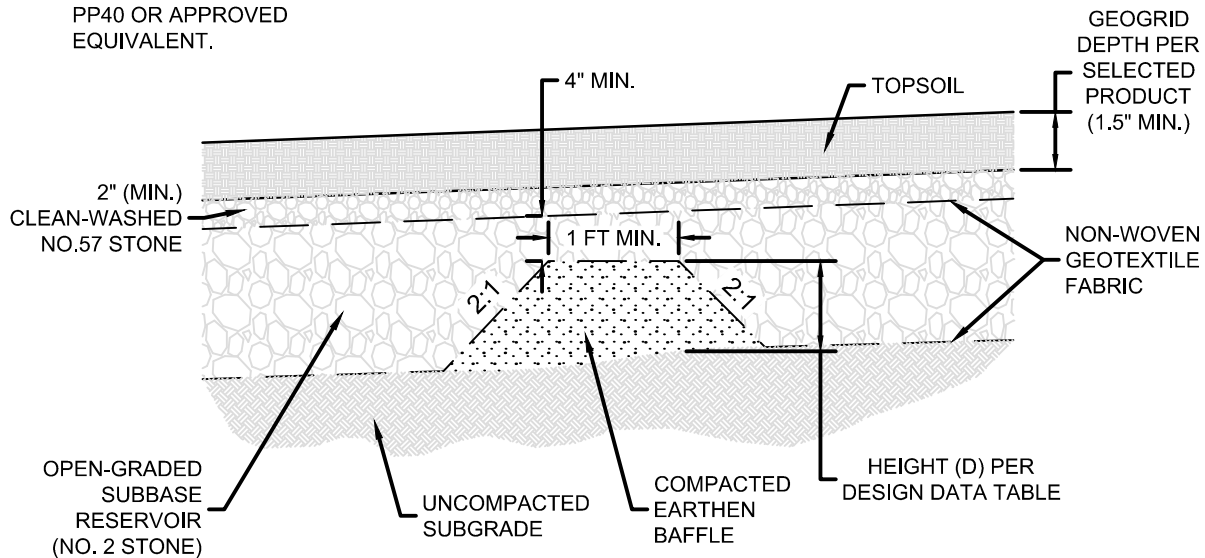
DESIGN DATA*					
Site	Road Length (ft)	Road Slope (ft/ft)	# of Baffles	Baffle Spacing (ft)	Baffle Height (ft)
MVP-MLV-AR-25	50	0.41	1	50	1
	920	0.12	1	920	1
	683	0.057	1	683	1
MVP-MLV-AR-26	12.5	0.06	1	12	1
	8.4	0.24	0	0	0
	22	0.053	1	22	1.25
	7	0.10	0	0	0
MVP-MLV-AR-27	17	0.18	1	17	1
	200	0.074	5	40	1
	121	0.026	2	60	1
	89	0.099	2	44	1
	54	0.301	1	54	1
	253	0.367	1	253	1
	129	0.051	4	32	1
	92	0.028	2	46	1
	127	0.202	1	127	1
	200	0.082	5	40	1

\*Refer to Stormwater Management Narrative for baffle design equations.

**NOTES:**

1. INSTALLATION OF GEOGRID SHALL BEGIN AT 5-FEET FROM THE EDGE OF PUBLIC / VDOT ROADS TO ACCOMMODATE ANY CULVERTS AND TURNING OF TIRES.
2. GEOGRID SHALL NOT BE INSTALLED IN THE MAIN LINE VALVE PAD AREAS.
3. GEOGRID SHALL BE SUREGREEN PP40 OR APPROVED EQUIVALENT.

**PLAN VIEW**  
NOT TO SCALE



**XS: A-A'**  
NOT TO SCALE

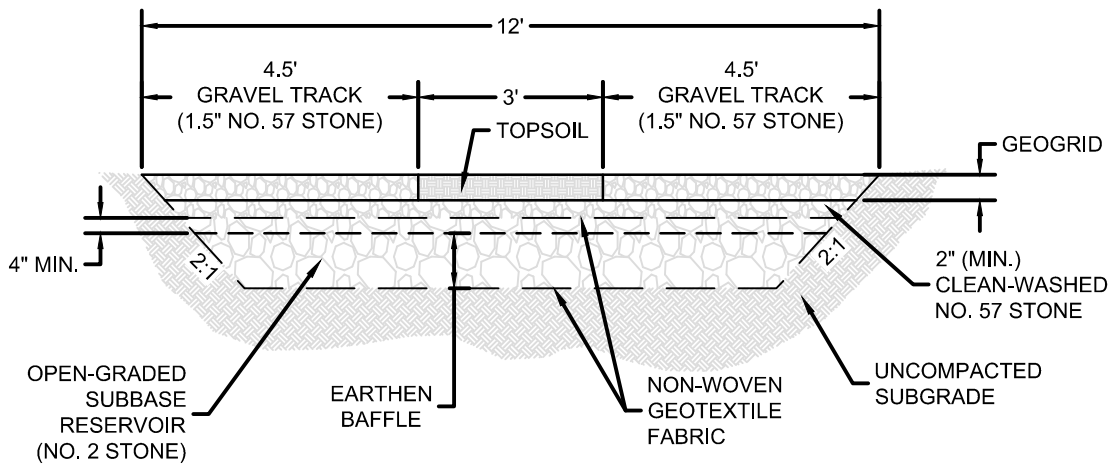
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CHECKED	DATE
APP'D	DATE 01/31/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

GAP GRADED GRAVEL DETAIL FOR MAINLINE VALVE PADS & PERMANENT ACCESS ROADS

DRAWING NO.	REV.
MVP-ES33.1	P



**XS: B-B'**  
**NOT TO SCALE**

**CONSTRUCTION SEQUENCE**

1. CONSTRUCTION OF THE ACCESS ROAD BAFFLES SHALL ONLY BEGIN AFTER THE ENTIRE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.
2. INFILTRATION TESTS SHALL BE PERFORMED AT THE RATE OF ONE INFILTRATION TEST PER SOIL GROUP OR AT THE RATE OF ONE PER 500 LINEAR FEET OF ACCESS ROAD, WHICHEVER IS GREATER.
3. WHERE POSSIBLE, EXCAVATORS OR BACKHOES SHOULD WORK FROM THE SIDES TO EXCAVATE THE RESERVOIR LAYER TO ITS APPROPRIATE DESIGN DEPTH AND DIMENSIONS TO PREVENT COMPACTION.
4. NATIVE SOILS ALONG THE BOTTOM AND SIDES SHOULD BE SCARIFIED OR TILLED TO A DEPTH OF 3 TO 4 INCHES PRIOR TO THE PLACEMENT OF THE FILTER FABRIC.
5. INSTALL COMPACTED EARTHEN BAFFLES TO THE SPECIFIED DESIGN HEIGHT.
6. FILTER FABRIC SHOULD BE INSTALLED ON THE BOTTOM AND THE SIDES OF THE RESERVOIR LAYER, AND THE COMPACTED EARTHEN BAFFLE. FILTER FABRIC STRIPS SHOULD OVERLAP DOWN-SLOPE BY A MINIMUM OF 2-FEET, AND BE SECURED A MINIMUM OF 4-FEET BEYOND THE EDGE OF THE EXCAVATION. EXCESS FILTER FABRIC SHOULD NOT BE TRIMMED UNTIL THE SITE IS FULLY STABILIZED.
7. MOISTEN AND SPREAD 6-INCH LIFTS OF OPEN-GRADED NO. 2 STONE SUBBASE RESERVOIR. MAINTAIN 4-INCH MINIMUM DEPTH OF NO. 2 STONE LAYER OVER COMPACTED EARTHEN BAFFLE.
8. INSTALL FILTER FABRIC ON TOP OF SUBBASE RESERVOIR.
9. INSTALL 2-INCH LAYER OF CLEAN-WASHED CHOKER STONE.
10. PLACE GEOGRID AND FILL WITH GRAVEL AND TOPSOIL PER GRAVEL TRACK WIDTHS AND CENTER AISLE WIDTH. GRAVEL TRACKS SHALL BE NO. 57 STONE.
11. SEED CENTER AISLE WITH MEADOW SEED MIX PER MVP-ES11.2 OR MVP-ES11.3.

**CONSTRUCTION INSPECTION**

1. DAILY INSPECTION SHALL INCLUDE NUMBER AND LOCATION OF BAFFLES AS WELL AS CLEANLINESS AND SIZING OF STONE FOR ROAD AND MLV PADS. IN ADDITION GEOTEXTILE WILL BE INSPECTED FOR MATERIAL PROPERTIES AND CORRECT INSTALLATION.

**MAINTENANCE**

1. DURING MAIN LINE VALVE ANNUAL MAINTENANCE ACTIVITIES, PERFORM A VISUAL INSPECTION OF THE ACCESS ROAD TO IDENTIFY EROSION ISSUES, SEDIMENT DEPOSITION, ORGANIC DEBRIS AND STAINING OR PONDING THAT MAY INDICATE CLOGGING.
2. GRASSED CENTER AISLE SHALL BE MOWED AT THE SAME INTERVAL AS MAIN LINE VALVE MAINTENANCE ACTIVITIES.
3. GRASSED CENTER AISLE WILL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM AND MATURE ENOUGH TO SURVIVE AND INHIBIT EROSION.

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 01/31/18</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

GAP GRADED GRAVEL DETAIL  
FOR MAINLINE VALVE PADS &  
PERMANENT ACCESS ROADS

<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES33.2	P

STORMWATER MANAGEMENT CALCULATIONS DEVELOPED FOR MAINLINE VALVE PADS AND PERMANENT ACCESS ROADS ARE FOUND IN THE STORMWATER QUANTITY CALCULATIONS

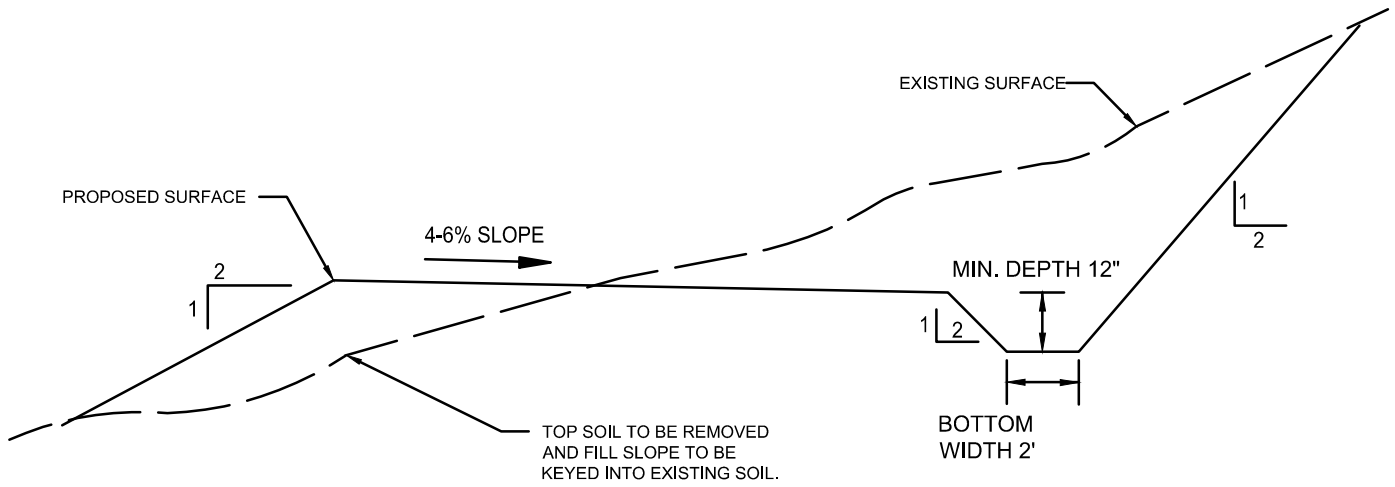
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<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 01/31/18</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**Mountain Valley PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
GAP GRADED GRAVEL DETAIL FOR MAINLINE VALVE PADS & PERMANENT ACCESS ROADS	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES33.3	P



**NOTE:**

1. INSLOPE WITH DITCH SECTION FOR USE ON STEEP SLOPE AND AREAS WITH POOR SOILS.
2. EROSION CONTROL MATTING TO BE INSTALLED ON CUT AND FILL SLOPES STEEPER THAN 3H:1V. SLOPES LESS THAN 3H:1V WILL BE MULCHED PER MVP-ES45 TO MVP-ES45.5.

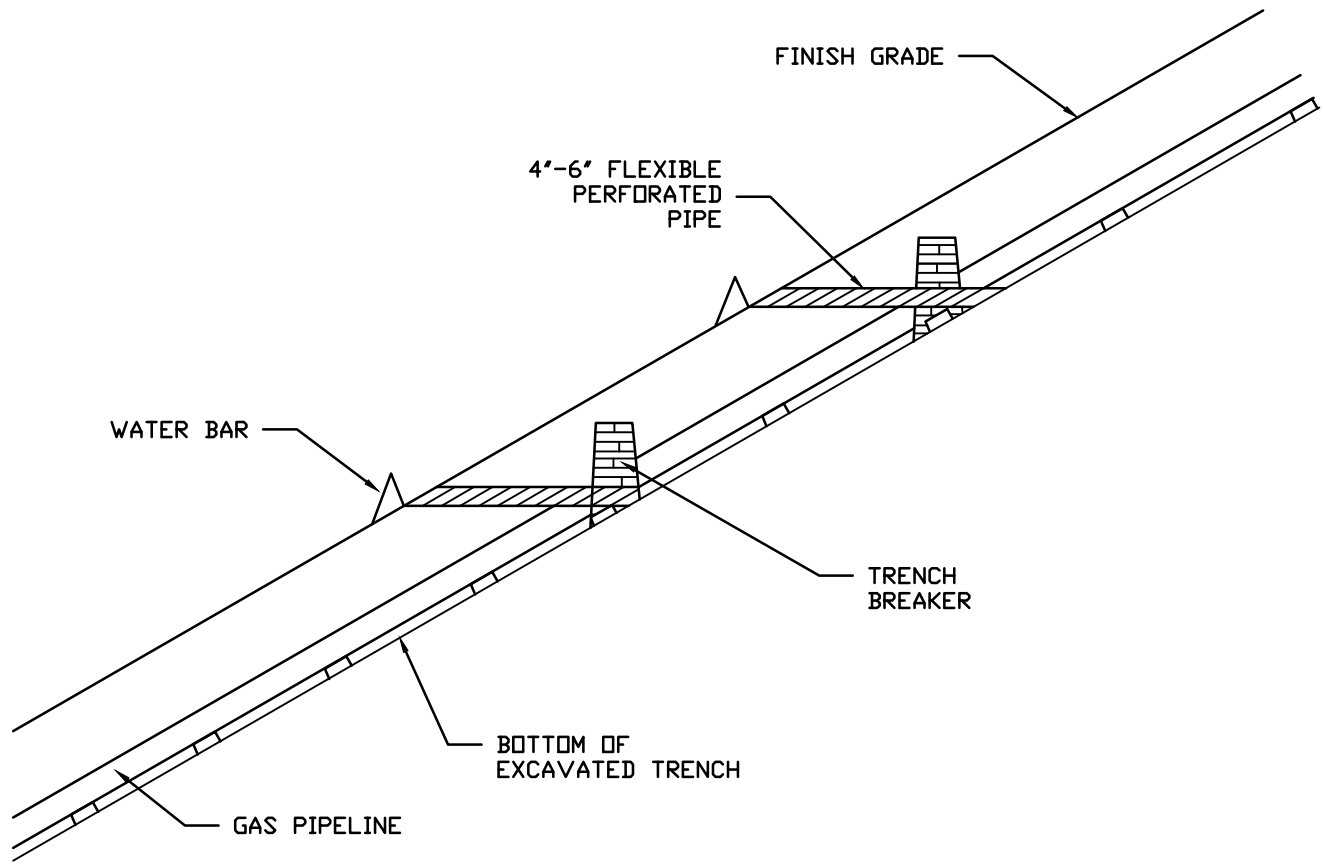
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
PROPOSED ACCESS ROAD TYPICAL SECTION	
DRAWING NO. MVP-ES34	REV. P





**NOTE:**

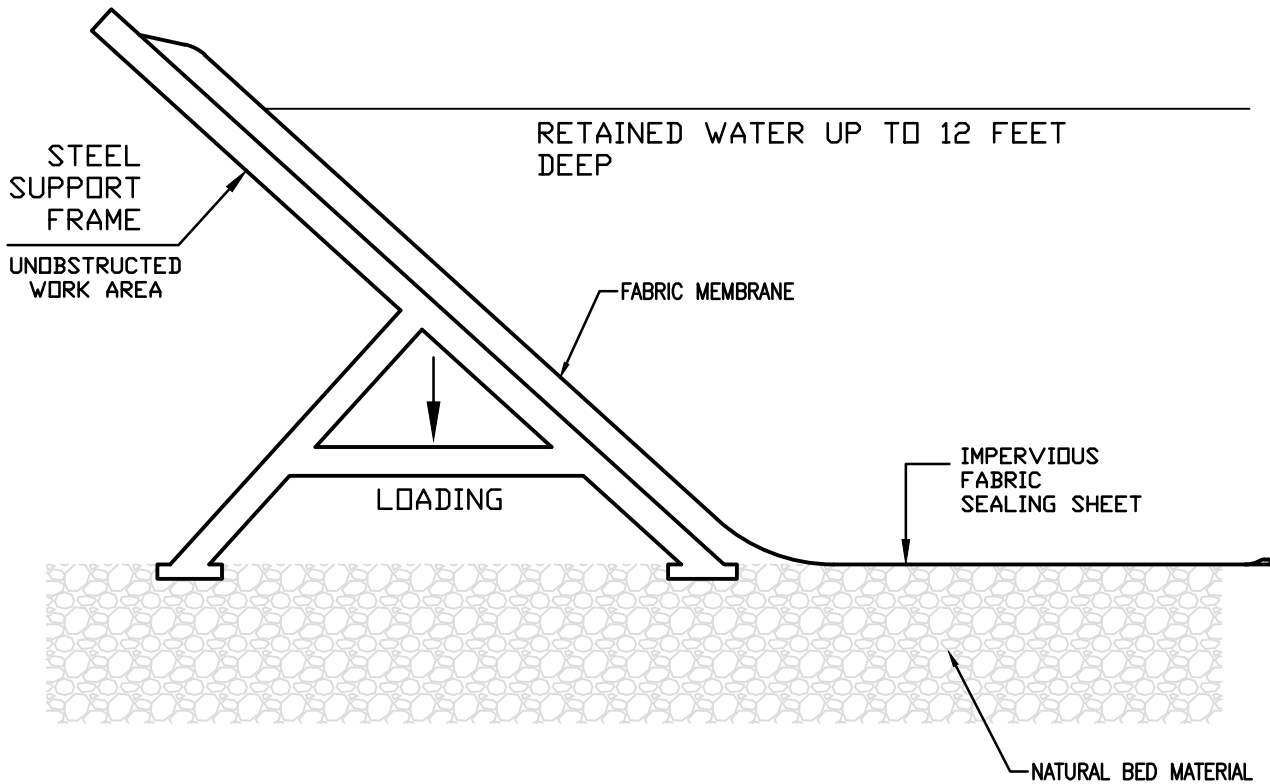
4'-6' FLEXIBLE PERFORATED PIPE TO BE INSTALLED AT TRENCH BREAKERS ON STEEP SLOPES TO DRAIN SUBSURFACE WATER INTO WATER BARS.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: PXXXX	



**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TRENCH DETAIL	
DRAWING NO. MVP-ES35	REV. P



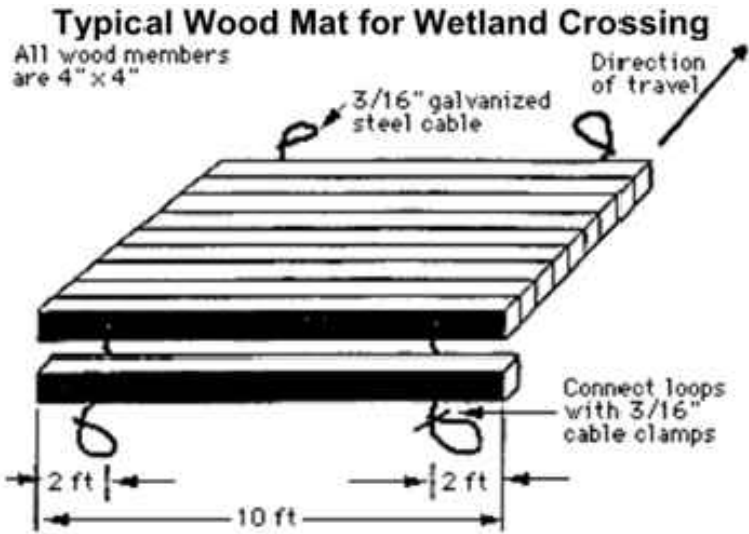
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CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
POSTADAM DETAIL	
DRAWING NO.	REV.
MVP-ES36	P



University of Minnesota FS 07009  
**A geotextile underlayment shall be used under the wood mat.**

Source: PaDEP, E&S Pollution Control Manual, March 2012

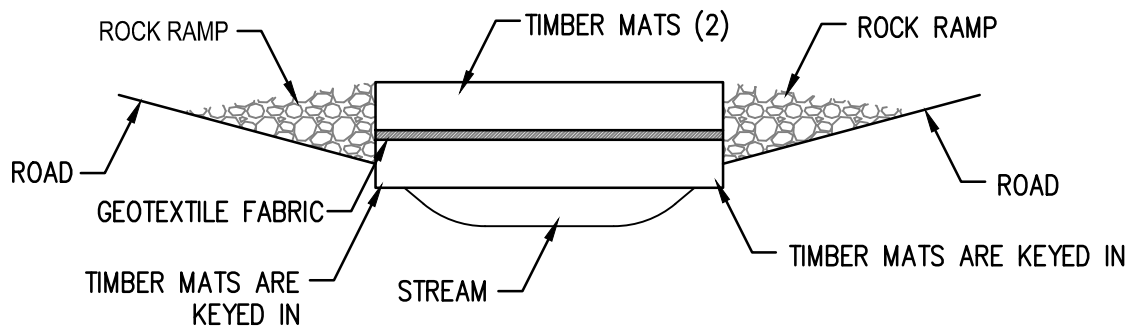
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CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
 PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TIMBER MAT/WETLAND CROSSING	
DRAWING NO.	REV.
MVP-ES37	P



NOTES:

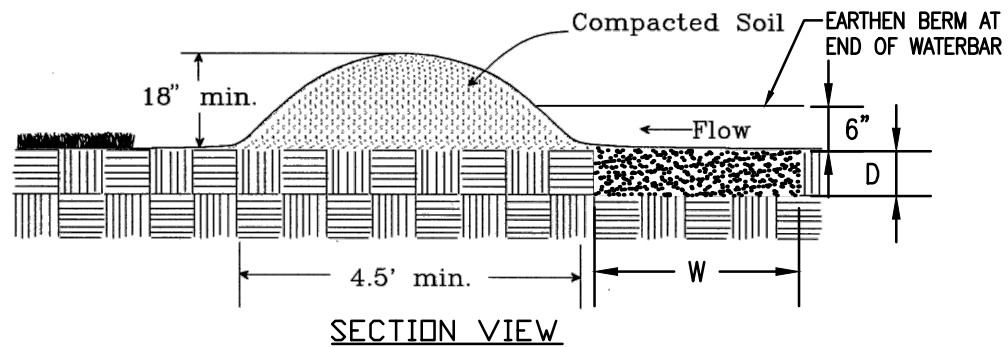
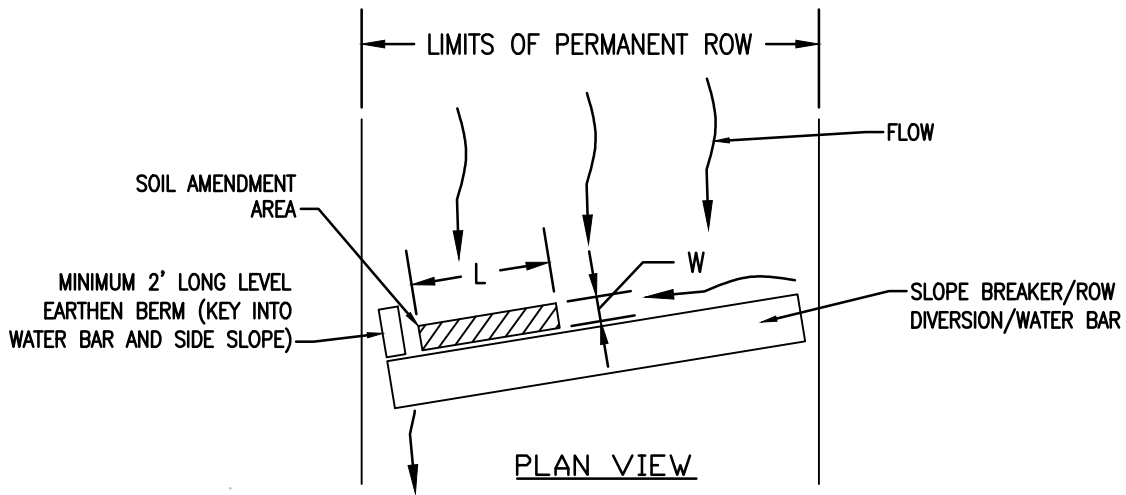
1. GEOTEXTILE FABRIC INSTALLED BETWEEN TIMBER MATS.
2. GEOTEXTILE FABRIC WILL BE WRAPPED AROUND THE SIDES OF THE TOP MAT AND SECURED.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING


<b>ENVIRONMENTAL DETAIL</b>	
FORD CROSSING EXAMPLE	
DRAWING NO.	REV.
MVP-ES37.1	P



**NOTES**

1. WIDTH "W" OF SOIL AMENDMENT PER PERMANENT DIVERSION DIKE/WATERBAR WITH SOIL AMENDMENT SCHEDULE.
2. THE INCORPORATION DEPTH "D" IS ASSUMED TO BE 1 FT PER TABLE 4.3 IN VA DEQ STORMWATER DESIGN SPEC #4. AN INCORPORATION DEPTH OF 2 FT IS USED IN CASES WHERE ADDITIONAL STORAGE CAPACITY IS NEEDED IN ORDER TO MEET WATER QUANTITY REQUIREMENTS.
3. DEVELOPED FROM VA. DSWC PLATE 3.09-1.
4. SEE SHEET 0.7, TEMPORARY RIGHT OF WAY DIVERSION/WATERBAR ADDITIONAL DETAILS FOR PLAN VIEW.

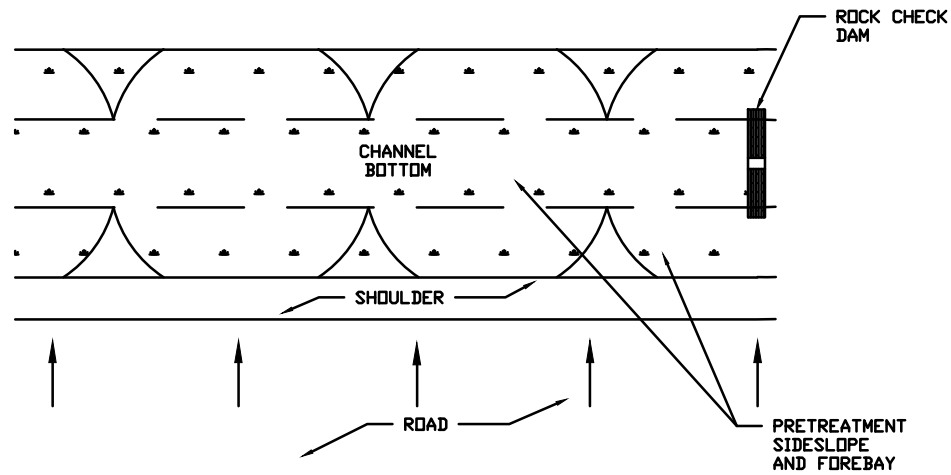
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APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



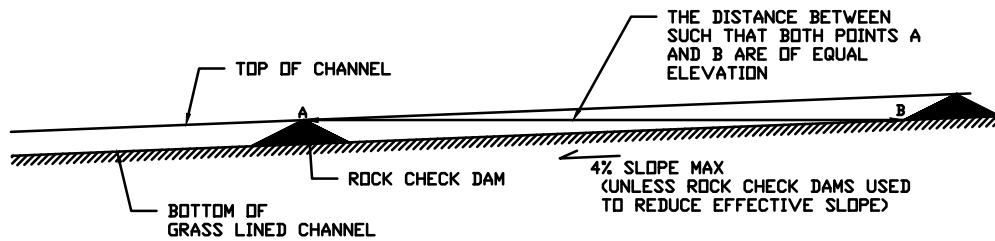
**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

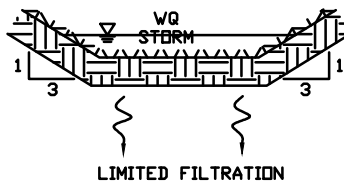
<b>ENVIRONMENTAL DETAIL</b>	
DIVERSION DIKE/WATERBARS WITH COMPOST	
DRAWING NO.	REV.
MVP-ES38	P



PLAN



LONGITUDINAL PROFILE



TYPICAL SECTION

NOTES:

1. GRASS LINED CHANNEL TO BE SIZED PER VIRGINIA BMP CLEARINGHOUSE SPECIFICATION NO. 3.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

PERMANENT GRASS-LINED CHANNEL

DRAWING NO.  
MVP-ES39

REV.  
P





NOTES:

A BONDED FIBER MATRIX (BFM) IS AN EFFECTIVE METHOD OF STABILIZING STEEP SLOPES WHEN USED PROPERLY. BMFs MAKE USE OF A CROSS-LINKED HYDROCOLLOID TACKIFIER TO BOND THERMALLY PROCESSED WOOD FIBERS. APPLICATION RATES VARY ACCORDING TO SITE CONDITIONS. FOR SLOPES UP TO 3H:1V THE BFM SHOULD BE APPLIED AT A RATE OF 3,000 LB/ACRE. STEEPER SLOPES MAY NEED AS MUCH AS 4,000 LB/ACRE.

BMFs SHOULD ONLY BE USED WHEN NO RAIN IS FORECASTED FOR AT LEAST 48 HOURS FOLLOWING THE APPLICATION. THIS IS TO ALLOW THE TACKIFIER SUFFICIENT TIME TO CURE PROPERLY. ONCE PROPERLY APPLIED, A BFM IS TYPICALLY 90% EFFECTIVE IN PREVENTING ACCELERATED EROSION. BMFs SHOULD NOT BE APPLIED BETWEEN SEPTEMBER 30 AND APRIL 1.

A POLYMER STABILIZED FIBER MATRIX (PSFM) CAN ALSO BE AN EFFECTIVE METHOD OF STABILIZING STEEP SLOPES WHEN USED PROPERLY. PSFMs MAKE USE OF A LINEAR SOIL STABILIZING TACKIFIER THAT WORKS DIRECTLY ON SOIL TO MAINTAIN SOIL STRUCTURE, MAINTAIN PORE SPACE CAPACITY AND FLOCCULATE DISLODGED SEDIMENT THAT WILL SIGNIFICANTLY REDUCE RUNOFF TURBIDITY. PROPERLY APPLIED, A PSFM MAY BE AS MUCH AS 99% EFFECTIVE.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
BONDED FIBER MATRIX	
DRAWING NO.	REV.
MVP-ES40	P

Typical Polymer Stabilized Fiber Matrix Application Rates							
Maximum Rainfall of $\leq 20''$							
SLOPE	6:1	5:1	4:1	3:1	2:1	1.5:1	1:1
Soil Stabilizer (gals/acre)	4	5	6	7	8	9	10
Fiber (lb/acre)	1,500	1,500	1,500	1,800	2,000	2,500	3,000
Maximum Rainfall of $> 20''$ and for Site Winterization							
SLOPE	$\leq 5:1$	4:1	$\geq 3:1$				
Soil Stabilizer (gals/acre)	6	8	10				
Fiber (lb/acre)	2,000	2,500	3,000				

**NOTES:**

UNLIKE ROLLED BLANKETS, THERE IS NO NEED TO SMOOTH THE SLOPE PRIOR TO APPLICATION OF HYDRAULICALLY APPLIED BLANKETS. IN FACT SOME ROUGHENING OF THE SURFACE, EITHER NATURAL OR MECHANICALLY INDUCED, IS PREFERABLE. HOWEVER, LARGE ROCKS, THOSE  $> 9$  INCHES, AND EXISTING RILLS SHOULD BE REMOVED PRIOR TO APPLICATION. TRACKING OR GROOVING OF SLOPES SHOULD BE CONSIDERED TO SLOW WATER FLOWS DURING A STORM EVENT. SLOPE INTERRUPTION DEVICES SUCH AS STAIR STEP GRADING OR BENCHING SHOULD BE APPLIED PRIOR TO THE APPLICATION. MIXING AND APPLICATION RATES SHOULD FOLLOW MANUFACTURER'S RECOMMENDATIONS.

HYDRAULICALLY APPLIED BLANKETS ARE TYPICALLY APPLIED IN TWO STAGES. UNLESS SPECIFICALLY RECOMMENDED TO BE APPLIED IN ONE APPLICATION BY THE MANUFACTURER, THE SEED MIXTURE AND SOIL AMENDMENTS SHOULD BE APPLIED FIRST. IF THE SEED IS APPLIED AT THE SAME TIME AS THE HYDRAULICALLY APPLIED BLANKET, THE BONDED FIBERS MAY KEEP THE SEED FROM MAKING SUFFICIENT CONTACT WITH THE SOIL TO GERMINATE. AFTER THE SEED MIXTURE IS APPLIED, THE BFM, FGM, OR PSFM SHOULD BE SPRAYED OVER THE AREA AT THE REQUIRED APPLICATION RATE. (SEE ABOVE TABLES)

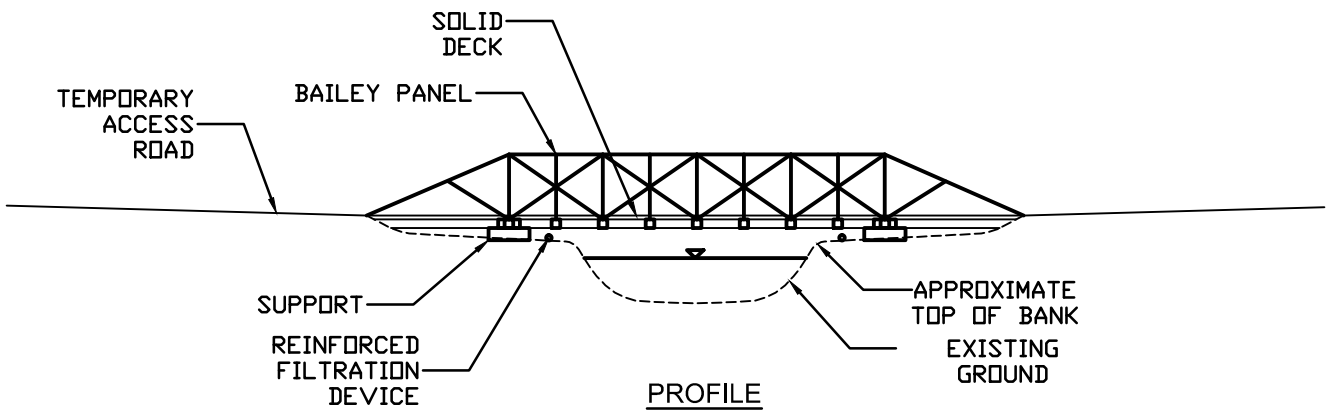
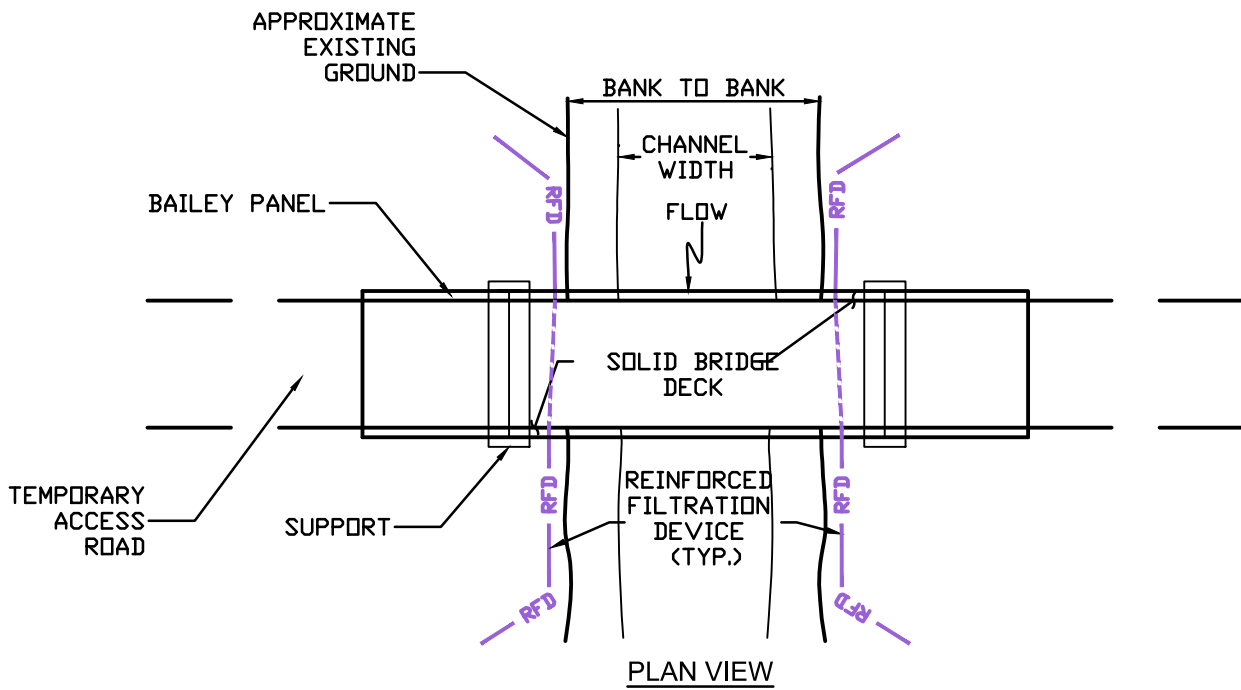
HYDRAULIC EROSION CONTROL PRODUCTS (HEPC USED ON JNF LANDS MUST BE SUITABLE FOR WILDLIFE

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
BONDED FIBER MATRIX	
DRAWING NO.	REV.
MVP-ES40.1	P



DRAWN	DATE
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APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

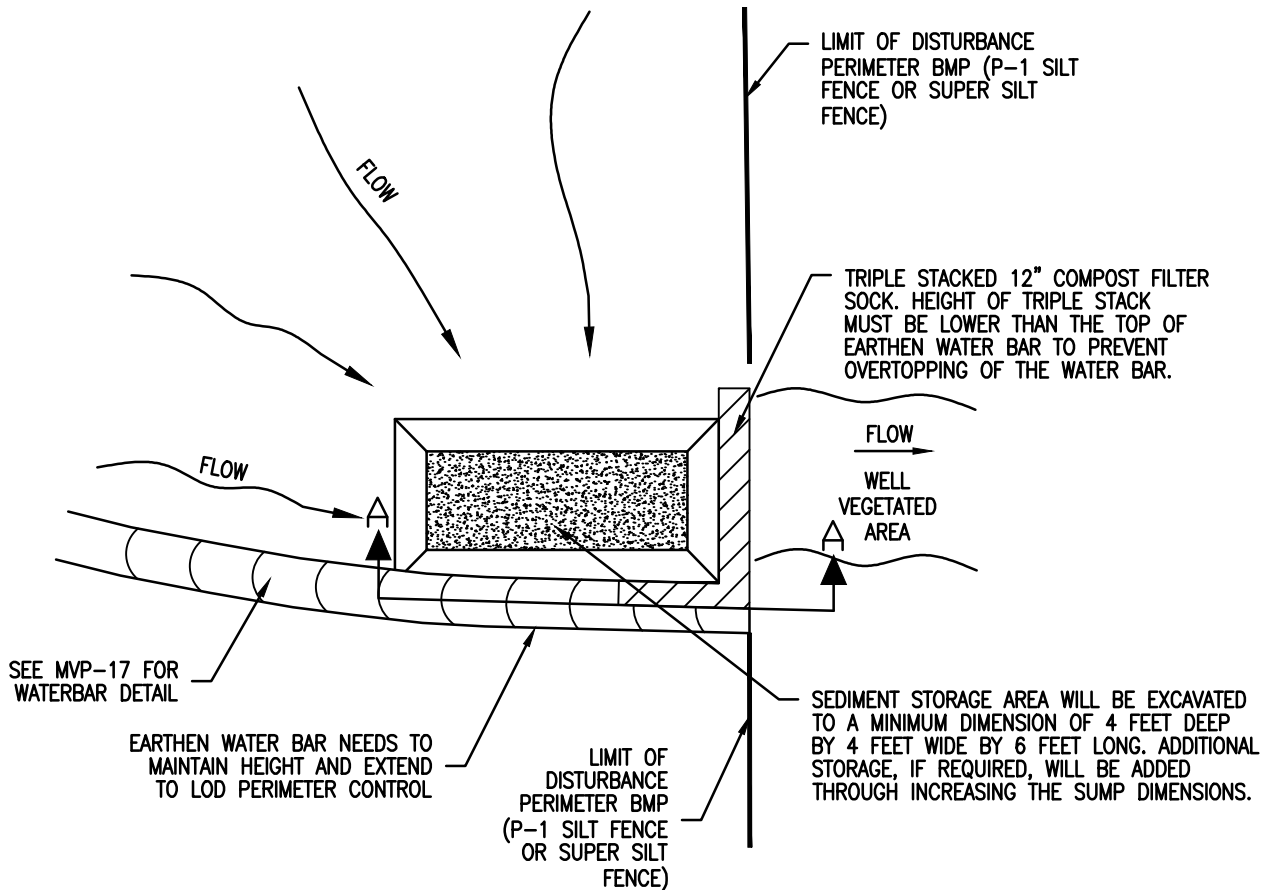


**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

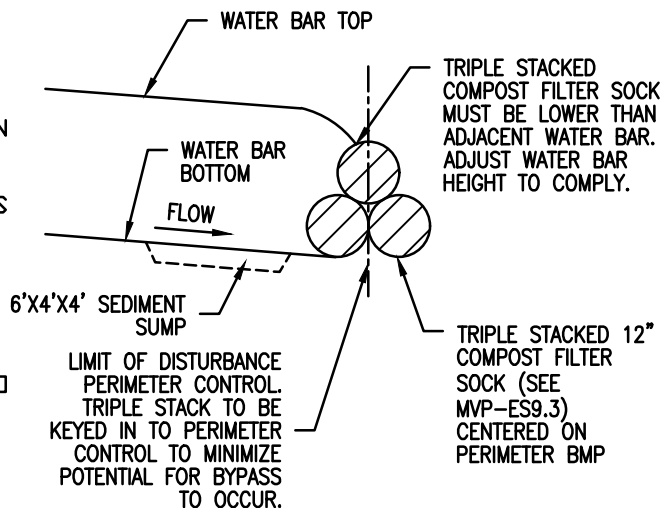
<b>ENVIRONMENTAL DETAIL</b>	
MODULAR TEMPORARY BAILEY BRIDGE	
DRAWING NO.	REV.
MVP-ES41	P

# CONDEMNATION



**NOTES:**

1. SUMP FILTER MAY BE USED IN CONJUNCTION WITH TEMPORARY WATERBAR (AS DIRECTED BY EI/LEI).
2. SUMP FILTER SHALL BE LOCATED ENTIRELY WITHIN THE LIMITS OF DISTURBANCE.
3. BMP SHOULD BE CHECKED EVERY 4 BUSINESS DAYS AND NO LATER THAN 48-HOURS FOLLOWING A MEASURABLE RAINFALL EVENT FOR SEDIMENT ACCUMULATION, PROPER OPERATION, AND COMPOST FILTER SOCK INTEGRITY.
4. ADDITIONAL COMPOST FILTER SOCKS MAY BE NECESSARY BEYOND WHAT IS SHOWN ON DETAIL TO MEET INTENDED BMP REQUIREMENTS.
5. REFER TO MVP-17 SERIES FOR ADDITIONAL SPECIFICATION REQUIREMENTS.



## SECTION A-A

DRAWN	JK	DATE	06/16/2020
CHECKED	RE	DATE	06/16/2020
APP'D	DW	DATE	06/16/2020
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

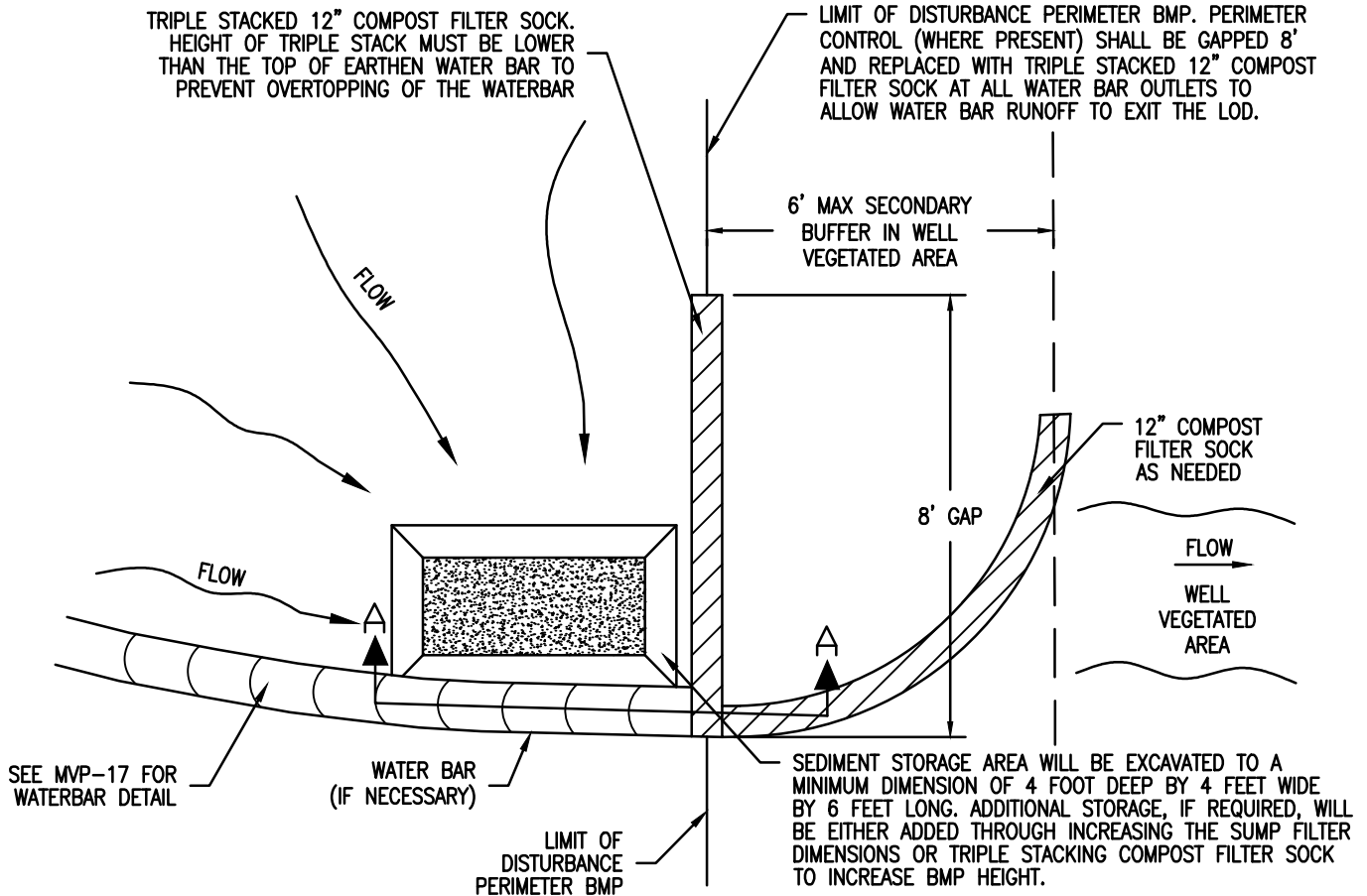
DESIGN ENGINEERING

### ENVIRONMENTAL DETAIL

TYPICAL SUMP FILTER  
(CONDEMNATION)

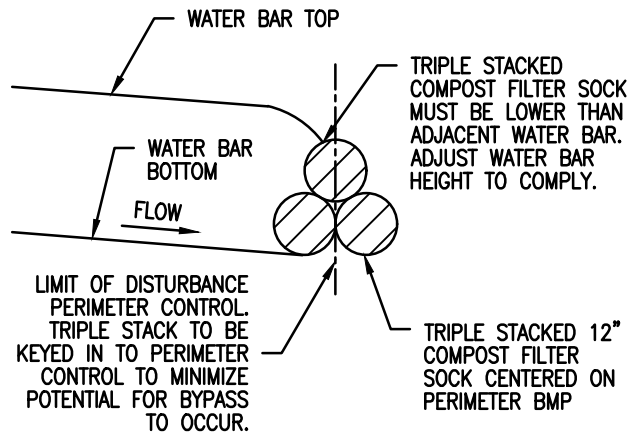
DRAWING NO.	REV.
MVP-ES42	P

# NON-CONDEMNATION



**NOTES:**

1. SUMP FILTER MAY BE USED IN CONJUNCTION WITH TEMPORARY WATERBAR (AS DIRECTED BY OWNER REPRESENTATIVE).
2. SUMP FILTER SHALL BE LOCATED ENTIRELY WITHIN THE LIMITS OF DISTURBANCE.
3. BMP SHOULD BE CHECKED EVERY 4 BUSINESS DAYS AND NO LATER THAN 48-HOURS FOLLOWING A MEASURABLE RAINFALL EVENT FOR SEDIMENT ACCUMULATION, PROPER OPERATION, AND COMPOST FILTER SOCK INTEGRITY.
4. ADDITIONAL COMPOST FILTER SOCKS MAY BE NECESSARY BEYOND WHAT IS SHOWN ON DETAIL TO MEET INTENDED BMP REQUIREMENTS.
5. REFER TO MVP-17 SERIES FOR ADDITIONAL SPECIFICATION REQUIREMENTS.



## SECTION A-A

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/27/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**DESIGN ENGINEERING**

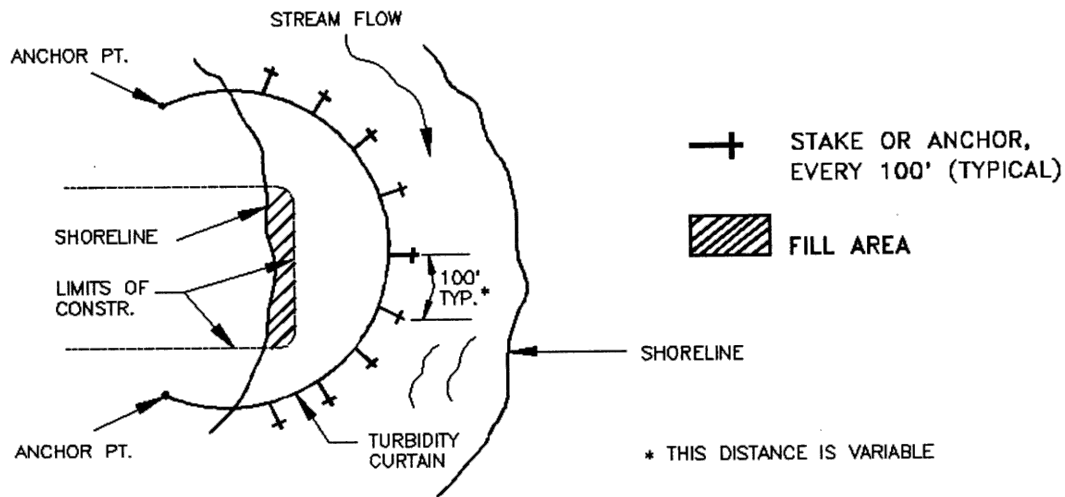
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TYPICAL SUMP FILTER  
(NON-CONDEMNATION)

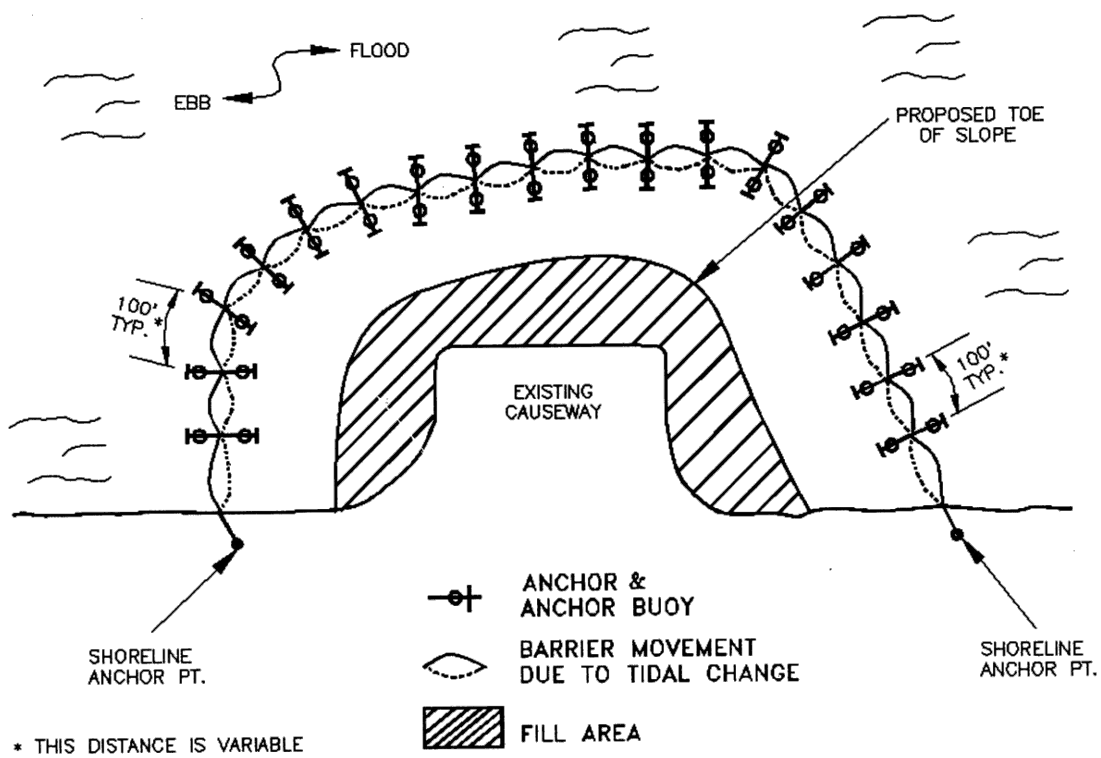
DRAWING NO.	REV.
MVP-ES42.1	P



# TYPICAL LAYOUTS: STREAMS, PONDS & LAKES (PROTECTED & NON-TIDAL)



# TIDAL WATERS AND/OR HEAVY WIND & WAVE ACTION



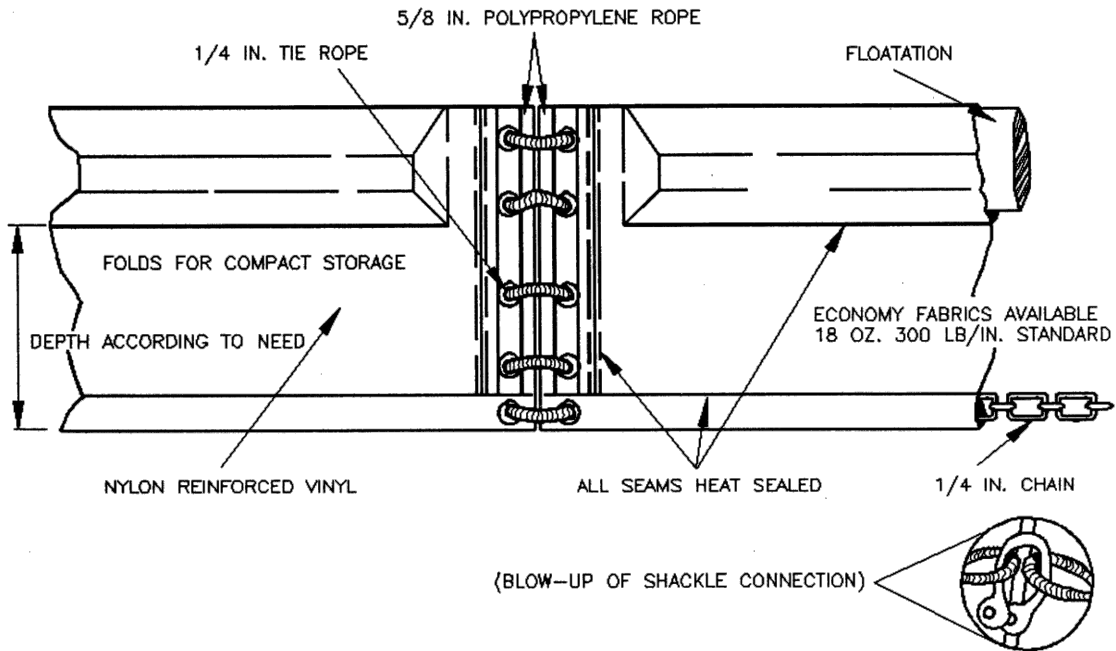
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TURBIDITY CURTAIN DETAIL	
DRAWING NO.	REV.
MVP-ES43	P



# TYPE I



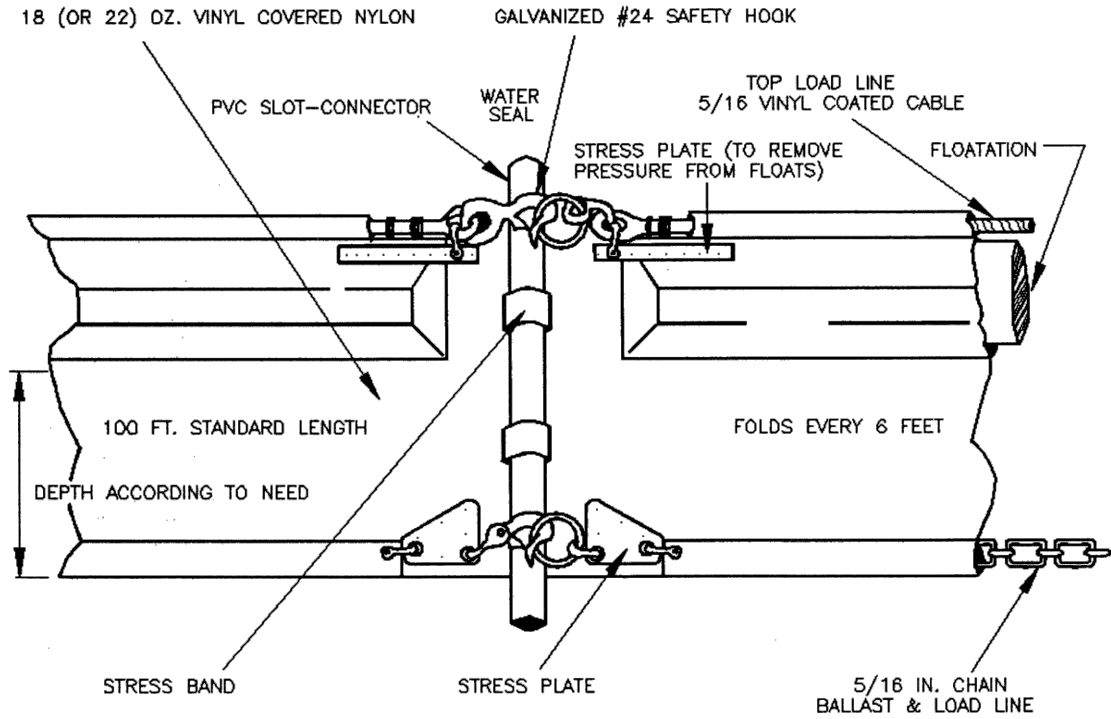
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CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TURBIDITY CURTAIN DETAIL	
DRAWING NO.	REV.
MVP-ES43.1	P

## TYPE II

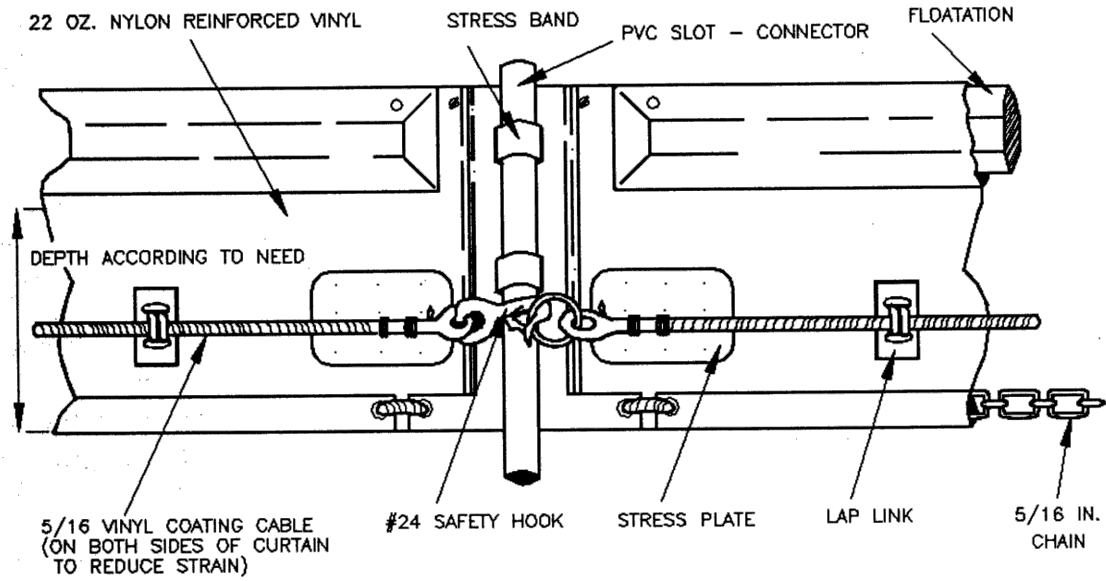


DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	


**Mountain Valley**  
 PIPELINE  
 DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TURBIDITY CURTAIN DETAIL	
DRAWING NO.	REV.
MVP-ES43.2	P

# TYPE III



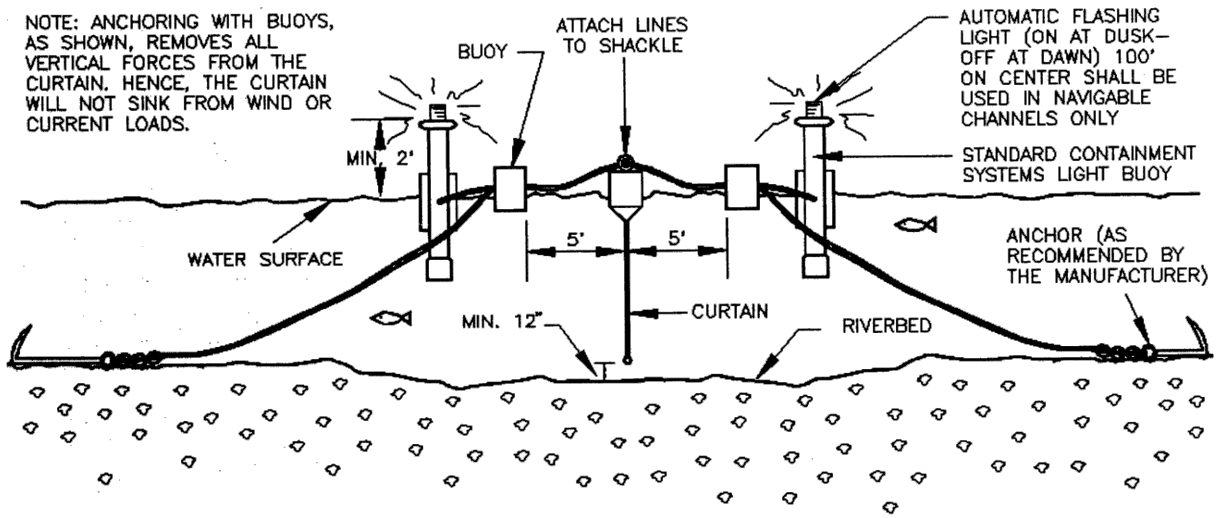
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TURBIDITY CURTAIN DETAIL	
DRAWING NO.	REV.
MVP-ES43.3	P

## ORIENTATION WHEN INSTALLED (TIDAL SITUATION – TYPE III)



DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TURBIDITY CURTAIN DETAIL	
DRAWING NO.	REV.
MVP-ES43.4	P

# POST-CONSTRUCTION STREAM CROSSING STABILIZATION FOR M.V.P.

## Definition

A series of erosion and sediment control measures to limit the formation of rills and/or gullies in the landscape approaching the edge of a stream, river and other waterbody, within the permanent natural gas pipeline right-of-way.

## Purpose

To minimize erosion potential along the edge of stream, river or other water body as a result of the change in land use in the permanent right-of-way of a pipeline.

## Conditions Where Practice Applies


Applicable to stream, river or other water body crossings within the natural gas pipeline right-of-way.

## Planning Considerations

Permanent water bars with compost filter socks and sump filters with discretionary streambank swales are required at all stream, river and other waterbody crossings in accordance with the spacing and sizing requirements shown on Plates 1-4

Based on visual observation of the post-construction field conditions by MVP Design Engineering and the MVP Environmental Inspector, the necessity for and location of streambank swales will be determined. Considerations will include but are not limited to locations where there is visual evidence of existing (or formation of) rills and/or gullies along the streambank and/or concentrated flow along the streambank with anticipated potential for erosion.

Sediment must be periodically removed from the sump filter and compost filter sock to maintain the required depth. Plans shall detail how excavated sediment is to be disposed of, such as by use in fill areas on site or removal to an approved off-site location.

<b>DRAWN</b>	<b>DATE</b>	 <p style="font-size: 1.2em; margin: 0;"><b>Mountain</b></p> <p style="font-size: 1.5em; margin: 0; color: #0070C0;"><b>Valley</b></p> <p style="font-size: 0.8em; margin: 0;">PIPELINE</p> <p style="font-size: 1.2em; margin: 0;"><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		POST CONSTRUCTION STREAM CROSSING STABILIZATION	
<b>APP'D</b>	<b>DATE</b> 08/11/17			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1			
<b>JOB NO.</b>			<b>DRAWING NO.</b> MVP-ES44	
<b>PROJECT ID:</b> MVP – VA PORTION		<b>REV.</b> P		

**Design Criteria**

As detailed on Plates 1-3, design criteria per specific erosion and sediment control measures include:

Water Bars / Slope Breakers

Permanent water bars will be installed twenty-five (25) feet from edge of stream, river or other waterbody crossing as shown on Plate 2. Slopes greater than 65% may require site specific stabilization measures based on field conditions as approved by MVP Design Engineering and MVP Environmental Inspector.

Excavation of Sump Filter

Side slopes of sump filter should be no steeper than 1:1. The minimum depth of excavation should be one (1) foot.

Compost Filter Sock

Since the sump filter will function as a pre-treatment for sediment removal, calculation of the 2-year velocity over the compost filter sock size conservatively assumes that the sump filter is full of sediment and in need of maintenance and that no flow is occurring through the sock due to clogging or sediment deposition.

The outfall velocity from this BMP should be non-erosive for the 2-year design storm. The 2-year velocities shall meet the criteria in Table 3.99-D-A. Due to the anticipated small size of contributing drainage area, the Rational Method shall be used to calculate discharge:

$$Q = CiA$$

where,

$$Q = \text{discharge (ft}^3\text{/sec)}$$

$$i = \text{Rainfall intensity (inches/hour)}$$

$$A = \text{Contributing drainage area (acres)}$$

Discharge over the compost filter sock is calculated using the broad-crested weir equation:

$$Q = C_d L H^{3/2}$$

where,

$$Q = \text{Discharge over weir (ft}^3\text{/sec)}$$

$$C_d = \text{Weir Coefficient}$$

$$L = \text{Length of weir crest (ft)}$$

$$H = \text{Overtopping depth (ft)}$$

The velocity over the weir is calculated using the following equation:

$$v = Q/A$$

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 08/11/17</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
POST CONSTRUCTION STREAM CROSSING STABILIZATION	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES44.1	P



where,

$v = \text{Velocity (ft/sec)}$

$Q = \text{Discharge over weir (ft}^3\text{/sec)}$

$A = \text{Flow area over weir (ft}^2\text{)}$

<b>TABLE 3.99-D-A</b>	
<b>PERMISSIBLE VELOCITIES FOR EARTH LININGS</b>	
Soil Types	Corrected Permissible Velocities (ft./sec.)
Fine Sand (noncolloidal)	2.0
Sandy Loam (noncolloidal)	2.0
Silt Loam (noncolloidal)	2.4
Ordinary Firm Loam	2.8
Fine Gravel	4.0
Stiff Clay (very colloidal)	4.0
Graded, Loam to Cobbles (noncolloidal)	4.0
Graded, Silt to Cobbles (colloidal)	4.4
Alluvial Silts (noncolloidal)	4.4
Alluvial Silts (colloidal)	4.0
Coarse Gravel (noncolloidal)	4.8
Cobbles and Shingles	4.4
Shales and Hard Pans	4.8

**NOTE:** Correction factor value = 0.8 for flow depths less than one foot has been applied to original table.  
Source: Chapter 5, Engineering Calculations: Table 5-22 and Plate 5-39, *Virginia Erosion and Sediment Control Handbook*, 3rd Ed., 1992.

Example

Given: A one-acre drainage area in Giles County, an 18-inch diameter compost filter sock with an effective level weir length of 8 feet, in a Sandy Loam soil installed per details in Plate 2.

Solution:


1. Calculate the discharge:

$$Q = CiA = 0.9 * 4.07 \text{ inches/hour} * 1 \text{ acre} = 3.66 \text{ ft}^3\text{/sec}$$

2. Rearranging the weir equation to solve for overtopping depth:

$$H = (Q / (C_D * L))^{\frac{2}{3}} = (3.66 \text{ ft}^3\text{/sec} / (2.99 * 8 \text{ ft}))^{\frac{2}{3}} = 0.29 \text{ ft}$$

3. Calculate the velocity over the compost filter sock:

DRAWN	DATE	 <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION	
APP'D	DATE 08/11/17			
SCALE N.T.S.	SHEET 1 OF 1		DRAWING NO. MVP-ES44.2	
JOB NO.				
PROJECT ID: MVP - VA PORTION				

$$v = Q/A = 3.66 \text{ ft}^3/\text{sec} / (0.29 \text{ ft} * 8 \text{ ft}) = 1.60 \text{ ft/sec}$$

4. Verify that the velocity is non-erosive in Table 3.99-D-A for Sandy Loam soil.  
 $1.60 \text{ ft/sec} < 2.0 \text{ ft/sec}$

Streambank Swale

Minimum thickness (T, as shown on Streambank Swale Typical Cross Section on Plate 3) shall be two (2) times the D<sub>50</sub>. For drainage areas one (1) acre or less, rock shall have a minimum D<sub>50</sub> = 6" and T = 12 inches for stream banks with a slope of 1:1 or flatter (i.e. S<sub>o</sub>=1.0 ft/ft). If the contributing drainage area is greater than one (1) acre or if the swale is steeper than 1:1 (1.0 ft/ft), the plans shall provide calculations to determine an appropriate size stone and minimum thickness. Rock may be salvaged on-site materials and may contain topsoil, fines, sand, gravel in a mix with at least 60% rock with a D<sub>50</sub> of at least 6".

Calculations (from VDOT Drainage Manual Appendix 7B-5)

Given: A one-acre drainage area in Giles County from previous example.

Solution:

CHANNEL DATA

Q = 3.66 (cfs)                      P = 3.02 (ft.)                      n = 0.069  
 S<sub>o</sub> = 1.00 (ft/ft)                      R = 0.18 (ft.)  
 d<sub>n</sub> = 0.37 (ft.)                      V<sub>n</sub> = 6.81 (fps)  
 A = 0.54 (ft<sup>2</sup>)                      Side Slope = 4:1

ASSUMED ROCK SIZE - D50 = 0.5 ft

VERIFY ASSUMED ROCK SIZE

φ = 41.2° (Appendix 7E-1)

Side Slope = 4: 1                      θ = 14°

K<sub>1</sub> = [1 - (sin<sup>2</sup> θ / sin<sup>2</sup> φ)]<sup>0.5</sup>

K<sub>1</sub> = [1 - (sin<sup>2</sup> 14° / sin<sup>2</sup> 41.5°)]<sup>0.5</sup> = 0.93

For Specific Gravity = 2.65 and Stability Factor = 1.2

D50 = 0.001 \* V<sub>a</sub><sup>3</sup> / (d<sub>avg</sub><sup>0.5</sup> \* K<sub>1</sub><sup>1.5</sup>)

D50 = 0.001 \* 6.81<sup>3</sup> / (0.5<sup>0.5</sup> \* 0.93<sup>1.5</sup>) = 0.45 ft.

D50 Computed (0.45) < D50 Assumed (0.5)

Therefore, assumed D50 is appropriate.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
POST CONSTRUCTION STREAM CROSSING STABILIZATION	
DRAWING NO.	REV.
MVP-ES44.3	P

**Construction Specifications**

General

1. All trees, brush, stumps, roots, obstructions and other unsuitable material shall be removed and disposed of properly.
2. Disturbed areas will be returned to pre-construction contours. Topsoil shall be replaced in accordance with the Mountain Valley Pipeline Project Specific Standards and Specifications.
3. Existing suitable stream substrate shall be salvaged and replaced to streambed at pre-construction contours.
4. The swale shall be excavated or shaped to the proper grade and cross-section.
5. Any excess soil shall be removed and disposed of properly.

Water Bars / Slope Breakers

1. Water bars / slope breakers shall be installed in accordance with WATER BAR, TYPICAL SLOPE BREAKER (SB), Std. & Spec. MVP-17 and MVP-18.
2. Permanent water bars are required at all stream, river and other waterbody crossings, as well as upslope from roadway and roadbed cut slopes.
3. Construct permanent water bars with compost filter sock after completion of grading in accordance with the water bar spacing and sizing requirements shown on plan and in table on Plate 3.
4. Water bar closest to stream top of bank shall be located twenty-five (25) feet maximum upslope from top of bank.
5. Water bars shall have a slope of one to four percent.
6. Water bars on retired roadways, skidtrails, and right-of-ways shall be left in place after permanent stabilization has been achieved.

Compost Filter Socks


1. Compost filter socks shall be installed in accordance with COMPOST FILTER SOCK, Std. & Spec. MVP ES-3.
2. Compost filter socks shall extend at least ten feet upslope from the uppermost limit of the sump filter.

Sump Filters

1. Sump filters to be installed at end of water bars. Refer to sump filter detail on Plate 2.
2. Sump filter shall be located entirely within the permanent right-of-way.
3. Sediment storage area shall be excavated to a minimum dimension of one-foot-deep by three-feet-wide by six-feet-long. Additional storage, if required due to a larger contributing drainage area, will either be added through increasing the sump filter dimension or stacking compost filter sock to increase BMP height.

Streambank Swales

Streambank swales shall be installed at locations determined by MVP Design Engineering and the MVP Environmental Inspector based on their visual observation of the post-construction field conditions.

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		POST CONSTRUCTION STREAM CROSSING STABILIZATION	
<b>APP'D</b>	<b>DATE</b> 08/11/17			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1			
<b>JOB NO.</b>				
<b>PROJECT ID:</b>			<b>DRAWING NO.</b>	<b>REV.</b>
MVP – VA PORTION			MVP–ES44.4	P

Locations shall include but are not limited to locations where there is visual evidence of formation of rills and/or gullies along the streambank and/or evidence of concentrated flow along the streambank with anticipated potential for erosion.


1. On-site salvaged rock and/or riprap, if on-site rock is not salvageable, shall be installed in accordance with RIPRAP, Std. & Spec. 3.19.
2. Erosion control fabric shall be installed along the edges of the riprap-lined channel as shown on Plate 3 in accordance with SOIL STABILIZATION BLANKETS AND MATTING, Std. & Spec. 3.36.

**Inspections and Maintenance**

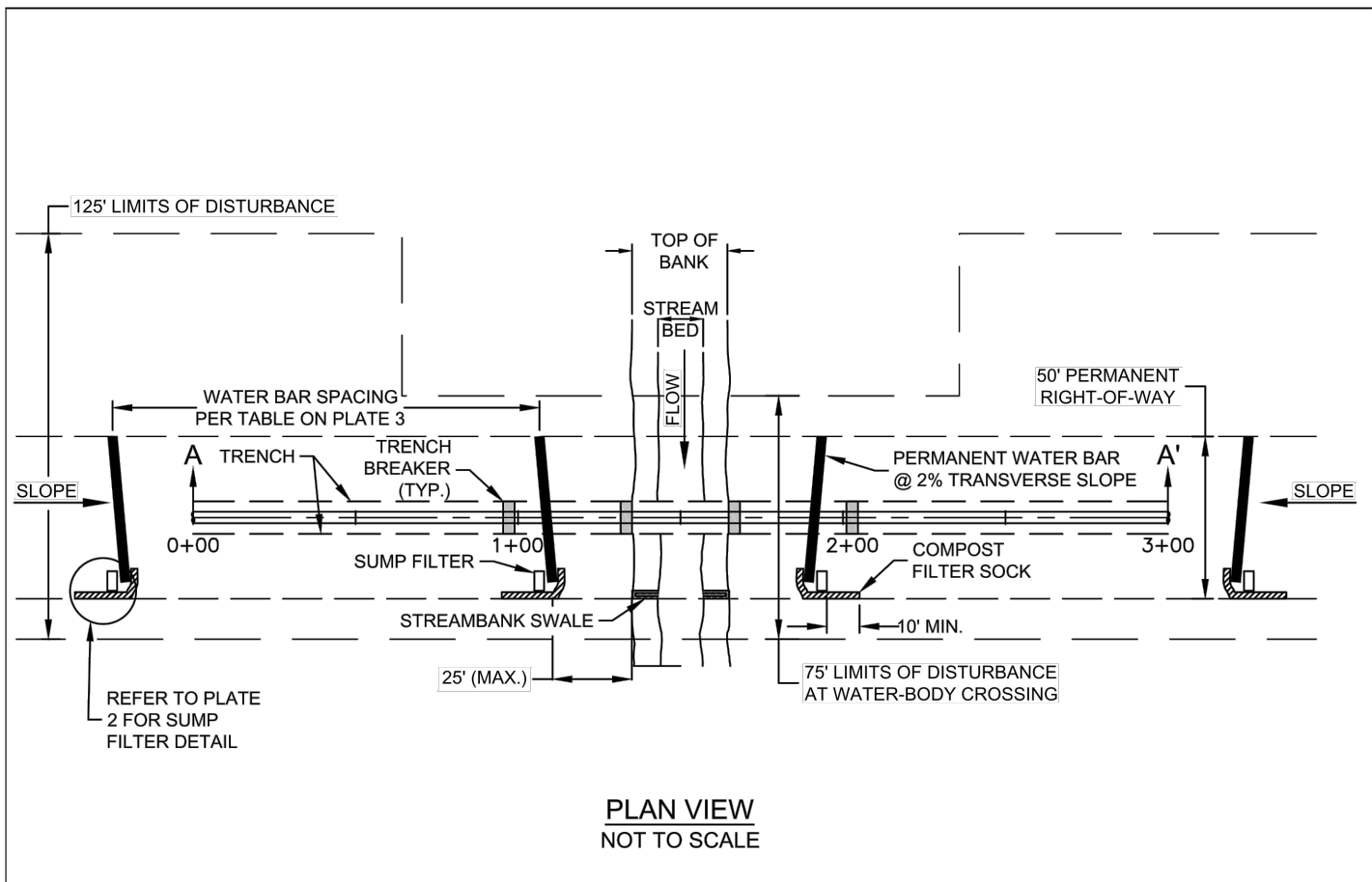
1. Inspections shall be conducted at a frequency of (i) at least once every four business days or (ii) at least once every five business days and no later than 48-hours following a measurable storm event.
2. Damaged or eroded water bars shall be restored to original dimensions within 24-hours of inspection.
3. Compost filter sock shall be inspected for sediment accumulation, integrity, and maintained as necessary. Accumulated sediment shall be removed when it reaches no more than half the aboveground height of the sock and disposed in the manner described elsewhere in the plan. Damaged socks shall be repaired according to manufacturer’s specifications or replaced within 24 hours of inspection.
4. Sump filter shall be inspected for sediment accumulation and proper operation. Sediment shall be removed and the sump filter restored to original dimensions when sediment has accumulated to half the design depth. Sediment removal from the sump shall be deposited in a suitable area and in such a manner that it will not erode and cause sedimentation problems.
5. Streambank swales shall be inspected for integrity and proper operation. Damaged or eroded streambank swales shall be restored to original dimension within 24-hours of inspection.
6. If during inspection, additional rills and/or gullies are observed, streambank swales shall be installed in accordance with the construction specifications herein at these locations within 24-hours of inspection.
7. Maintenance of water bars, compost filter socks and sump filters shall be provided until roadway, skidtrail, or right-of-way has achieved permanent stabilization.

**Post Stabilization**

Once permanent stabilization has been achieved, sediment storage should be seeded with permanent seed mix in accordance with the Mountain Valley Pipeline Project Specific Standards and Specifications. Compost filter socks shall remain to decompose in place and streambank swales shall remain in place.

<b>DRAWN</b>	<b>DATE</b>	 <p style="font-size: 1.2em; margin: 0;"><b>Mountain Valley</b></p> <p style="margin: 0;">PIPELINE</p> <p style="font-size: 1.2em; margin: 0;"><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		POST CONSTRUCTION STREAM CROSSING STABILIZATION	
<b>APP'D</b>	<b>DATE</b> 08/11/17			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1			
<b>JOB NO.</b>			<b>DRAWING NO.</b> MVP-ES44.5	
<b>PROJECT ID:</b> MVP – VA PORTION		<b>REV.</b> P		





PLAN VIEW  
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

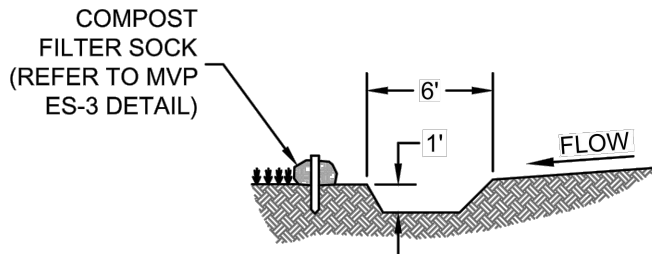
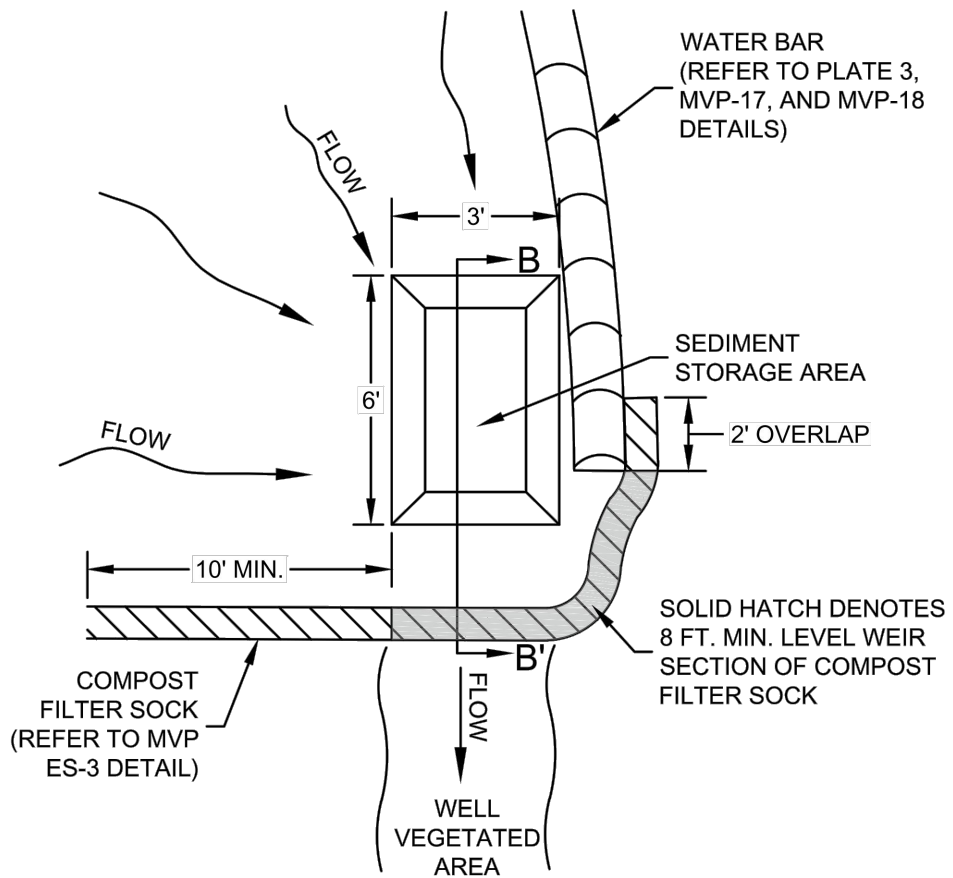
PLATE 1

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
POST CONSTRUCTION STREAM CROSSING STABILIZATION	
DRAWING NO.	REV.
MVP-ES44.6	P



**SUMP FILTER DETAIL**  
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 2

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley PIPELINE**

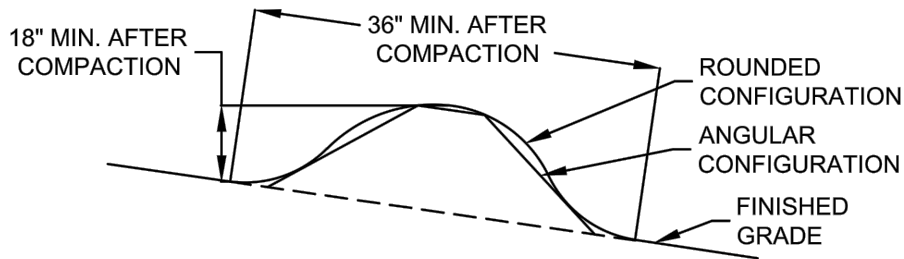
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

POST CONSTRUCTION STREAM CROSSING STABILIZATION

DRAWING NO.  
MVP-ES44.7

REV.  
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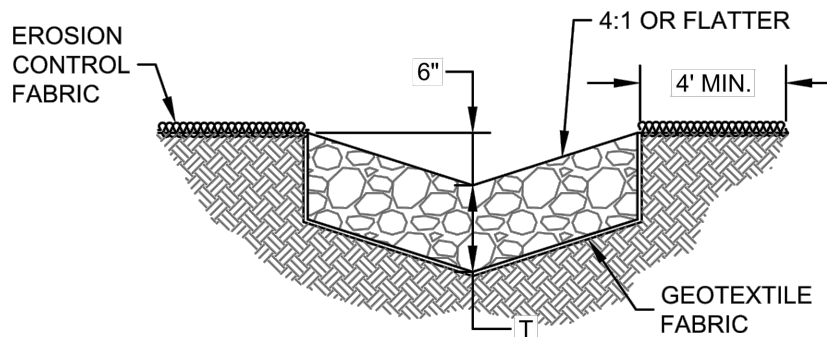


MINIMUM SPACING FOR PERMANENT WATER BARS	
PIPELINE GRADE	DISTANCE (FEET)
<2%	- 2 <sup>3</sup>
2-5%	400
6-15%	200
16-30%	100
>31%	50 <sup>4</sup>

**NOTES:**

1. REFER TO MVP-17 AND MVP-18 DETAILS (WATER BAR, TYPICAL SLOPE BREAKERS).
2. PERMANENT WATER BARS WILL BE INSTALLED AS NEEDED BASED ON FIELD CONDITIONS.
3. PERMANENT WATER BARS WILL BE INSTALLED 25 FEET FROM EACH WATERBODY BOUNDARY REGARDLESS OF SLOPE CONDITIONS.
4. SLOPES GREATER THAN 65% MAY REQUIRE SITE SPECIFIC STABILIZATION MEASURES BASED ON FIELD CONDITIONS AS APPROVED BY MVP DESIGN ENGINEERING AND MVP ENVIRONMENTAL INSPECTOR.

**PERMANENT WATER BAR DETAIL**  
NOT TO SCALE



**NOTES:**

1. IF THE CONTRIBUTING DRAINAGE AREA IS GREATER THAN 1 ACRE OR IF THE SWALE IS STEEPER THAN 1:1 (1.0 FT/FT), THE PLANS SHALL PROVIDE CALCULATIONS TO DETERMINE AN APPROPRIATE SIZE STONE, MINIMUM THICKNESS, AND CHANNEL SIZE.
2. MINIMUM THICKNESS, T, SHALL BE TWO TIMES THE D50.
3. FOR DRAINAGE AREAS 1 ACRE OR LESS, D50 = 6 INCHES AND T = 12 INCHES.
4. SWALE SIDE SLOPES SHALL BE 4:1 OR FLATTER.

**STREAMBANK SWALE TYPICAL CROSS SECTION**  
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 3

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

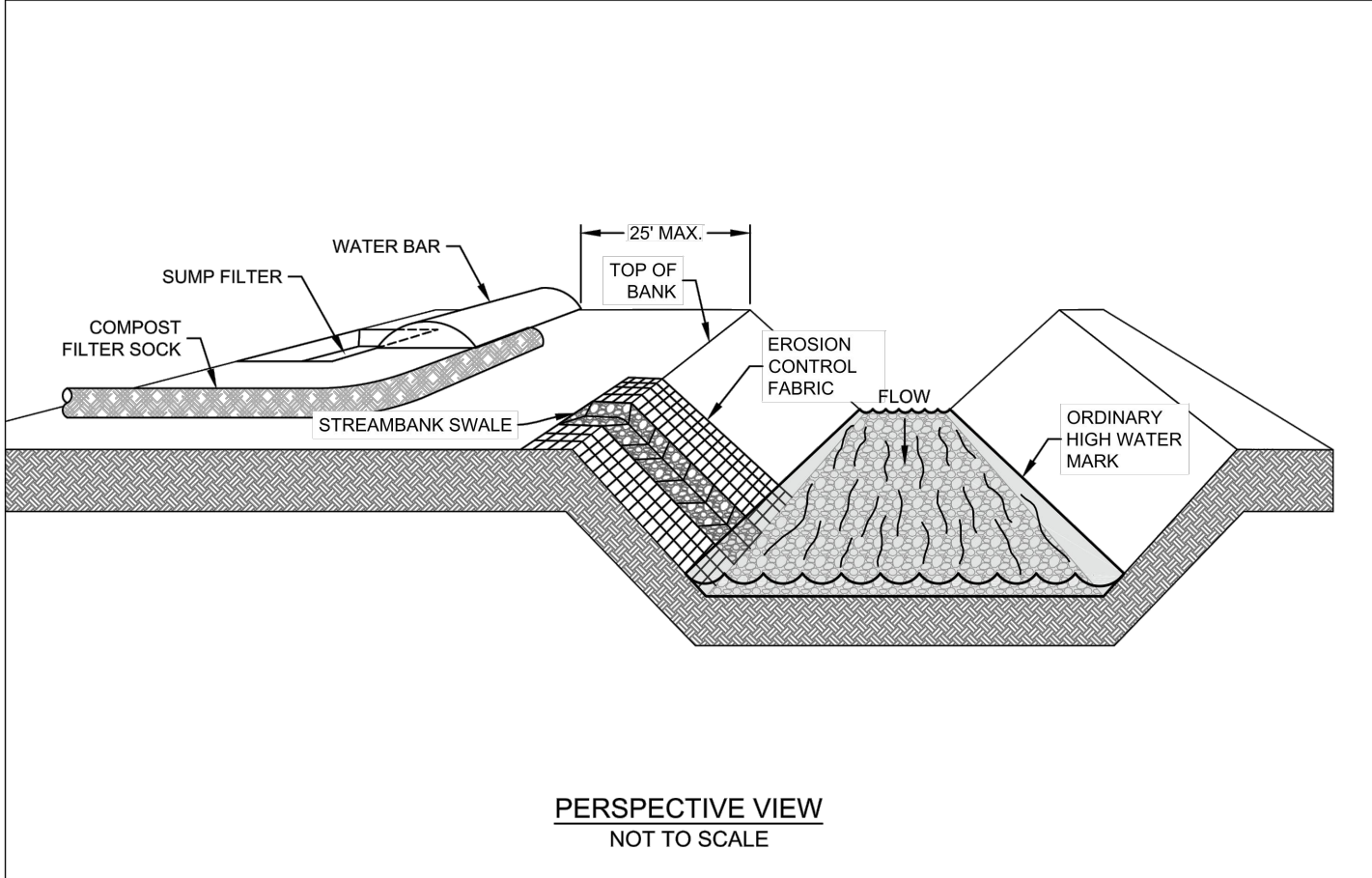
**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

POST CONSTRUCTION STREAM CROSSING STABILIZATION

DRAWING NO.  
MVP-ES44.8

REV.  
P



POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
POST CONSTRUCTION STREAM CROSSING STABILIZATION	
DRAWING NO.	REV.
MVP-ES44.9	P



# MULCHING

## Definition

Application of plant residues or other suitable materials to the soil surface.

## Purposes

1. To prevent erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.
2. To foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

## Conditions Where Practice Applies


1. Areas which have been permanently seeded (see Appendix B – Typical Construction Details MVP-ES11.1 through ES12.3) should be mulched immediately following seeding.
2. Areas which cannot be seeded because of the season should be mulched to provide some protection to the soil surface. An organic mulch should be used, and the area then seeded as soon weather or seasonal conditions permit. It is not recommended that fiber mulch be used alone for this practice; at normal application rates it just simply does not provide the protection that is achieved using other types of mulch.
3. Mulch may be used together with plantings of trees, shrubs, or certain ground covers which do not provide adequate soil stabilization by themselves.
4. Mulch shall be used in conjunction with temporary seeding operations as specified in TEMPORARY SEEDING, Std. & Spec. 3.31

## Planning Considerations

Mulches are applied to the soil surface to conserve a desirable soil property or to promote plant growth. A surface mulch is one of the most effective means of controlling runoff and erosion on disturbed land.

Mulches can increase the infiltration rate of the soil, reduce soil moisture loss by evaporation, prevent crusting and sealing of the soil surface, modify soil temperatures, and provide a suitable microclimate for seed germination.

Organic mulch materials, such as straw, wood chips, bark, and fiber mulch have been found to be the most effective.

<b>DRAWN</b>	<b>DATE</b>	 <p><b>Mountain Valley PIPELINE</b></p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		MULCHING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES45	P
<b>PROJECT ID:</b>				
PXXXX				

Chemical soil stabilizers or soil binders should not be used alone for mulch. These materials are useful to bind organic mulches together to prevent displacement.

A variety of manufactured SOIL STABILIZATION BLANKETS AND MATTING (see Std. & Spec. 3.36) have been developed for erosion control in recent years. Some of these products can be used as mulches, particularly in critical areas such as waterways. They also may be used to hold other mulches to the soil surface.

The choice of materials for mulching will be based on the type of soil to be protected, site conditions, season and economics. It is especially important to mulch liberally in mid-summer and prior to winter, and on cut slopes and southern slope exposures.

Organic Mulches

Straw - The mulch most commonly used in conjunction with seeding. The straw should come from wheat or oats (free of troublesome weed seeds) and may be spread by hand or machine. Straw can be windblown and must be anchored down by an acceptable method.

Hay - Hay shall not be used as mulch for Project activities.

Com Stalks - These should be shredded into 4- to 6-inch lengths. Stalks decompose slowly and are resistant to displacement.

Wood Chips - Suitable for areas that will not be closely mowed, and around ornamental plantings. Chips decompose slowly and do not require tacking. They must be treated with 12 pounds of nitrogen per ton to prevent nutrient deficiency in plants; however, can be a very inexpensive mulch if chips are obtained from trees cleared on the site.


Bark Chips, Shredded Bark - These are by-products of timber processing which are used in landscaped plantings. Bark is also a suitable mulch for areas planted to grasses and not closely mowed. It may be applied by hand or mechanically and is not usually toxic to grasses or legumes; additional nitrogen fertilizer is not required.

Fiber Mulch - Used in hydroseeding operations and applied as part of the slurry. It creates the best seed-soil contact when applied over top of (as a separate operation) newly seeded areas. These fibers do not require tacking, although tacking agents or binders are sometimes used in conjunction with the application of fiber mulch. This form of mulch does not provide sufficient protection to highly erodible soils. Additionally, fiber mulch will not be considered adequate mulch when used during the dry summer months or when used for late fall mulch cover. Use straw mulch during these periods. Fiber mulch may be used to tack (anchor) straw mulch. This treatment is well suited for steep slopes, critical areas, and areas susceptible to displacement.

There are other organic materials which make excellent mulches but are only available locally or seasonally. Creative use of these materials can reduce costs.

Chemical Mulches and Soil Binders

A wide range of synthetic, spray-on materials are marketed to stabilize and protect the soil surface. These are emulsions or dispersions of vinyl compounds, rubber or other substances which are mixed with water and applied to the soil. They may be used alone in some cases as temporary stabilizers, or in conjunction with fiber mulches or straw.

<b>DRAWN</b>	<b>DATE</b>	 <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		MULCHING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES45.1	P
<b>PROJECT ID:</b>				
PXXXX				

When used alone, chemical mulches do not have the capability to insulate the soil or retain soil moisture that organic mulches have. This soil protection is also easily damaged by traffic. Application of these mulches is usually more expensive than organic mulching, and the mulches decompose in 60-90 days.

Blankets and Matting

Field experience has shown that plastic netting, when used alone, does not retain soil moisture or modify soil temperature. In some cases it may stabilize the soil surface while grasses are being established, but is primarily used in grassed waterways and on slopes to hold straw or similar mulch in place.

Jute mesh and other soil stabilization blankets are good choices for mulching on difficult slopes and in minor drainage swales. Most of the soil stabilization mattings (used to create a permanent matrix for root growth within the soil) must receive mulching in order to properly stabilize an area. Notably, some manufacturers have recently developed permanent mattings which include self-contained, temporary mulching materials; however, these measures will have to meet the requirements noted in Std. & Spec. 3.36, SOIL STABILIZATION BLANKETS AND MATTING, before they can be recommended for use on steep slopes and in channel flow situations.

The most critical aspect of installing blankets and mats is obtaining firm, continuous contact between the material and the soil. Without such contact, the material may fail and thereby allow erosion to occur. It is important to use an adequate number of staples and make sure the material is installed properly in order to maximize soil protection. These products are discussed in more detail in Std. & Spec. 3.36, SOIL STABILIZATION BLANKETS & MATTING.

MVP will utilize hydraulically applied soil stabilization blankets and matting (i.e. Earthguard, Flexterra, or equivalent) as an alternate to the rolled ESC blanket material identified under STD & SPEC 3.36. Information regarding the hydraulically applied blankets is provided under Appendix B MVP-ES40 and MVP-ES40.1.

Specifications

Organic Mulches

Organic mulches may be used in any area where mulch is required, subject to the restrictions noted in Table 3.35-A.

Materials: Select mulch material based on site requirements, availability of materials, and availability of labor and equipment. Table 3.35-A lists the most commonly used organic mulches. Other materials, such as peanut hulls and cotton burs, may be used with the permission of the local Plan-Approving Authority.

Prior to mulching: Complete the required grading and install needed sediment control practices.

Lime and fertilizer should be incorporated and surface roughening accomplished as needed. Seed should be applied prior to mulching except in the following cases:

- a. Where seed is to be applied as part of a hydroseeder slurry containing fiber mulch.
- b. Where seed is to be applied following a straw mulch spread during winter months.


DRAWN		DATE		 <p><b>Mountain Valley</b> PIPELINE</p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			MULCHING	
APP'D		DATE 08/11/17				
SCALE	N.T.S.	SHEET 1 OF 1			DRAWING NO. MVP-ES45.2	
JOB NO.						
PROJECT ID: MVP – VA PORTION						

TABLE 3.35-A			
ORGANIC MULCH MATERIALS AND APPLICATION RATES			
MULCHES:	RATES:		NOTES:
	Per Acre	Per 1000 sq. ft.	
Straw	1 ½ - 2 tons (Minimum 2 tons for winter cover)	70 – 90 lbs.	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	Minimum 1500 lbs.	35 lbs.	Do not use as mulch for winter cover or during hot, dry periods.* Apply as slurry.
Corn Stalks	4 – 6 tons	185 – 275 lbs.	Cut or shredded in 4-6" lengths. Air-dried. Do not use in fine turf areas. Apply with mulch blower or by hand.
Wood Chips	4 – 6 tons	185 – 275 lbs.	Free of coarse matter. Air-dried. Treat with 12 lbs nitrogen per ton. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.
Bark Chips or Shredded Bark	50 – 70 cu. yds.	1-2 cu. yds.	Free of coarse matter. Air-dried. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.
* When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2000 lbs./ac. Or 45 lbs./1000 sq. ft.			

Source: Va. DSWC

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:  PXXXX	



**Mountain Valley PIPELINE**

DESIGN ENGINEERING

ENVIRONMENTAL DETAIL	
MULCHING	
DRAWING NO. MVP-ES45.3	REV. P



Application: Mulch materials shall be spread uniformly, by hand or machine.

When spreading straw mulch by hand, divide the area to be mulched into approximately 1,000 sq. ft. sections and place 70-90 lbs. (n to 2 bales) of straw in each section to facilitate uniform distribution.

Mulch Anchoring: Straw mulch must be anchored immediately after spreading to prevent displacement. Other organic mulches listed in Table 3.35-A do not require anchoring. The following methods of anchoring straw may be used:

1. Mulch anchoring tool (often referred to as a Krimper or Krimper Tool): This is a tractor-drawn implement designed to punch mulch into the soil surface. This method provides good erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.
2. Fiber Mulch: A very common practice with widespread use today. Apply fiber mulch by means of a hydroseeder at a rate of 500-750 lbs/acre over top of straw mulch. It has an added benefit of providing additional mulch to the newly seeded area.
3. Liquid mulch binders: Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks, to prevent displacement. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread or may be sprayed into the mulch as it is being blown onto the soil.


The following types of binders may be used:

- a. Synthetic binders - Formulated binders or organically formulated products may be used as recommended by the manufacturer to anchor mulch.
- b. \*Asphalt - Any type of asphalt thin enough to be blown from spray equipment is satisfactory. Recommended for use are rapid curing (RC-70, RC-250, RC-800), medium curing (MC-250, MC-800) and emulsified asphalt (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2).

Apply asphalt at 0.10 gallon per square yard (10 gal./1000 sq. ft. or 430 gal./acre). Do not use heavier applications as it may cause the straw to "perch" over rills. All asphalt designations are from the Asphalt Institute Specifications.

\*Note: This particular method is not used as commonly today as it once was in the past. The development of hydraulic seeding equipment promoted the industry to turn to synthetic or organically based binders and tackifiers. When this method is used, environmental concerns should be addressed to ensure that petroleum-based products do not enter valuable water supplies. Avoid applications into waterways or channels.

4. Mulch nettings: Lightweight plastic, cotton, or paper nets may be stapled over the mulch according to manufacturer's recommendations.
5. Peg and twine: Because it is labor-intensive, this method is feasible only in small areas where other methods cannot be used. Drive 8- to 10-inch wooden pegs to within 3 inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a square pattern. Turn twine 2 or more times around each peg.

DRAWN		DATE		 <p><b>Mountain Valley</b> PIPELINE</p> <p>DESIGN ENGINEERING</p>	<b>ENVIRONMENTAL DETAIL</b>	
CHECKED		DATE			MULCHING	
APP'D		DATE				
SCALE	N.T.S.	SHEET	1 OF 1			
JOB NO.					DRAWING NO. MVP-ES45.4	
PROJECT ID:		PXXXX		REV. P		

Chemical Mulches


Chemical mulches\* may be used alone only in the following situations:

- a. Where no other mulching material is available.
- b. In conjunction with temporary seeding during the times when mulch is not required for that practice.
- c. From March 15 to May 1 and August 15 to September 30, provided that they are used on areas with slopes no steeper than 4:1, which have been roughened in accordance with SURFACE ROUGHENING, Std. & Spec. 3.29. If rill erosion occurs, another mulch material shall be applied immediately.

\*Note: Chemical mulches may be used to bind other mulches or with fiber mulch in a hydroseeded slurry at any time. Manufacturer's recommendations for application of chemical mulches shall be followed.

**Maintenance**

All mulches and soil coverings should be inspected periodically (particularly after rainstorms) to check for erosion. Where erosion is observed in mulched areas, additional mulch should be applied. Nets and mats should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re-install netting or matting as necessary after repairing damage to the slope or ditch. Inspections should take place up until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; repair as needed.

<b>DRAWN</b>	<b>DATE</b>	 <b>DESIGN ENGINEERING</b>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		<b>MULCHING</b>	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES45.5	P
<b>PROJECT ID:</b> PXXXX				

## TOPSOILING & SOIL HANDLING FOR M.V.P.

### Definition

Methods of preserving and using the surface layer of undisturbed soil, often enriched in organic matter, in order to obtain a more desirable planting and growth medium.

### Purposes

To provide a suitable growth medium for final site stabilization with vegetation and promote successful reforestation.

### Conditions Where Practice Applies

1. Where the preservation or importation of topsoil is determined to be the most effective method of providing a suitable growth medium.
2. Where the subsoil or existing soil presents the following problems:
  - a. The texture, pH, or nutrient balance of the available soil cannot be modified by reasonable means to provide an adequate growth medium.
  - b. The soil material is too shallow to provide an adequate root zone and to supply necessary moisture and nutrients for plant growth.
  - c. The soil contains substances potentially toxic to plant growth.
3. Only on slopes that are 2:1 or flatter unless other measures are taken to prevent erosion and sloughing.


### Planning Considerations

Topsoil is the surface layer of the soil profile, generally characterized as being darker than the subsoil due to the presence of organic matter. It is the major zone of root development, carrying much of the nutrients available to plants, and supplying a large share of the water used by plants.

Although topsoil provides an excellent growth medium, there are disadvantages to its use. Stripping, stockpiling, and reapplying topsoil, or importing topsoil, may not always be cost-effective. Topsoiling can delay seeding or sodding operations, increasing the exposure time of denuded areas. Most topsoil contains weed seeds, and weeds may compete with desirable species.

Advantages of topsoil include its high organic matter content and friable consistence, water-holding capacity, and nutrient content.

In site planning, the option of topsoiling should be compared with that of preparing a seedbed in subsoil. The clay content of subsoils does provide high moisture availability and deter leaching of nutrients and, when properly limed and fertilized, subsoils may provide a good growth medium which is generally free

<b>DRAWN</b>	<b>DATE</b>	 <p style="font-size: 1.2em; margin: 0;"><b>Mountain</b></p> <p style="font-size: 1.5em; margin: 0; color: #0070C0;"><b>Valley</b></p> <p style="font-size: 0.8em; margin: 0; color: #0070C0;"><b>PIPELINE</b></p> <p style="font-size: 1.1em; margin: 10px 0 0 0;"><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		TOPSOILING & SOIL HANDLING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1			
<b>JOB NO.</b>			<b>DRAWING NO.</b> MVP-ES46	
<b>PROJECT ID:</b>	PXXXX			

of weed seeds. In many cases topsoiling may not be required for the establishment of less demanding, lower maintenance plant material. Topsoiling is strongly recommended where ornamental plants or high-maintenance turf will be grown. Topsoiling is a required procedure when establishing vegetation on shallow soils, soils containing potentially toxic materials, and soils of critically low pH (high acid) levels.

If topsoiling is to be done, the following items should be considered:

1. Whether an adequate volume of topsoil exists on the site. Topsoil will be spread at a compacted depth of 2 to 4 inches (depths closer to 4 inches are preferred).
2. Location of the topsoil stockpile so that it meets specifications and does not interfere with work on the site.
3. Allow sufficient time in scheduling for topsoil to be spread and bonded prior to seeding or planting.
4. Care must be taken not to apply topsoil to subsoil if the two soils have contrasting textures. Clayey topsoil over sandy subsoil is a particularly poor combination, as water may creep along the junction between the soil layers, causing the topsoil to slough. Sandy topsoil over a clay subsoil is equally as likely to fail.
5. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. Topsoiling of steep slopes should be discouraged unless good bonding of soils can be achieved.

### Specifications

#### Materials

Field exploration of the site shall be made to determine if there is sufficient surface soil of good quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support healthy vegetation. It shall contain no substance that is potentially toxic to plant growth.


In areas where revegetation is of concern based on existing soil conditions and determined by the MVP Environmental Inspector (EI), topsoil samples shall be taken for analysis. Samples will be collected by the MVP EI and sent to a recognized laboratory for analysis of the following criteria:

Organic matter content shall be not less than 1.5% by weight.

pH range shall be from 6.0-7.5. If pH is less than 6.0, lime shall be added in accordance with soil test results or in accordance with the recommendations of the vegetative establishment practice being used.

Soluble salts shall not exceed 500 ppm.

Soil samples collected and sent for analysis will be identified by the MVP Constructions Spread # and pipeline station from which the sample was obtained. Areas that fail to revegetate following restoration will be sampled and analyzed based on the above parameters.

<b>DRAWN</b>	<b>DATE</b>	 <p style="font-size: 1.2em; margin: 0;"><b>Mountain Valley</b></p> <p style="font-size: 0.8em; margin: 0;"><b>PIPELINE</b></p> <p style="font-size: 1.1em; margin: 0;"><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>		
<b>CHECKED</b>	<b>DATE</b>		TOPSOILING & SOIL HANDLING		
<b>APP'D</b>	<b>DATE 08/11/17</b>				
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>				
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<b>DRAWING NO.</b> MVP-ES46.1	<b>REV.</b> P				
<b>PROJECT ID:</b> MVP - VA PORTION					



Topsoil Importing

Topsoil would be imported as needed in residential areas only. If additional off-site topsoil is needed, it must meet the standards stated above.

Stripping

Topsoil operations should not be performed when the soil is wet or frozen. Stripping shall be confined to the immediate construction area. A 4-to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All perimeter dikes, basins, and other sediment controls shall be in place prior to stripping.

Stockpiling

Topsoil shall be stockpiled in such a manner that natural drainage is not obstructed and no off-site sediment damage shall result. Stabilize or protect stockpiles in accordance with MS #2.

Excavated subsoil shall be stockpiled separately from topsoil.

Side slopes of the stockpile shall not exceed 2:1.

Perimeter controls must be placed around the stockpile immediately; seeding of stockpiles shall be completed within 7 days of the formation of the stockpile, in accordance with Std. & Spec. 3.31, TEMPORARY SEEDING if it is to remain dormant for longer than 14 days (refer to MS #1 and MS #2).

Site Preparation Prior to and Maintenance During Topsoiling and Excavation

Before topsoiling or excavation, establish needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, level spreaders, waterways, sediment basins, etc. These practices must be maintained during topsoiling and excavation.

Grading: Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.

Liming: Where the pH of the subsoil is 6.0 or less, or the soil is composed of heavy clays, agricultural limestone shall be spread in accordance with the soil test or the vegetative establishment practice being used.

Bonding: After the areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by disking or scarifying to a depth of at least 4-6 inches to ensure bonding of the topsoil and subsoil. Refer to 2.8.3 Soil Compaction Mitigation within the Project Standards and Specifications for additional information.

Applying Topsoil

Topsoil shall not be placed while in a frozen or muddy condition, when topsoil or subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or seeding. The topsoil shall be uniformly distributed to a minimum compacted depth of 2 inches on 3:1 or steeper slopes and 4 inches on flatter slopes or to mimic existing conditions present in the adjacent undisturbed areas. (See Table 3.30-A to determine volume of topsoil required for application to various depths). Any irregularities in the surface, resulting from topsoiling or other operations, shall be corrected in order to prevent the formation of depressions or water pockets.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	



<b>ENVIRONMENTAL DETAIL</b>	
TOPSOILING & SOIL HANDLING	
DRAWING NO. MVP-ES46.2	REV. P

Once the topsoil has been applied to the subgrade the topsoil should be disked and raked. Excess rock will be removed from at least the top 12 inches of soil to the extent practicable in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing. Refer to Standards and Specifications Section 2.8 Final Grading for additional information.

DEPTH (INCHES)	PER 1,000 (SQUARE FEET)	PER ACRE
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

SOURCE: Va. DSWC


Soil Sterilants

No seed shall be placed on soil which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

Special Soil Related Requirements for Working in Wetlands

Norfolk District 2017 Nationwide Permit Regional Conditions, dated March 20, 2017 (subject to revision in Spring of 2017), NWP 12 – Utility Line Activities items 3.b.iii, 5.a, and 5.b require the following:

1. Minimizing clearing of wetlands. Grubbing shall be limited to the permanent easement for underground utility lines. Outside of the permanent easement, wetland vegetation shall only be removed at or above the ground surface unless written justification is provided and the impacts are reviewed and approved by the Corps.
2. Whenever practicable, excavated material shall be placed on a Corps confirmed upland site. However, when this is not practicable, temporary stockpiling is hereby authorized provided that:
  - a. All excavated material stockpiled in a vegetated wetland area is placed on filter cloth, mats, or some other semi-permeable surface. The material will be stabilized with straw bales, filter cloth, etc. to prevent reentry into any waterway.
  - b. All excavated material must be placed back into the trench to the original contour and all excess excavated material must be completely removed from the wetlands within 30 days after the pipeline has been laid through the wetland areas. Permission must be granted by the District Commander or his authorized representatives if the material is to be stockpiled longer than 30 days.

<b>DRAWN</b>	<b>DATE</b>	 <b>DESIGN ENGINEERING</b>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		TOPSOILING & SOIL HANDLING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES46.3	P
<b>PROJECT ID:</b>				
PXXXX				

# BARE ROOT SAPLING AND SHRUB PLANTING

## Definition

The establishment of riparian buffer areas and forested or scrub-shrub wetland areas using bare root seedling plantings to supplement the permanent riparian seed mix.

## Purposes

To establish target native tree species comparable to the region, site characteristics (e.g., topography; soil characteristics; adjacent vegetation), and adjacent forest composition in order to encourage the timely reestablishment of habitat removed during Project construction in select areas of the Project. Tree and shrub species intended for use in bare root plantings are identified in Appendix B – MVP-ES11.6 and MVP-ES11.7.

## Conditions Where Practice Applies

Specific areas disturbed by Project activities along pipeline corridor. Locations where bare root plantings will be implemented at waterbody crossings are identified in Appendix B – MVP-ES11.8 and 11.9.

## Planning Considerations

### Storage


Ideally bare root seedlings should be planted immediately upon delivery. Keep seedlings in original sack or box from the nursery to preserve moisture within the package. Seedlings shall be stored in a cool, damp, and shady location that will not receive direct sunlight and is sheltered from the wind. Refrigerated trailer storage is preferred. Leave air gaps between boxes or sacks when stacking seedlings and only stack up to 3 high.

### Handling

It is important to handle bare root seedlings with care due to the fragile nature of the exposed roots and stems. Do not plant any seedling that has been damaged.

Carefully examine each seedling prior to planting and discard if any of the following are present:

- Broken stems or main root
- Mold or mildew
- Stems that are without bark
- Desiccated roots
- A root system less than 5 inches long

<b>DRAWN</b>	<b>DATE</b>	 <p style="font-size: 1.2em; margin: 0;"><b>Mountain</b></p> <p style="font-size: 1.5em; margin: 0; color: #0070C0;"><b>Valley</b></p> <p style="font-weight: bold; margin: 0;">PIPELINE</p> <p style="font-size: 1.2em; margin: 0;"><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		<p>BARE ROOT SAPLING AND SHRUB PLANTING</p>	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1			
<b>JOB NO.</b>			<p><b>DRAWING NO.</b></p> <p style="font-size: 1.2em;">MVP-ES47</p>	
<b>PROJECT ID:</b>		<p><b>REV.</b></p> <p style="font-size: 1.2em;">P</p>		
<p style="font-size: 1.5em;">PXXXX</p>				

**Specifications**


**Planting**

- Planting of bare root seedlings shall only take place between October 1<sup>st</sup> and April 30<sup>th</sup>.
- Planting shall take place after seeding application.
- A spade, planting bar, or shovel shall be used to plant all bare root seedlings.

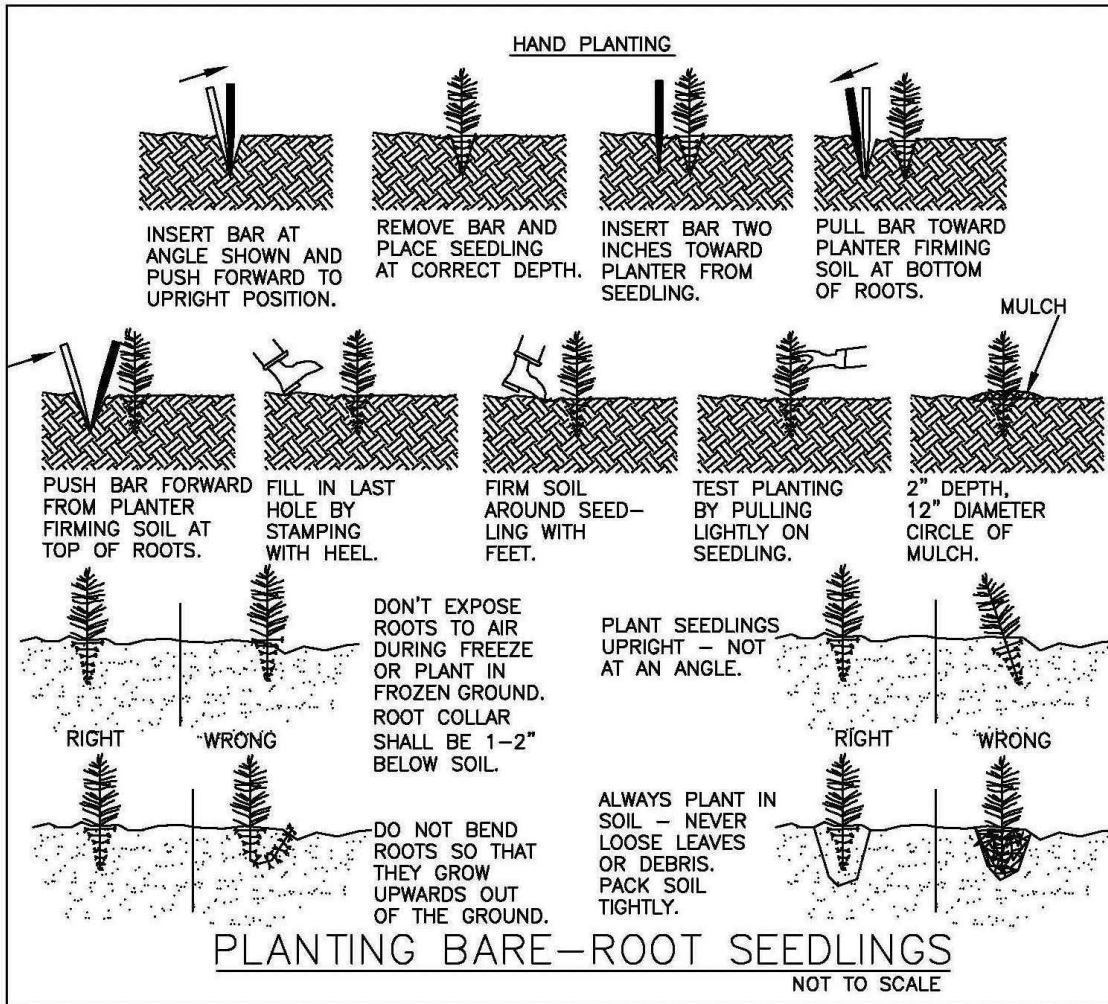
**Steps for Planting Bare Root Seedling**

1. The planting hole shall be dug 8-10 inches deep and 4-5 inches wide. The hole shall be deep enough to fit the entire bare root system without bending.
2. All bare root seedlings shall be treated with root dip absorbent polymers and mycorrhizal root dip inoculates in accordance with manufacturer’s recommendations.
3. Carefully separate the seedlings and place one seedling per planting hole. Discard any that have any of the defects outlined above.
4. For seedling with root systems longer than the depth of the planting hole, prune roots back to a length of 8-10 inches below root collar. Bare root pruning shall take place in a cool, shaded location out of the wind. After bare root pruning, re-moisten the seedling before planting. If not planting the seedling immediately, re-moisten and store appropriately in original packaging.
5. Insert the roots of the seedling to the bottom of the planting hole and lift upward slightly so that the root collar is at or slightly below finished grade. This will ensure that the root system is planted without bending.
6. Fertilize each bare root seedling with a 5 gram tablet of controlled release fertilizer.
7. The seedling shall be maintained in an upright position when filling the planting hole. To fill the planting hole insert the spade, planting bar, or shovel behind the planting hole and tilt back to close the bottom of the planting hole. Next tilt the tool forward to close the top of the hole. Gently pack soil to fill any remaining void space in the planting hole.

If a definite browse line exists in the adjacent forest all bare root seedlings shall be planted in tree tubes tall enough to protect the seedlings from deer browse (a minimum of 5’ tall).

<b>DRAWN</b>	<b>DATE</b>	 <p><b>DESIGN ENGINEERING</b></p>	<b>ENVIRONMENTAL DETAIL</b>	
<b>CHECKED</b>	<b>DATE</b>		BARE ROOT SAPLING AND SHRUB PLANTING	
<b>APP'D</b>	<b>DATE</b>			
<b>SCALE</b> N.T.S.	<b>SHEET</b> 1 OF 1		<b>DRAWING NO.</b>	<b>REV.</b>
<b>JOB NO.</b>			MVP-ES47.1	P
<b>PROJECT ID:</b>	PXXXX			





DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
PXXXX	



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

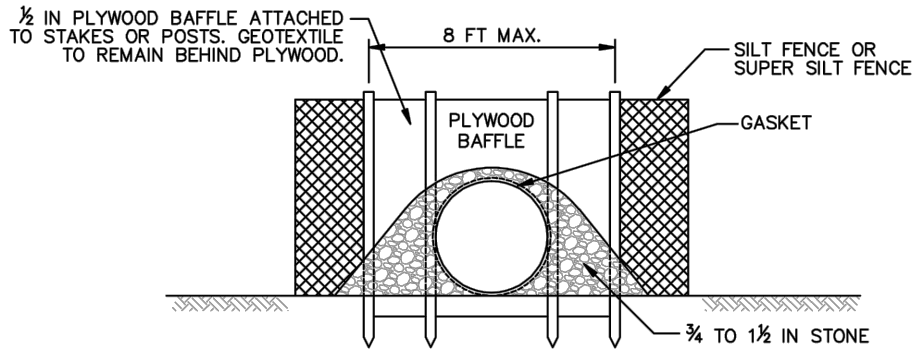
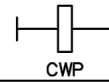
BARE ROOT SAPLING AND SHRUB PLANTING

DRAWING NO. MVP-ES47.2

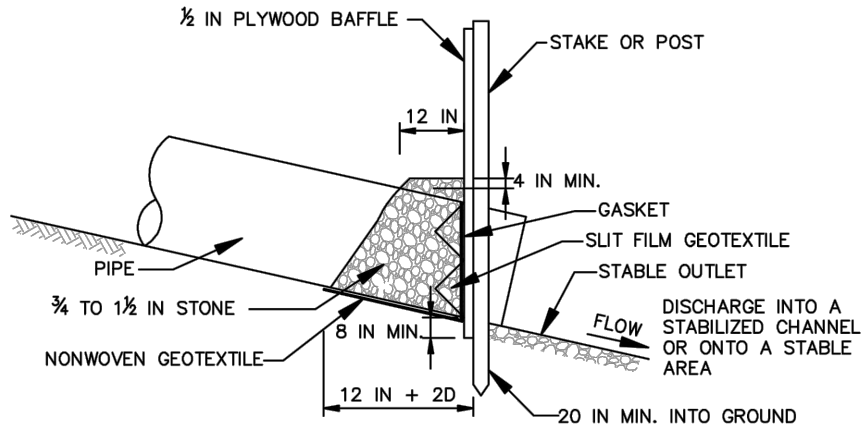
REV. P

# DETAIL E-4 CLEAR WATER PIPE THROUGH SILT FENCE OR SUPER SILT FENCE

STANDARD SYMBOL



CROSS SECTION - LOOKING DOWNGRADE



PROFILE

## CONSTRUCTION SPECIFICATIONS

1. INSTALL SILT FENCE OR SUPER SILT FENCE IN ACCORDANCE WITH DETAIL E-1 OR DETAIL E-2.
2. AT THE PIPE LOCATION, CUT AND PULL BACK THE WOVEN SLIT FILM GEOTEXTILE AND CHAIN LINK FENCING. SECURE GEOTEXTILE TO PIPE WITH GASKET. INSTALL ADDITIONAL STAKES OR POSTS IF NECESSARY TO ACCOMMODATE THE INSTALLATION OF THE BAFFLE BOARD.
3. ENTRENCH 1/2 INCH PLYWOOD BAFFLE A MINIMUM OF 8 INCHES AND SECURE TO THE UPGRADE SIDE OF THE FENCE STAKES OR POSTS. BAFFLE SHOULD BE AT LEAST THE HEIGHT OF THE FENCE.
4. PLACE 3/4 TO 1 1/2 INCH STONE OR EQUIVALENT RECYCLED CONCRETE BEHIND THE PLYWOOD BAFFLE ON NONWOVEN GEOTEXTILE AND EXTEND 12 INCH MIN. ALONG TOP OF PIPE AND TO A HEIGHT OF 4 INCHES ABOVE THE TOP OF PIPE.
5. USE NONWOVEN AND WOVEN SLIT FILM GEOTEXTILES AS SPECIFIED IN SECTION H-1 MATERIALS.
6. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN SEDIMENT REACHES 6 INCHES IN HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL BAFFLE, CHAIN LINK, AND GEOTEXTILE. REPLACE STONE IF DISPLACED. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

2011

MARYLAND DEPARTMENT OF ENVIRONMENT  
WATER MANAGEMENT ADMINISTRATION

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

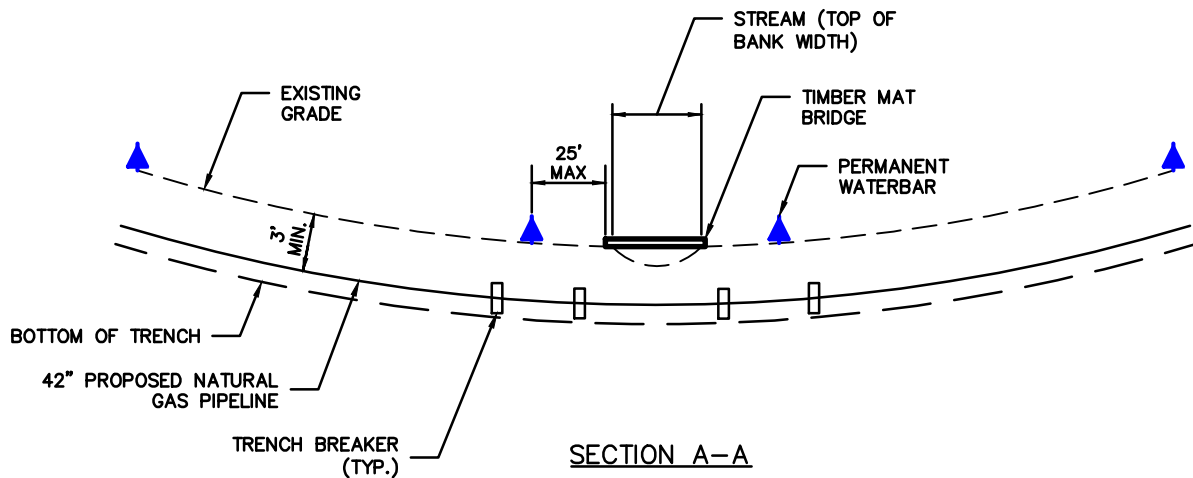
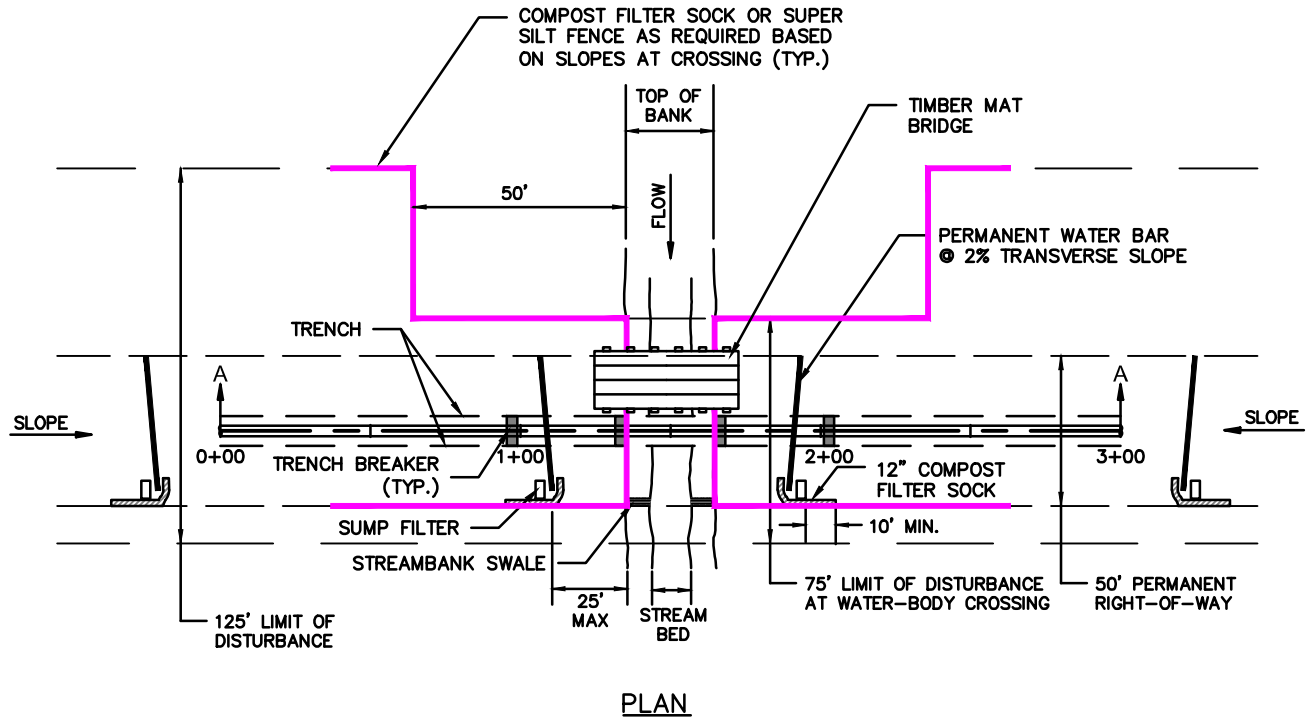
**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

## ENVIRONMENTAL DETAIL

CLEAR WATER PIPE THROUGH SILT FENCE OR SUPER SILT FENCE

DRAWING NO.  
MVP-ES48

REV.  
P



DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE

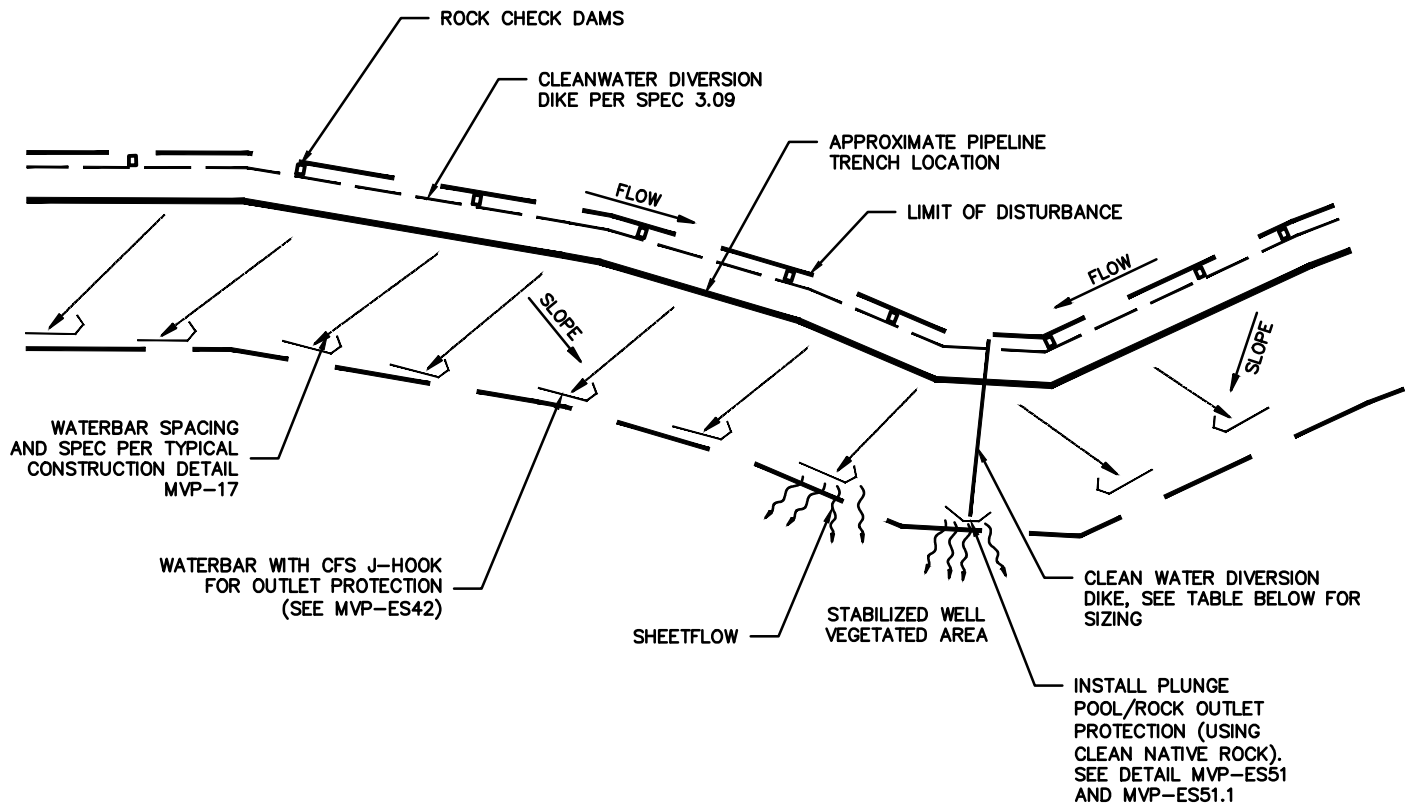
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

TIMBER MAT BRIDGE  
STREAM CROSSING

DRAWING NO.  
MVP-ES49

REV.  
P



**NOTES:**

- 1) CLEAN WATER DIVERSION DIKE TO BE CONSTRUCTED PER VESCH STD & SPEC 3.09
- 2) AS NEEDED ON STEEP SLOPES INSTALL ROCK CHECK DAMS PER VESCH STD & SPEC 3.20, EXCEPT THAT NATIVE ROCK PRODUCED DURING EXCAVATION WILL BE SUBSTITUTED FOR THE STONE AND RIP RAP.
- 3) PER VESCH STD & SPEC 3.15 THE DIVERSION DIKE MUST BE 6-INCHES HIGHER THAN THE PIPE ON THE INLET SIDE AND THE DIKE MUST SLOPE NO GREATER THAN 3:1 TO RE-JOIN THE ADJACENT DIKE HEIGHT.
- 4) ALL ROCK CHECK DAMS TO BE A MINIMUM OF 1-FT HIGH AS MEASURED AT THE LOW POINT LOCATED AT THE CENTER OF THE STRUCTURE.

Number of Temporary Slope Drains Spaced Across Diversion Dike <sup>1,2,3</sup>			
Average Slope (%)			
	12	18	24
10%	4	2	1
20%	3	1	1
30%	3	1	1
40%	2	1	1

<sup>1</sup>Maximum allowable drainage area of 5-acres assumed for sizing purposes per VESCH Std & Spec 3.15 - Temporary Slope Drain

<sup>2</sup>Temporary slope drains designed for the 10-yr storm using the rational method in lieu of the VESCH Std & Spec 3.15 slope drain sizing table (Table 3.15-A)

<sup>3</sup>Pipe flow capacity taken as 1/2 of the capacity when flowing half full to ensure no buildup of water within diversion dike

DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley PIPELINE**

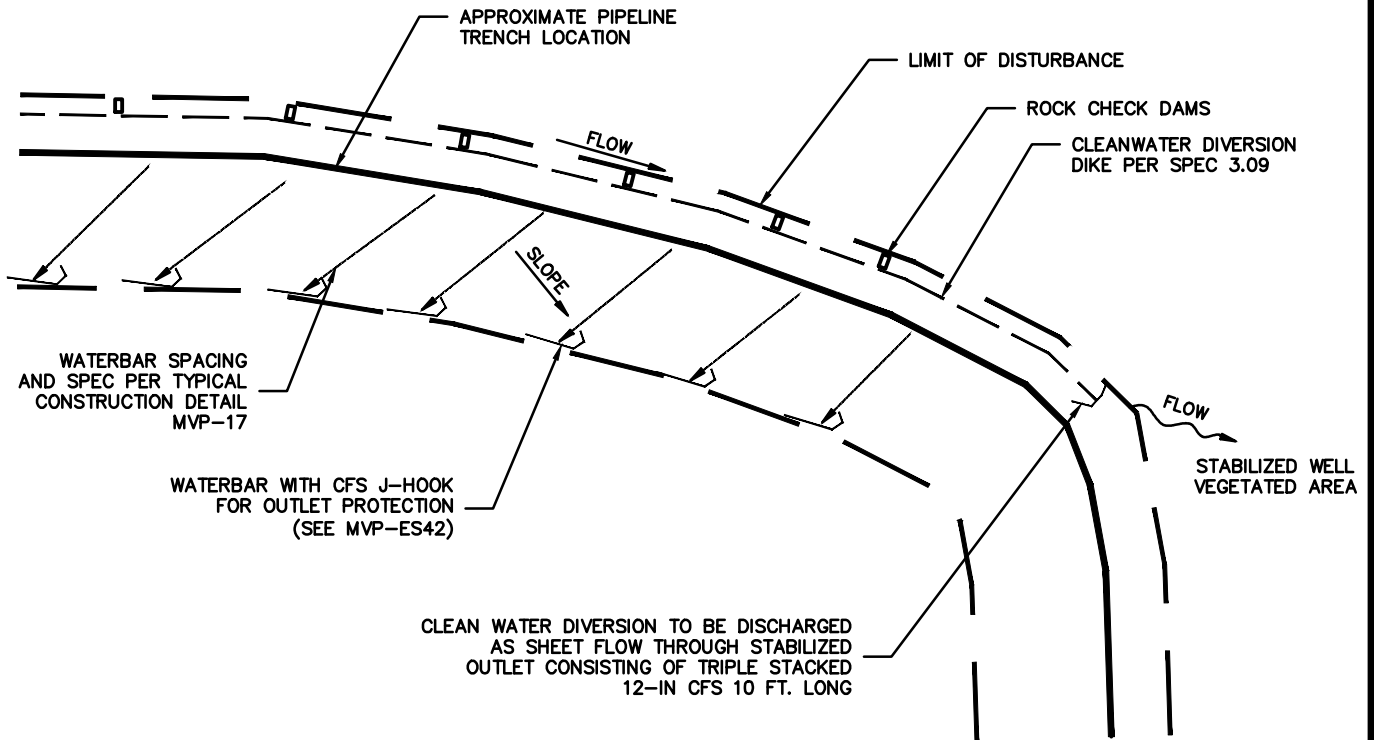
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

CLEAN WATER DIVERSION WITH CLEAN WATER PIPE

DRAWING NO.	REV.
MVP-ES50	P






**NOTES:**

- 1) CLEAN WATER DIVERSION DIKE TO BE CONSTRUCTED PER VESCH STD & SPEC 3.09
- 2) AS NEEDED ON STEEP SLOPES INSTALL ROCK CHECK DAMS PER VESCH STD & SPEC 3.20, EXCEPT THAT NATIVE ROCK PRODUCED DURING EXCAVATION WILL BE SUBSTITUTED FOR THE STONE AND RIP RAP
- 3) ALL ROCK CHECK DAMS TO BE A MINIMUM OF 1-FT HIGH AS MEASURED AT THE LOW POINT LOCATED AT THE CENTER OF THE STRUCTURE.

DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



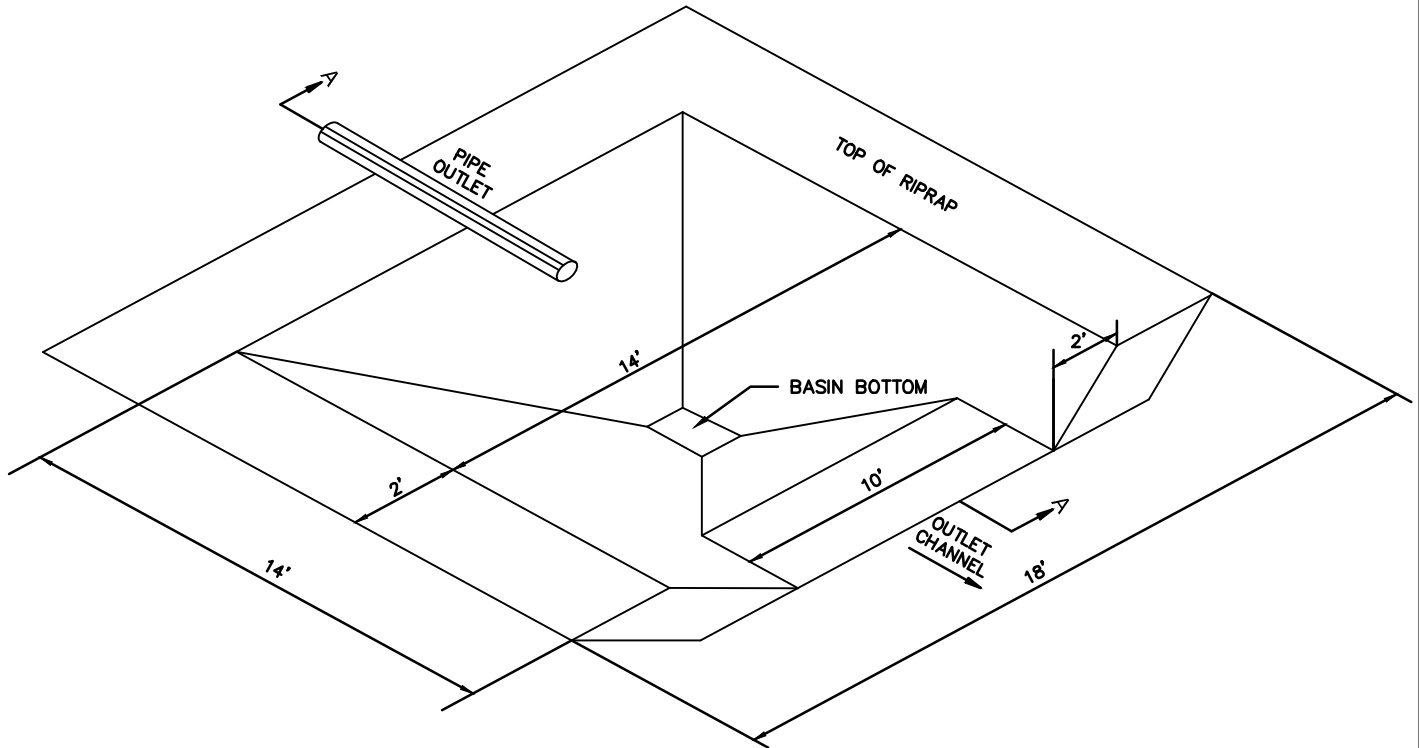
**Mountain Valley PIPELINE**

DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

CLEAN WATER DIVERSION WITH END RELEASE

DRAWING NO.	REV.
MVP-ES50.1	P



**NOTE:**

1. PLUNGE POOL OUTLET TO BE CONSTRUCTED WITHIN THE LIMITS OF DISTURBANCE.
2. PLUNGE POOL TO BE KEYED INTO CONSTRUCTED SLOPE. STEEP SLOPES MAY REQUIRE ADDITIONAL MEASURES IF SITE CONDITIONS CREATE EROSION CONDITIONS.

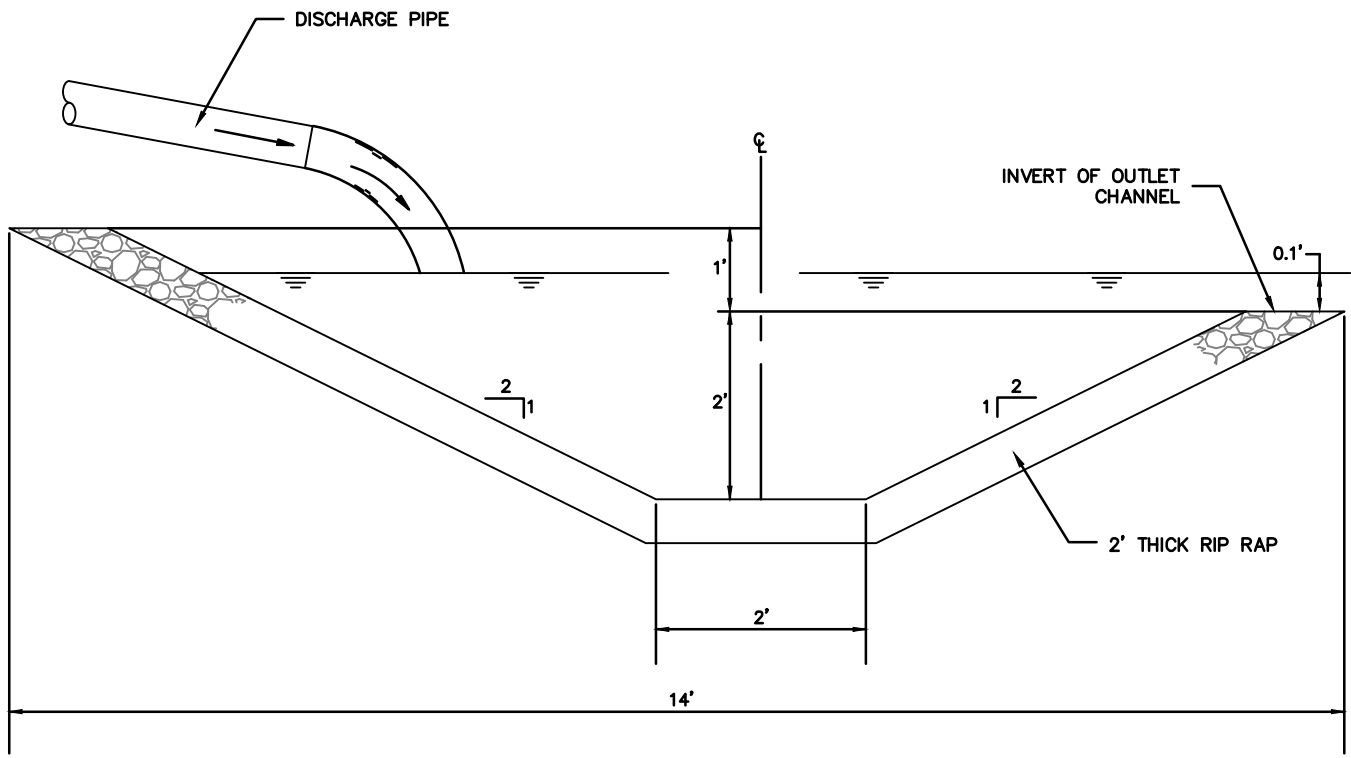
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CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
PLUNGE POOL OUTLET ISOMETRIC VIEW	
DRAWING NO.	REV.
MVP-ES51	P



SECTION A-A

NOTE:

1. USE NATIVE ROCK OR IMPORTED RIP-RAP SIZE D50 6-INCH, PLACEMENT THICKNESS 2-FEET.

DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley**  
PIPELINE

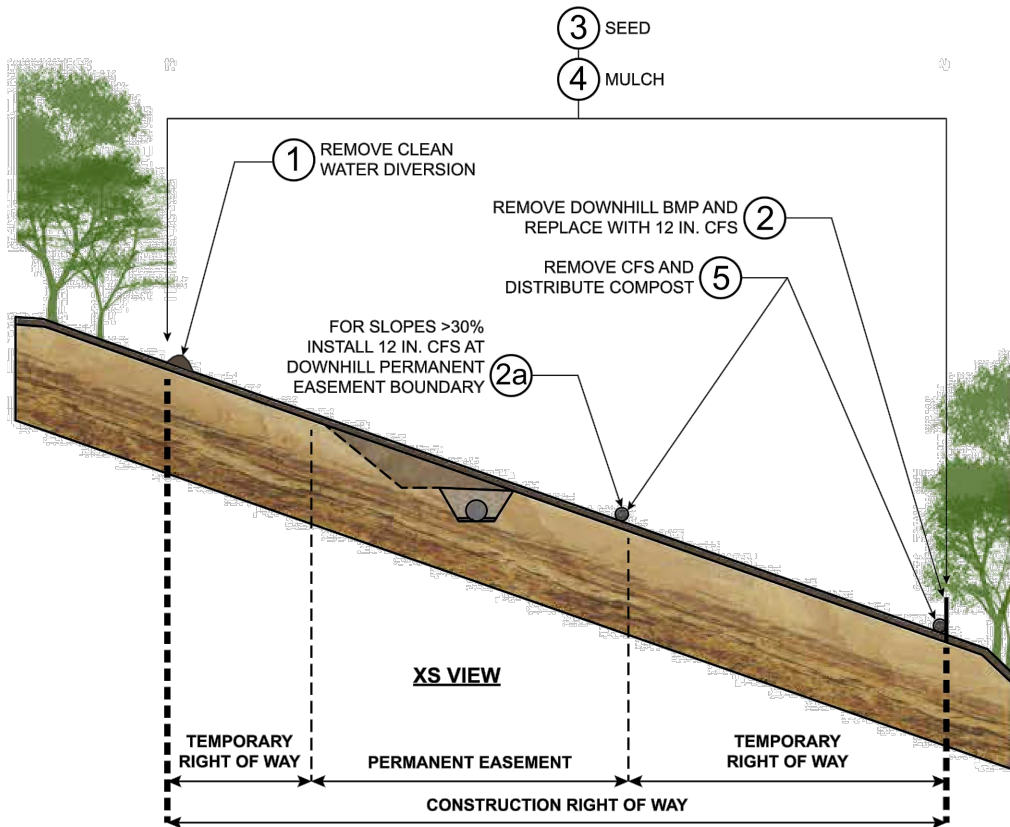
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

PLUNGE POOL OUTLET

DRAWING NO.  
MVP-ES51.1

REV.  
P



**RESTORATION BMP PHASING**

The following is the sequence of erosion and sediment control best management practice removal and installation related to restoration activities. This work will occur between restoration of pipeline limit of disturbance to pre-construction grades and final closure of the project defined as "achieving vegetative stabilization". The sequence is:

- 1) Remove and grade out the clean water diversion dike.
- 2) Remove downslope BMPs utilized during construction and immediately replace with 12-in compost filter sock. On slopes greater than 30%, an additional intermediate 12-in compost filter socks will be placed per the slope spacing (MVP-ES3.2) to attenuate the velocity of runoff in the reclaimed area.
- 3) Where seed is not included in the mulch (step 4), seed the area using the seed types and rates MVP-ES11.1 to MVP-ES11.9 and MVP-ES12.1 to MVP-ES12.4.
- 4) Apply mulch in the form of organic mulch (per MVP-ES45), soil stabilization matting (per VADEQ STD & SPEC 3.36), or hydraulic erosion control product (per MVP-ES40).
- 5) Following a determination that the site has achieved vegetative stabilization, the compost filter sock will be "opened" and the mulch contained within will be spread within the LOD.

DRAWN	DATE	10/13/17
CHECKED	DATE	10/13/17
APP'D	DATE	10/13/17
SCALE	N.T.S.	SHEET 1 OF 1
JOB NO.		
PROJECT ID:		
MVP – VA PORTION		

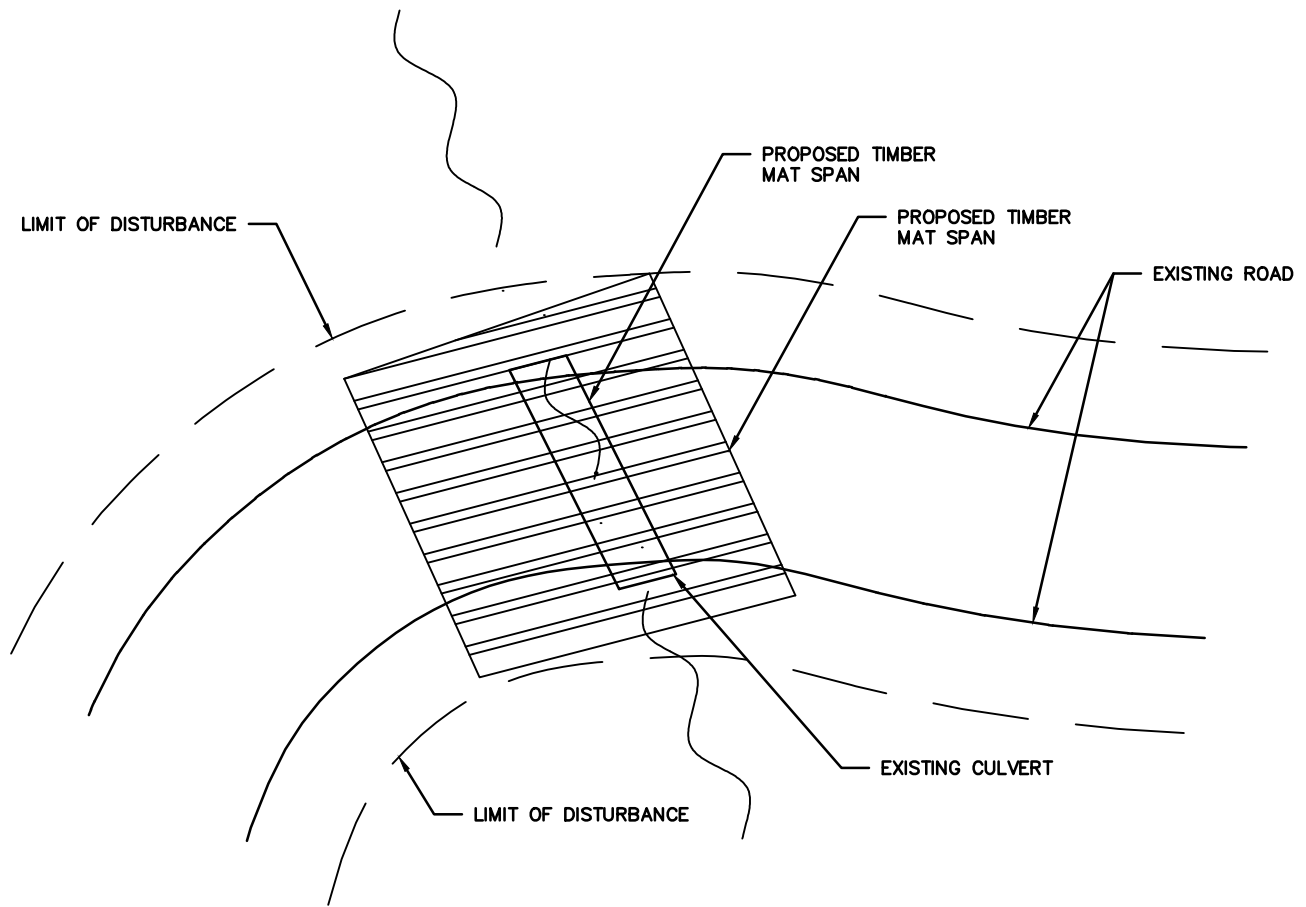


**Mountain Valley PIPELINE**

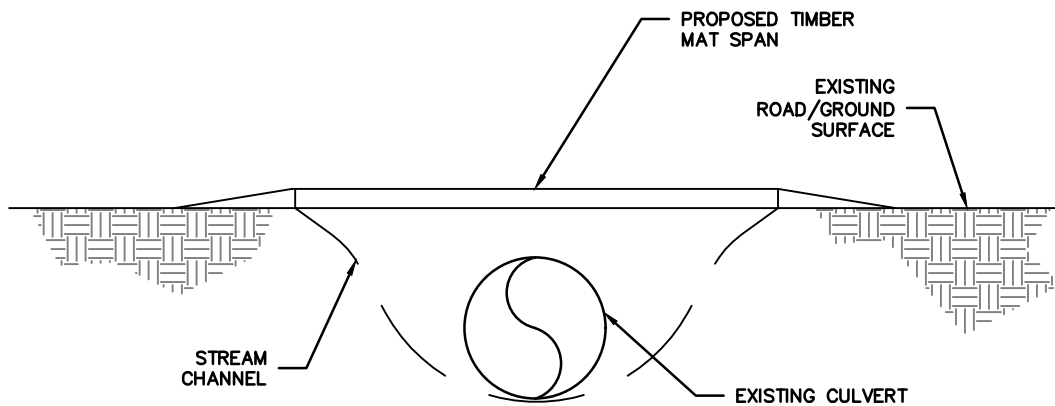
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
RESTORATION DETAIL	
DRAWING NO.	REV.
MVP-ES52	P





PLAN



SECTION

DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

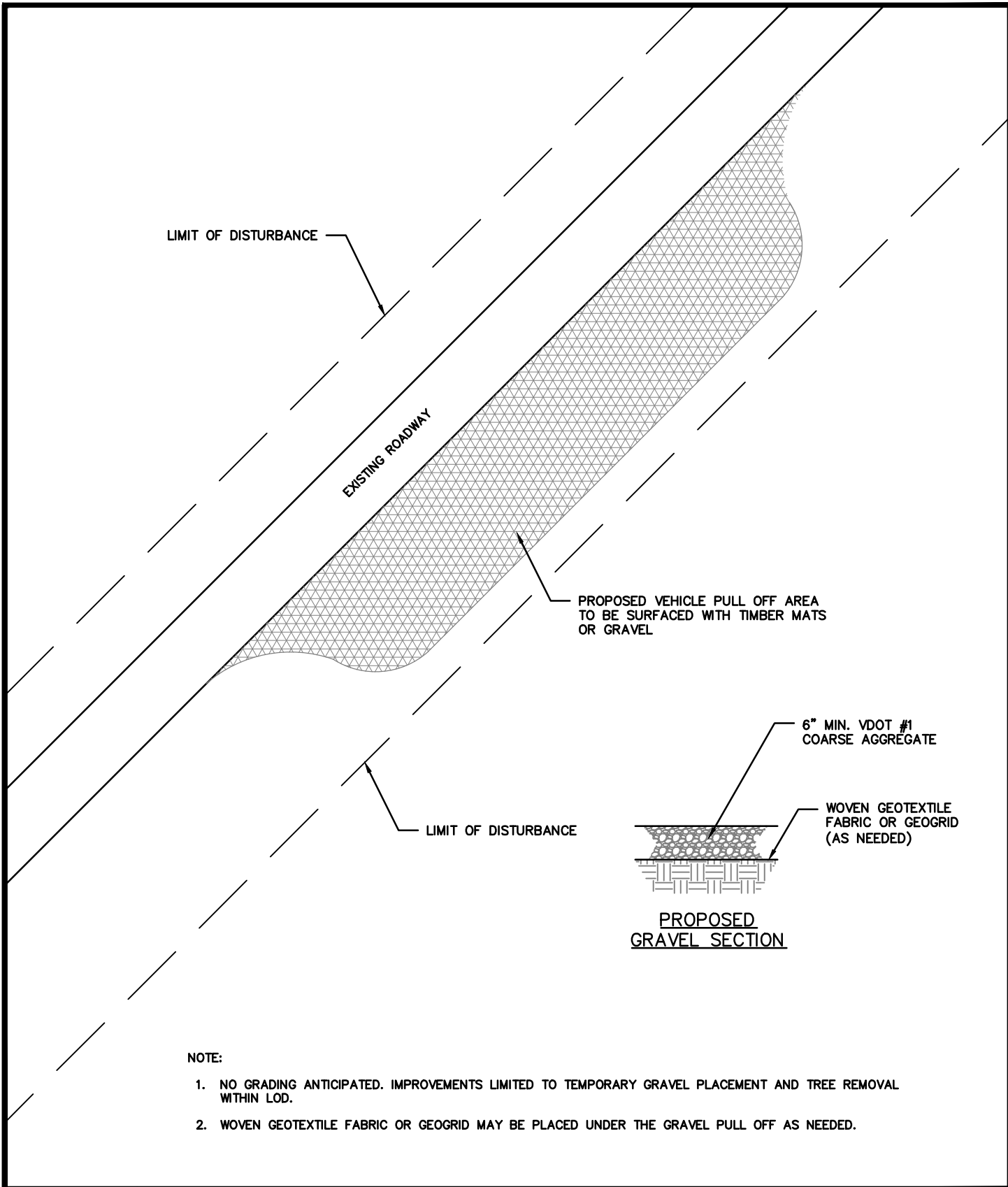
**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

TEMPORARY TIMBER MAT  
WIDENING DETAIL

DRAWING NO.  
MVP-ES53

REV.  
P



DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



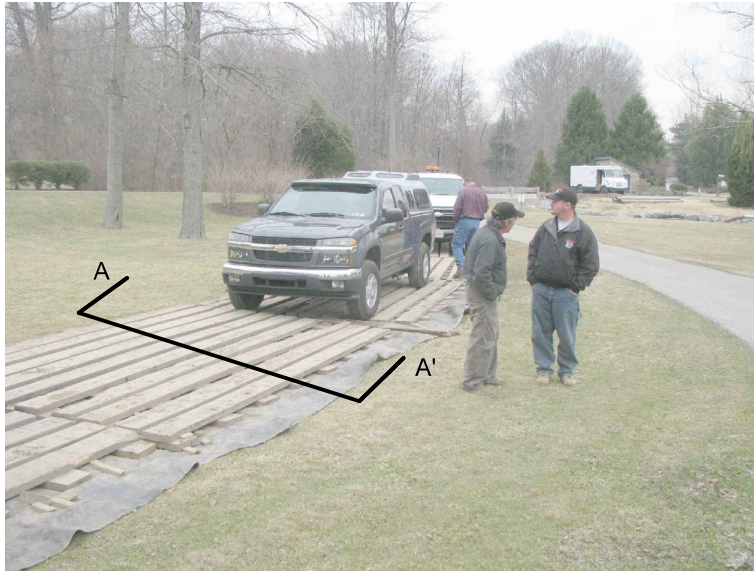
**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
TEMPORARY VEHICLE PULL OFF DETAIL	
DRAWING NO.	REV.
MVP-ES54	P

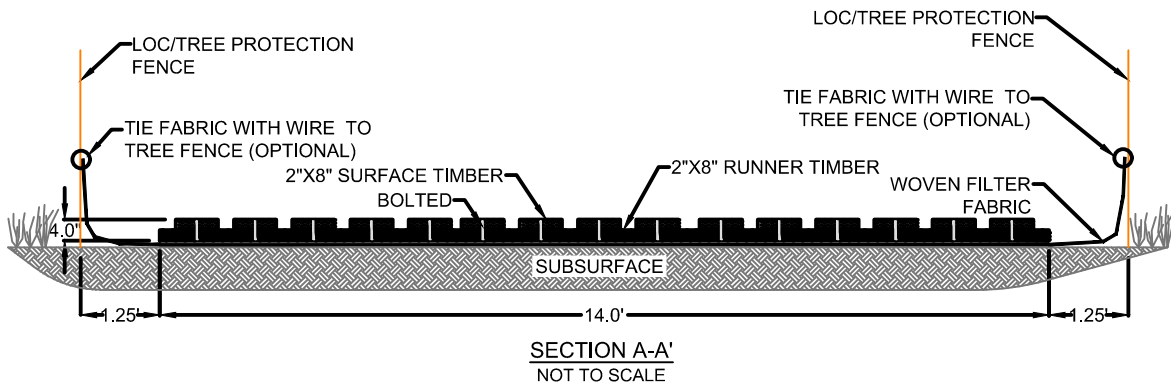
# ACCESS ROAD DECK MAT

## NOT TO SCALE



- NOTES:
1. MAT SHALL BE "DECK MAT" BY CAROLINA MAT INCORPORATED OR APPROVED EQUAL.
  2. MATS SHALL BE INSTALLED SUCH THAT THE SURFACE TIMBER RUNS PARALLEL WITH THE VEHICLE TREAD. SUBSEQUENT MATS SHALL BE INSTALLED SUCH THAT THEY BUTT UP AGAINST EACH OTHER.

EXAMPLE INSTALLATION  
USING 10' WIDE DECK MAT

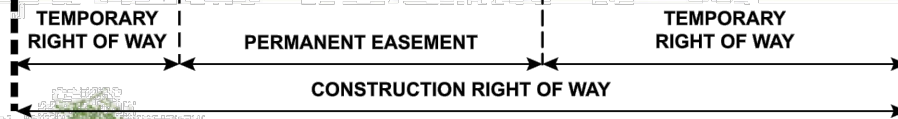
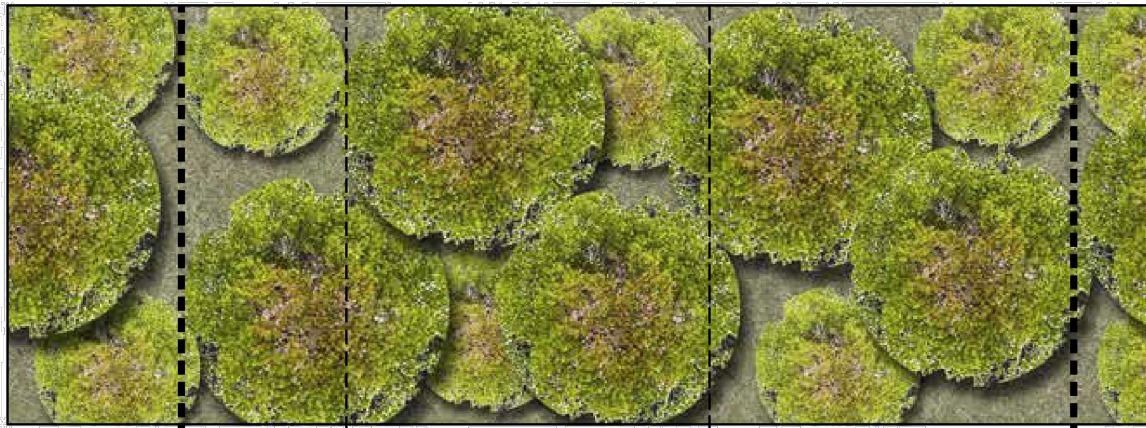


DRAWN	DATE 10/13/17
CHECKED	DATE 10/13/17
APP'D	DATE 10/13/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

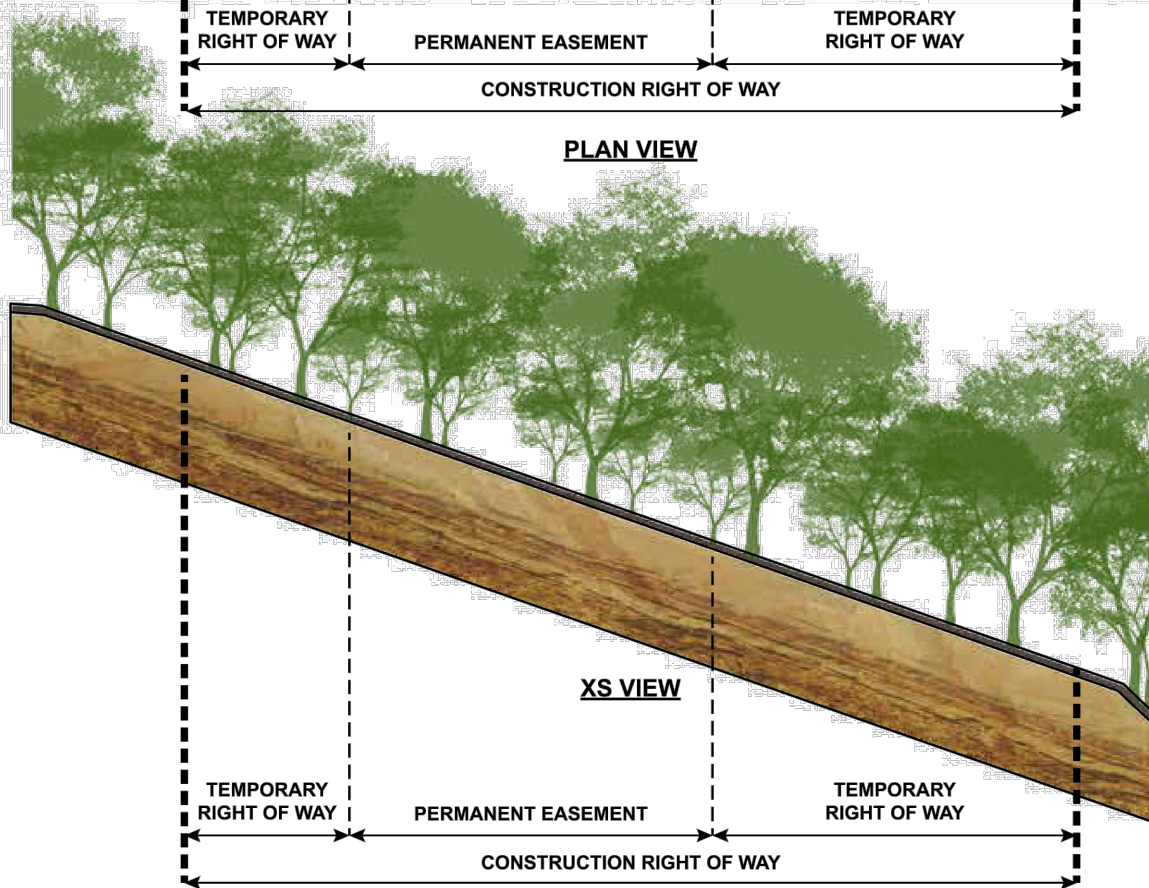


**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
DECK MAT	
DRAWING NO.	REV.
MVP-ES55	P



**PLAN VIEW**



**XS VIEW**

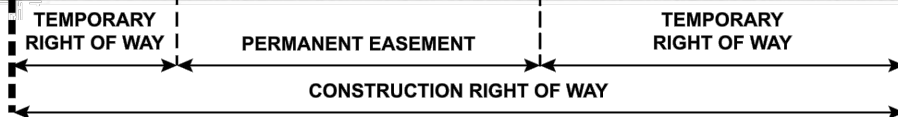
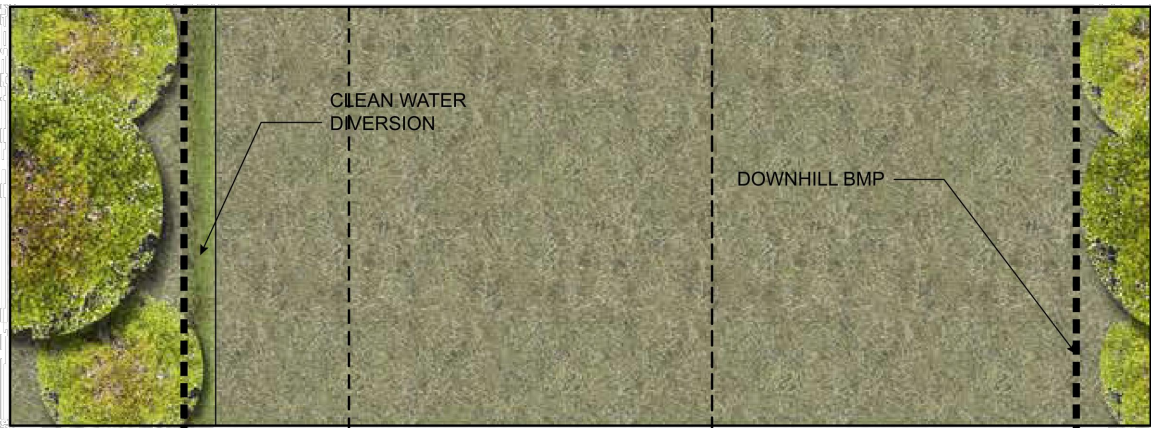
**CONSTRUCTION ACTIVITIES DURING STEP 1**  
 - SURVEY AND STAKE CONSTRUCTION ROW

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP – VA PORTION	

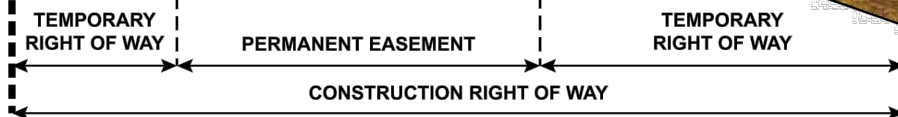
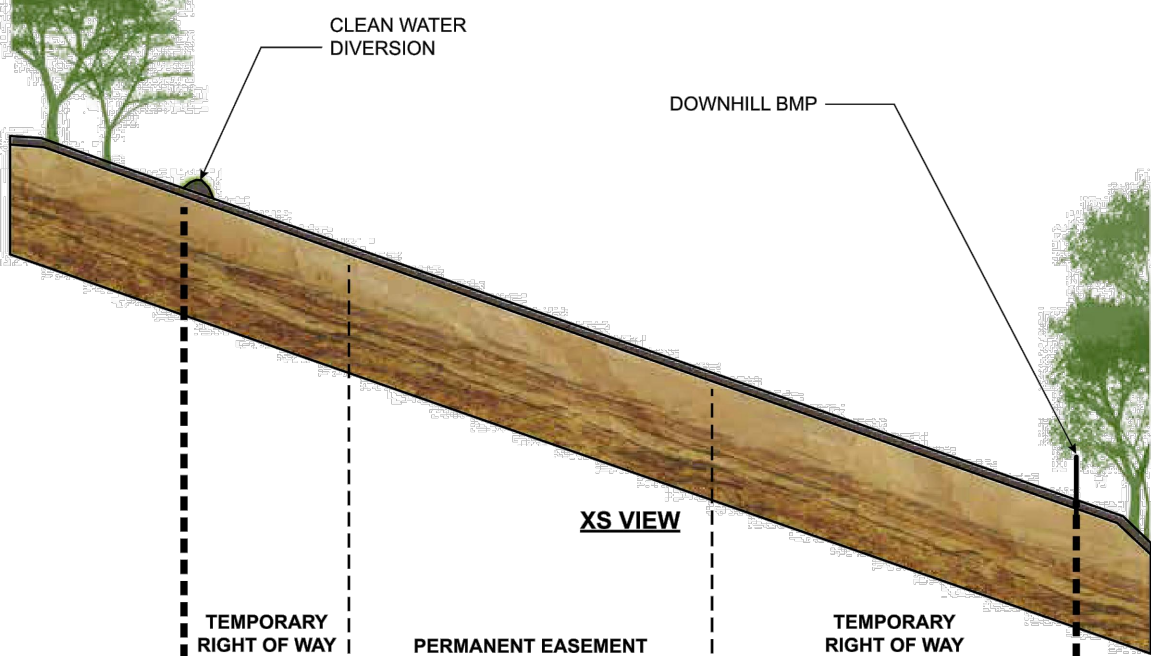
**Mountain Valley**  
 PIPELINE  
 DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
CONSTRUCTION SEQUENCE STEP 1 OF 14	
DRAWING NO. MVP-ES56.1	REV. P





**PLAN VIEW**



**CONSTRUCTION ACTIVITIES DURING STEP 2**

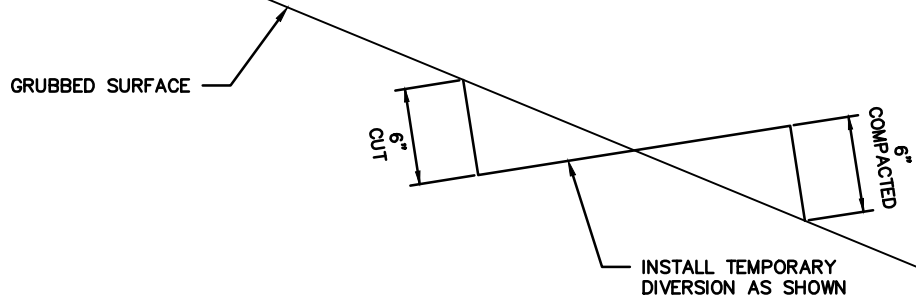
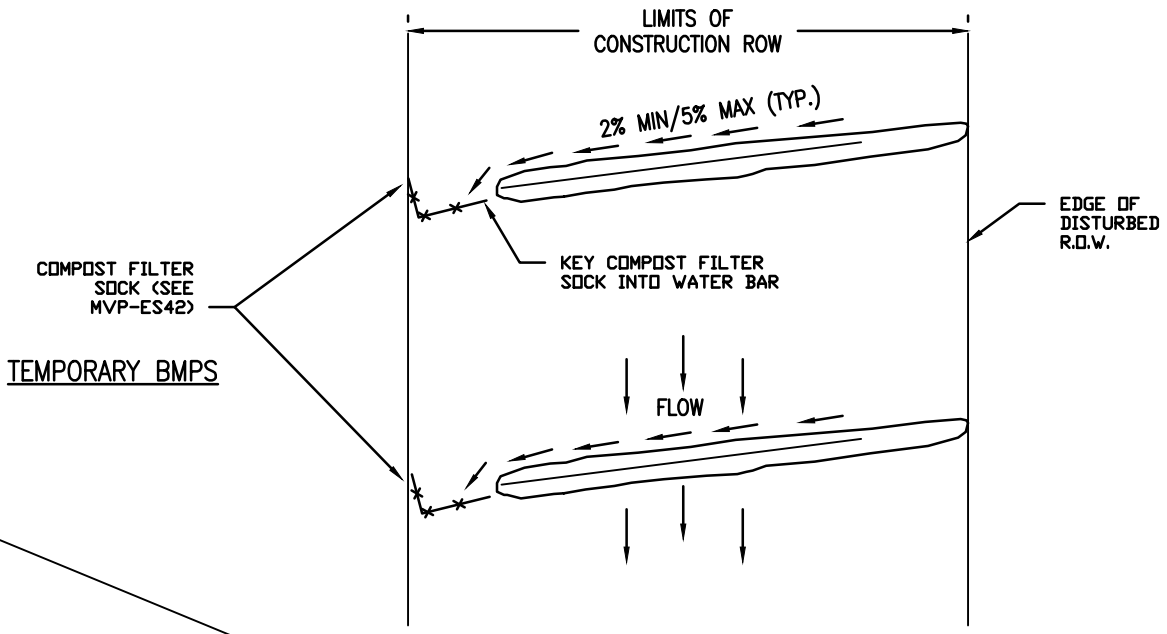
- CLEAR CONSTRUCTION ROW
- INSTALL PERIMETER E&S CONTROLS
- SEED AND MULCH CLEAN WATER DIVERSION
- FOLLOWING GRUBBING AND PRIOR TO TOPSOIL SEGREGATION, INSTALL TEMPORARY DIVERSION PER MVP-ES56.2A UTILIZING THE SPACING CONTAINED ON MVP-17.2

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID: MVP - VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
CONSTRUCTION SEQUENCE STEP 2 OF 14	
DRAWING NO. MVP-ES56.2	REV. P



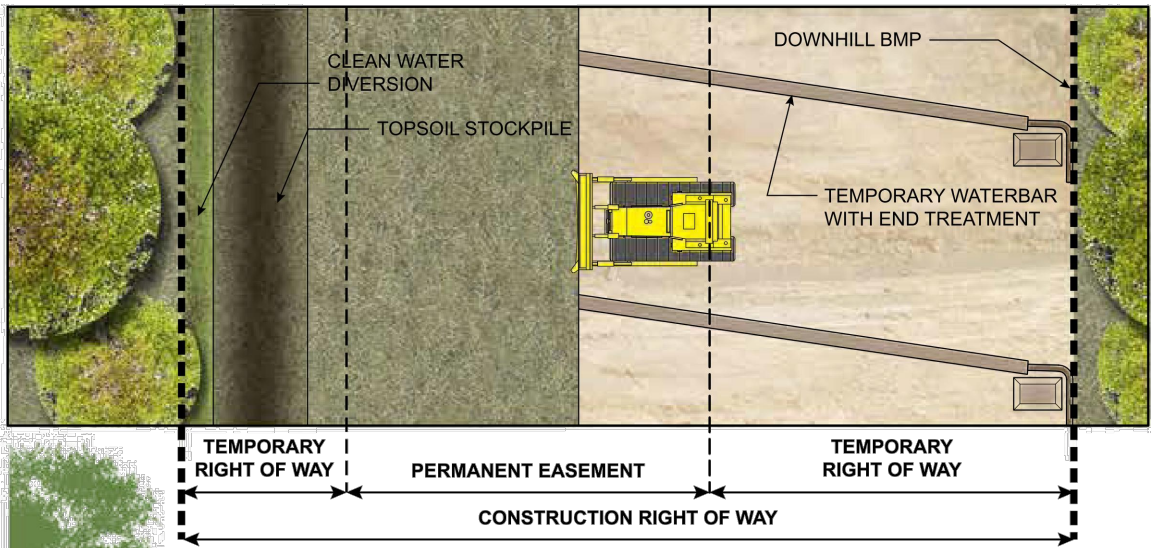
DRAWN	JK	DATE	04/01/20
CHECKED	RE	DATE	04/01/20
APP'D	DJW	DATE	04/01/20
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



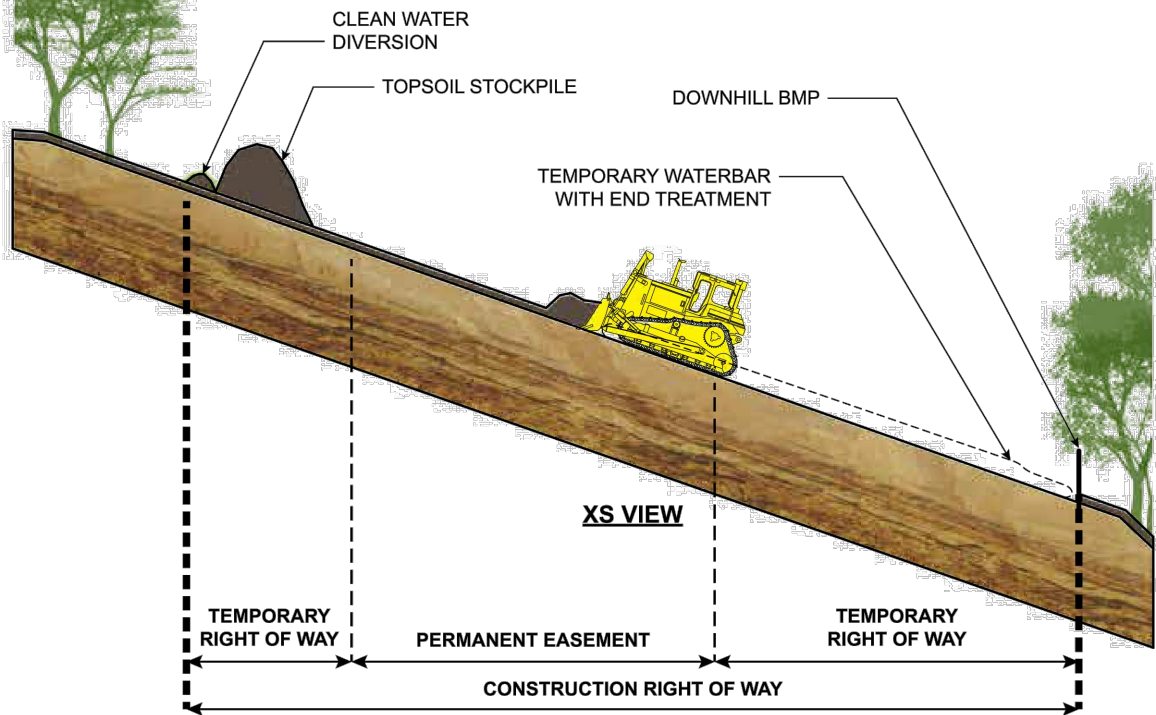
**Mountain Valley PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
PRE-TOPSOIL SEGREGATION TEMPORARY WATER DIVERSION	
DRAWING NO.	REV.
MVP-ES56.2A	P



**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 3**

- STRIP AND STOCKPILE TOPSOIL FROM CONSTRUCTION ROW
- SEED AND MULCH TOPSOIL STOCKPILE
- WATERBARS INSTALLED AT THE END OF EACH DAY FOLLOWING EARTH DISTURBANCE

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley PIPELINE**

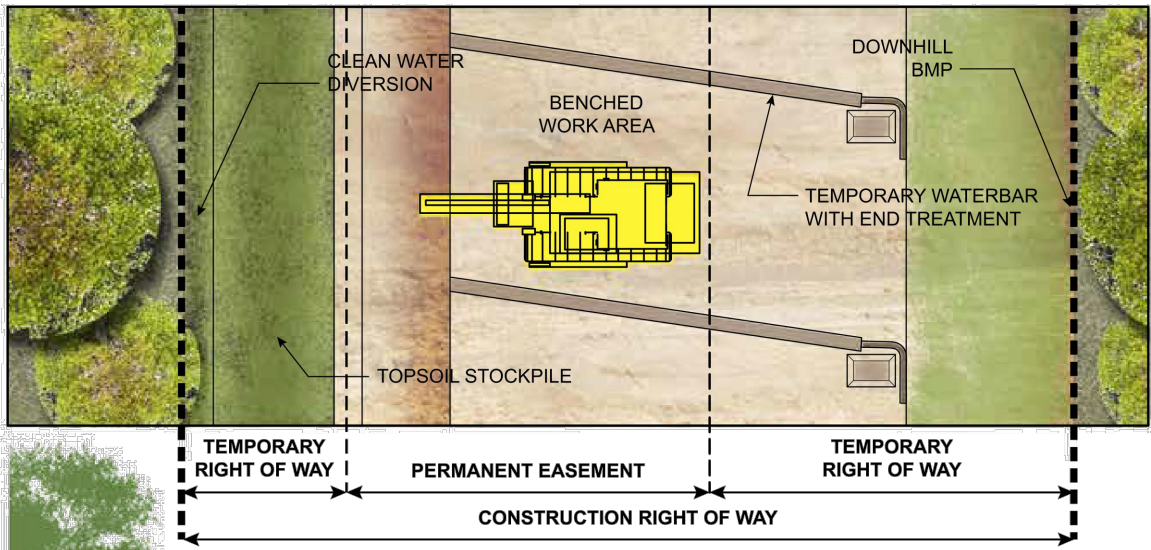
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

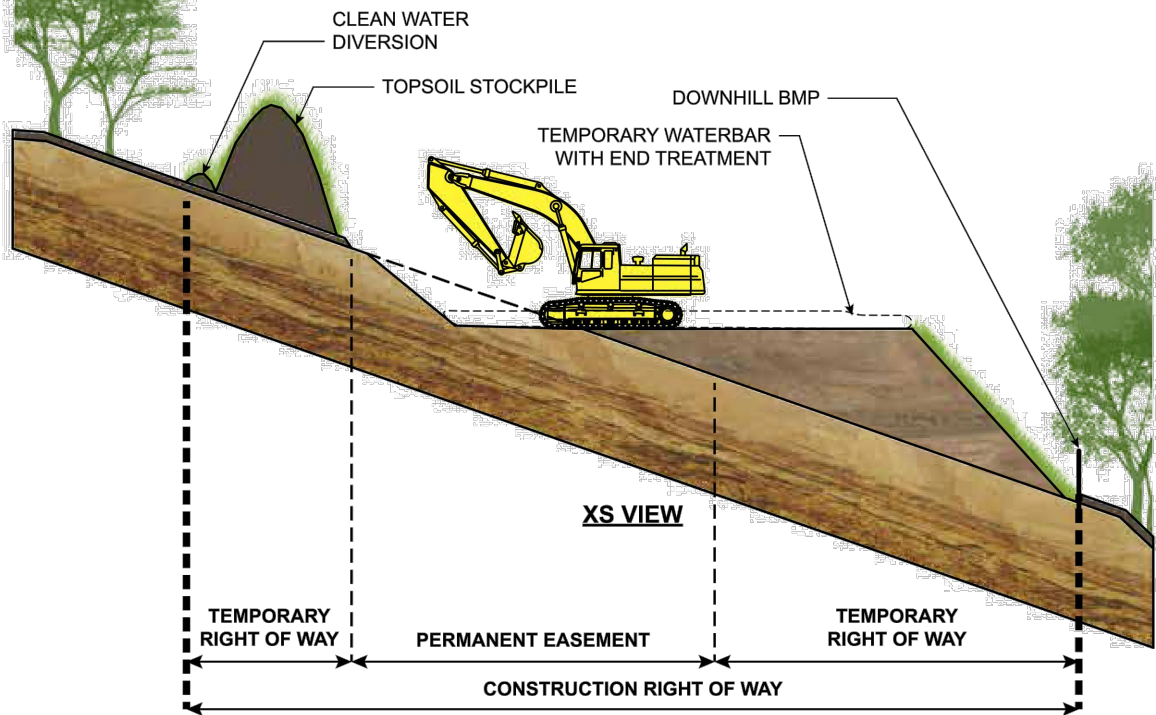
CONSTRUCTION SEQUENCE  
STEP 3 OF 14

DRAWING NO.	REV.
MVP-ES56.3	P





**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 4**

- BENCH WORK AREA
- TEMPORARY SEED AND MULCH FILL SLOPE
- TEMPORARY WATERBAR IS REMOVED AT THE START OF EACH WORK DAY IN AREAS OF ACTIVE CONSTRUCTION. IT IS REINSTALLED AT THE END OF EACH DAY PRIOR TO LEAVING THE SITE.

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

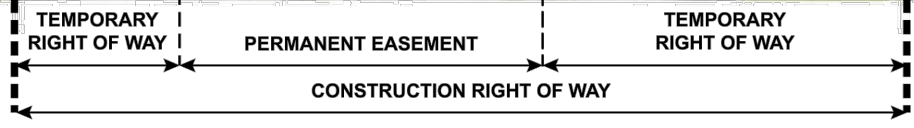
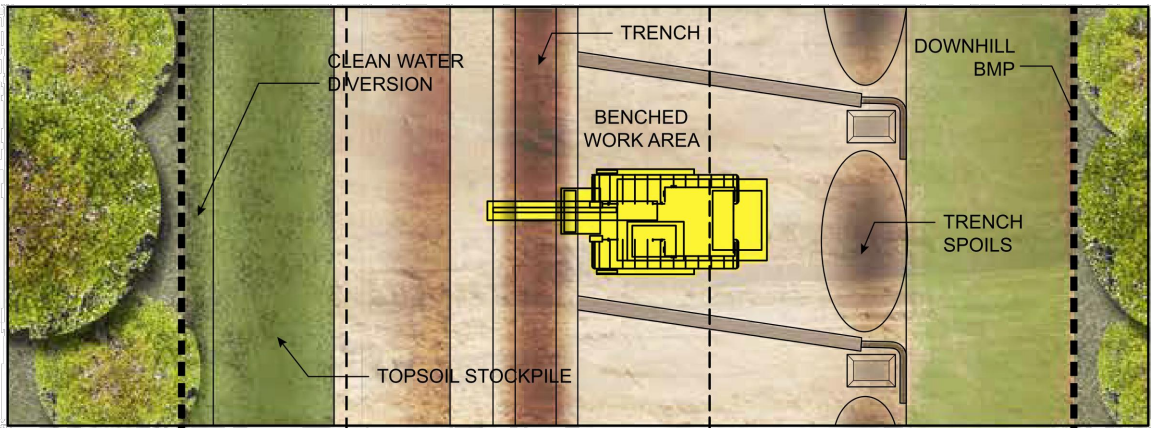


**Mountain Valley PIPELINE**

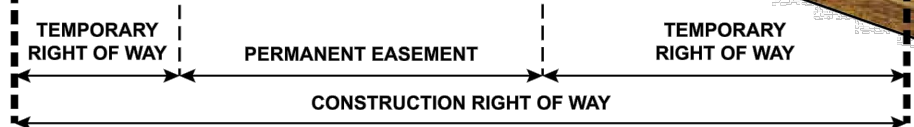
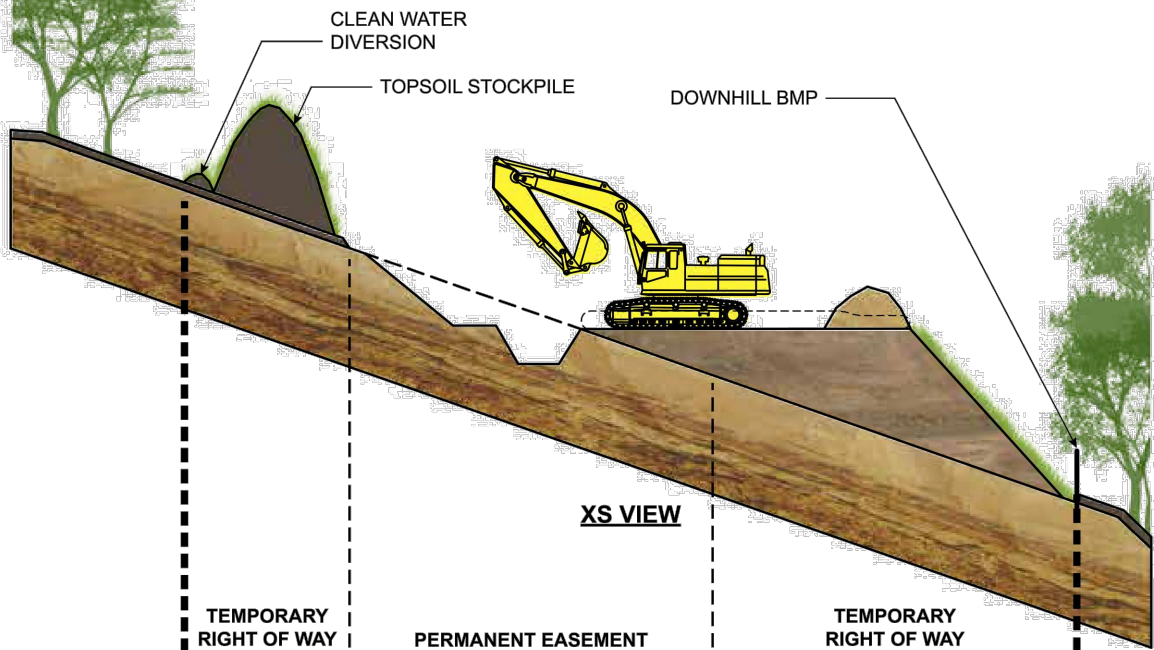
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
CONSTRUCTION SEQUENCE STEP 4 OF 14	
DRAWING NO. MVP-ES56.4	REV. P





**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 5**

- EXCAVATE TRENCH
- TEMPORARY SEED AND MULCH SPOIL STOCKPILE
- TEMPORARY WATERBARS ARE RE-INSTALLED AT THE END OF EACH DAY ONCE EARTH DISTURBING ACTIVITIES HAVE COMMENCED

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

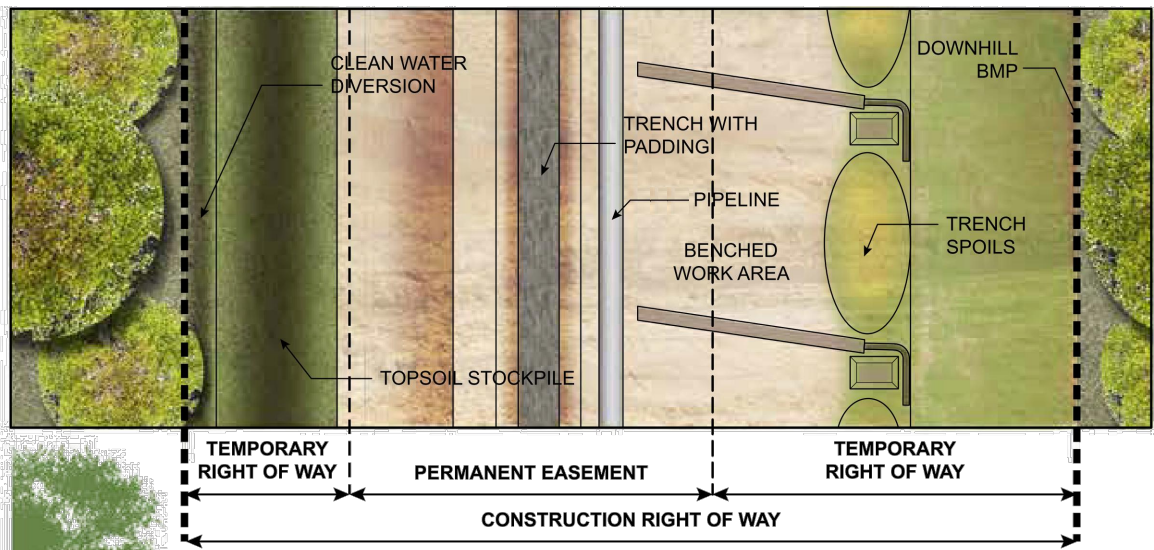
**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

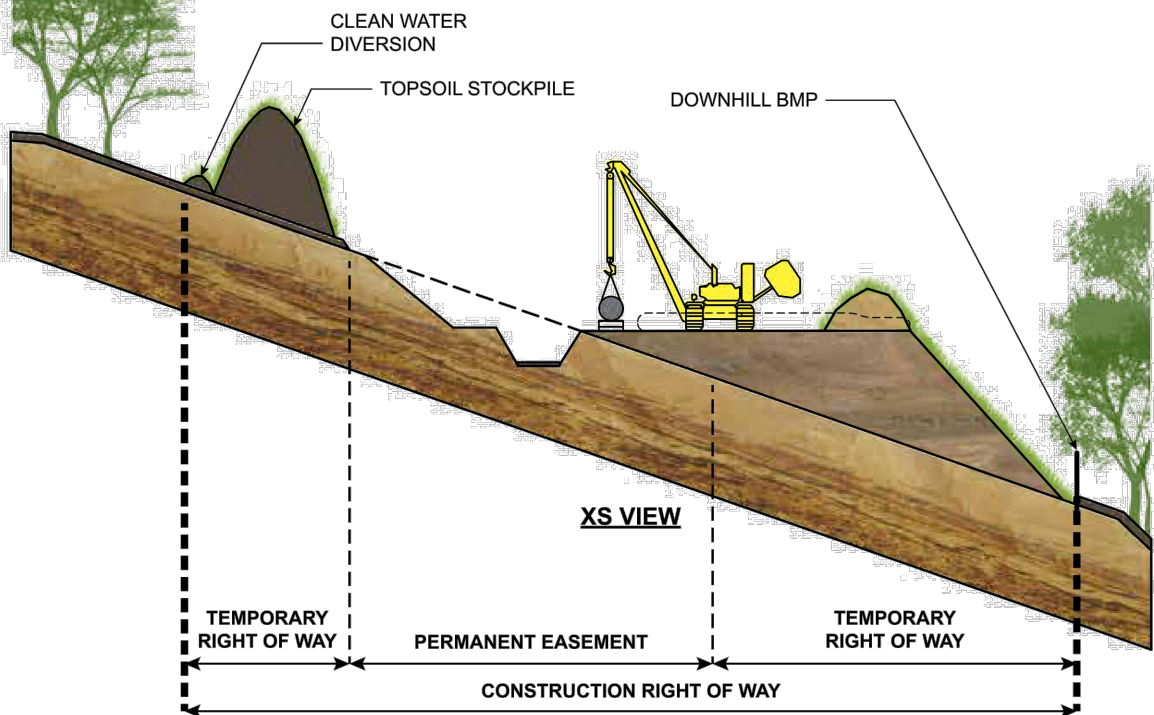
CONSTRUCTION SEQUENCE  
STEP 5 OF 14

DRAWING NO.  
MVP-ES56.5

REV.  
P



**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 6**

- PAD TRENCH BOTTOM, STRING AND FIELD BEND PIPE
- LINE-UP, INITIAL WELDING
- AS-BUILT FOOTAGE
- X-RAY INSPECTION, WELD REPAIR
- COAT FIELD WELDS
- INSPECTION AND REPAIR OF COATING
- TEMPORARY WATERBARS ARE RE-INSTALLED AT THE END OF EACH DAY ONCE EARTH DISTURBING ACTIVITIES HAVE COMMENCED

DRAWN	JK	DATE	04/01/20
CHECKED	RE	DATE	04/01/20
APP'D	DJW	DATE	04/01/20
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.

PROJECT ID:

MVP – VA PORTION



DESIGN ENGINEERING

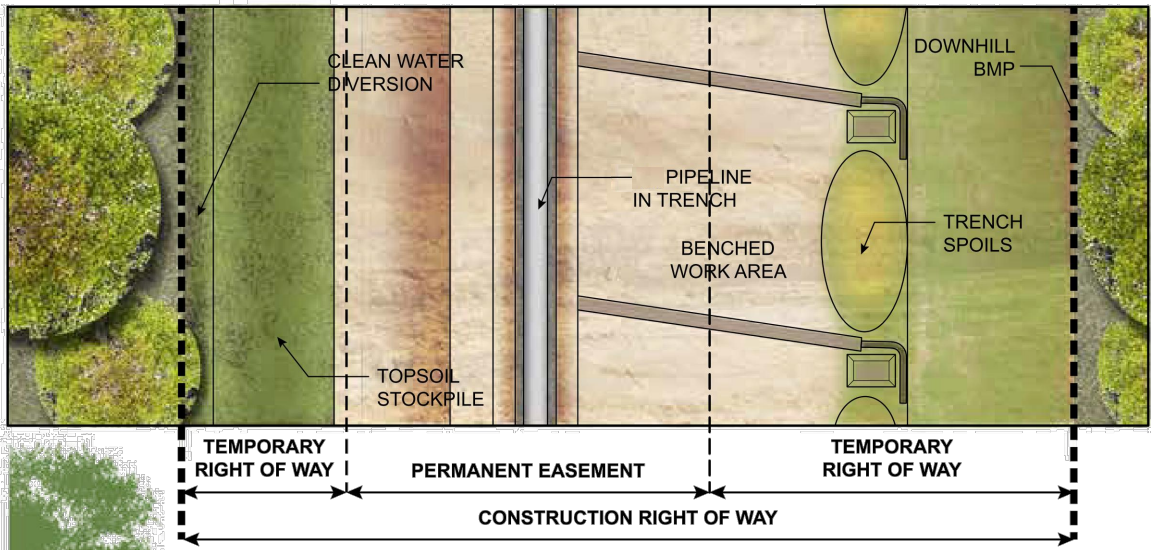
**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 6 OF 14

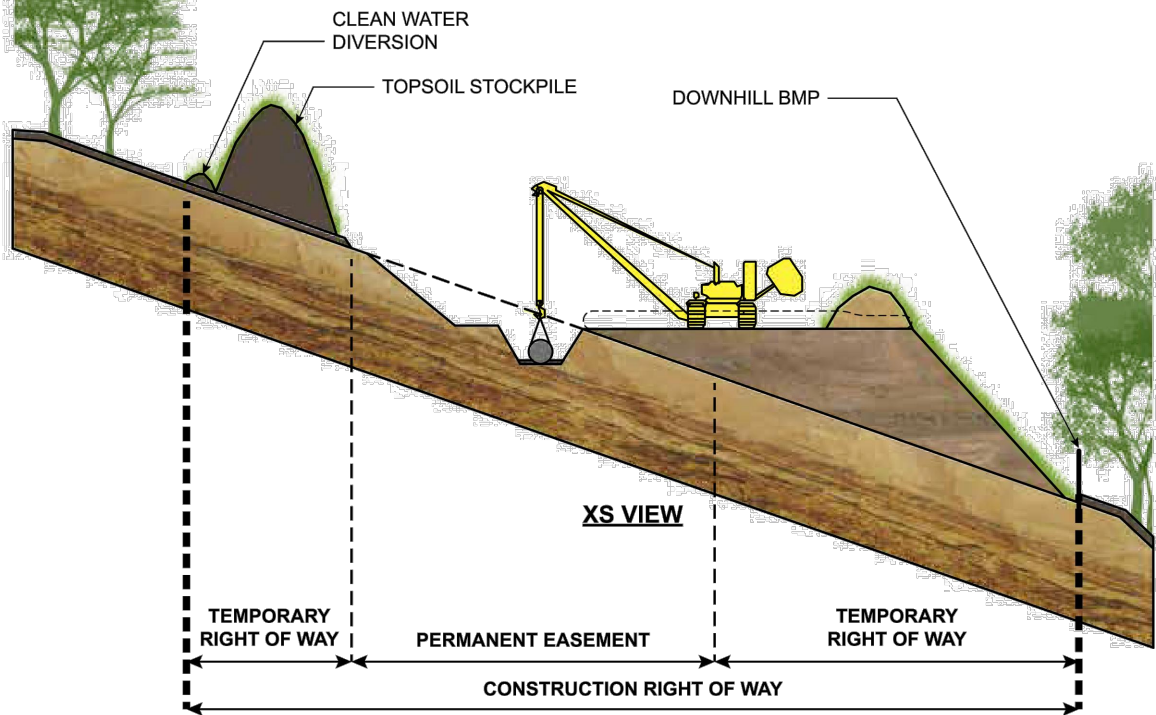
DRAWING NO.  
MVP-ES56.6

REV.  
P





**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 7**

- LOWER PIPE INTO TRENCH
- AS-BUILT SURVEY
- TEMPORARY WATERBARS ARE RE-INSTALLED AT THE END OF EACH DAY ONCE EARTH DISTURBING ACTIVITIES HAVE COMMENCED

DRAWN	JK	DATE	04/01/20
CHECKED	RE	DATE	04/01/20
APP'D	DJW	DATE	04/01/20
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.

PROJECT ID:

MVP – VA PORTION



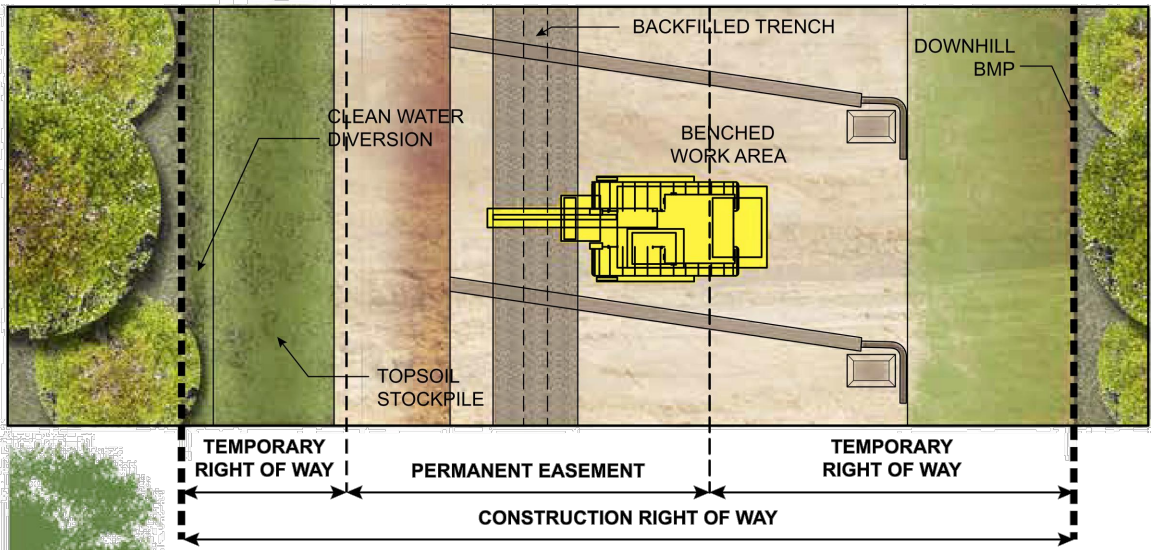
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

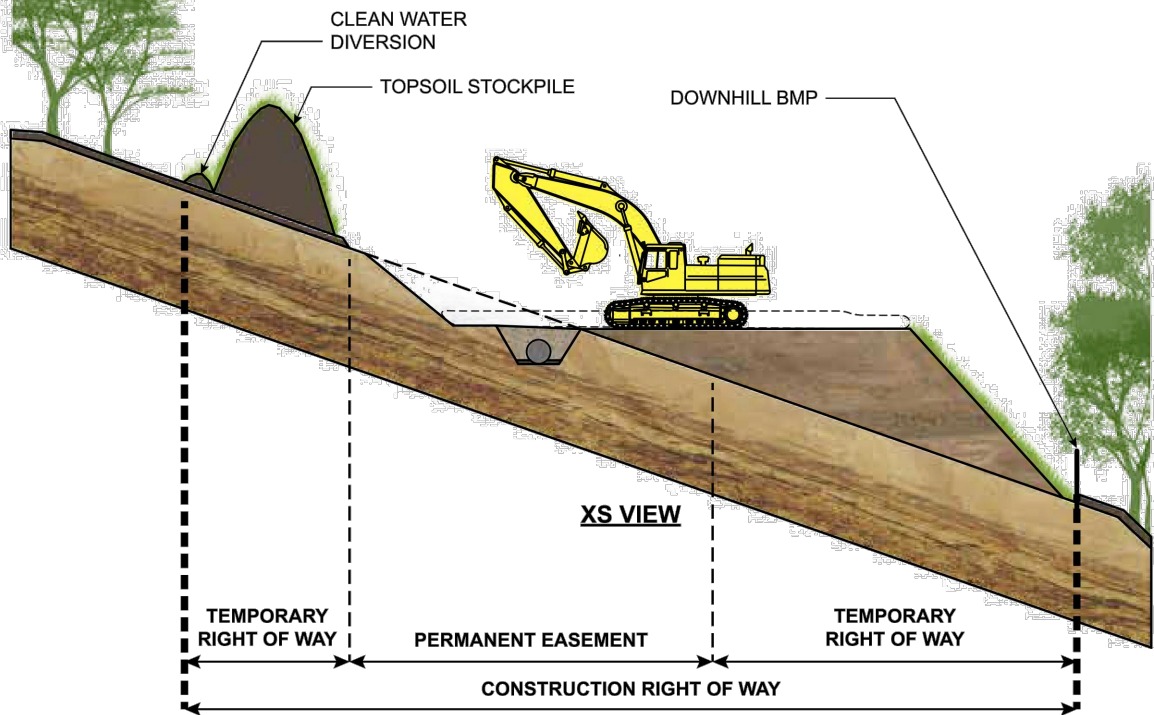
CONSTRUCTION SEQUENCE  
STEP 7 OF 14

DRAWING NO.  
MVP-ES56.7

REV.  
P



**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 8**

- BACKFILL TRENCH
- HYDROSTATIC TESTING
- TEMPORARY WATERBARS ARE RE-INSTALLED AT THE END OF EACH DAY ONCE EARTH DISTURBING ACTIVITIES HAVE COMMENCED

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

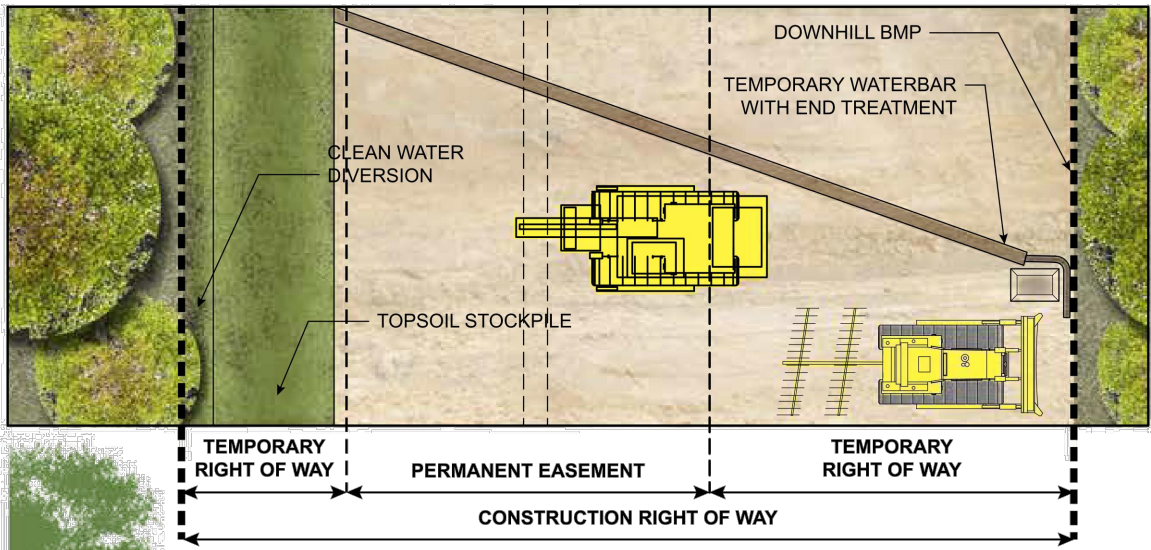
**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 8 OF 14

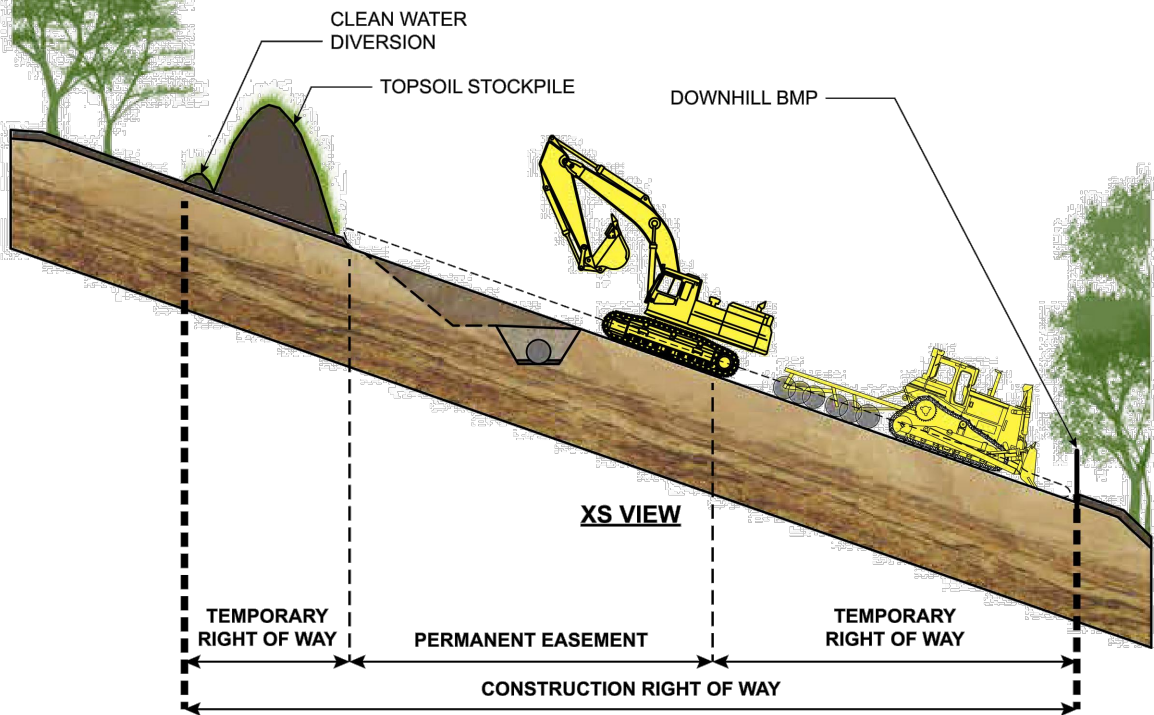
DRAWING NO.  
MVP-ES56.8

REV.  
P





**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 9**

- BACKFILL WORK AREA
- DISK SUBSOIL
- TEMPORARY WATERBARS ARE RE-INSTALLED AT THE END OF EACH DAY ONCE EARTH DISTURBING ACTIVITIES HAVE COMMENCED

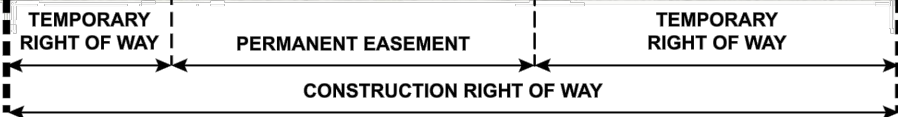
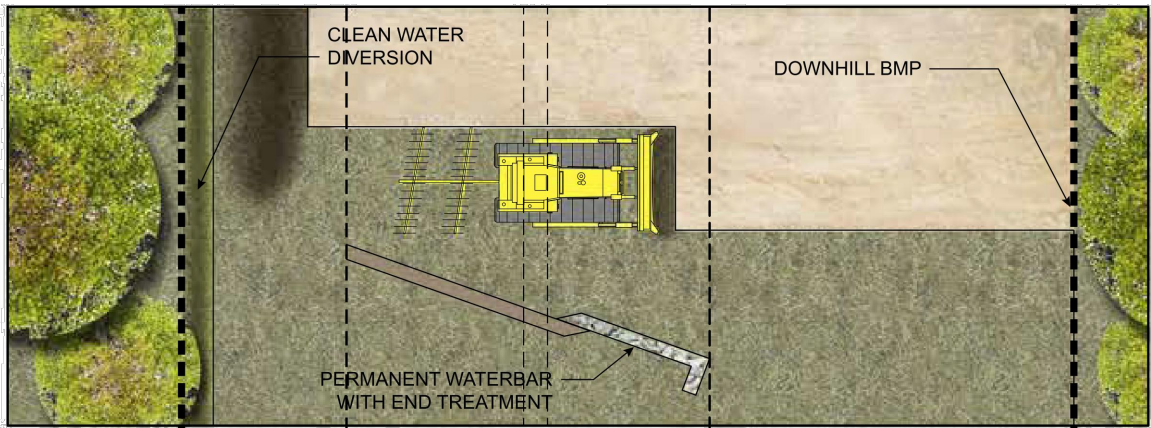
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CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley PIPELINE**  
DESIGN ENGINEERING

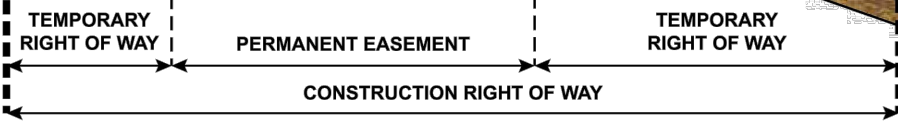
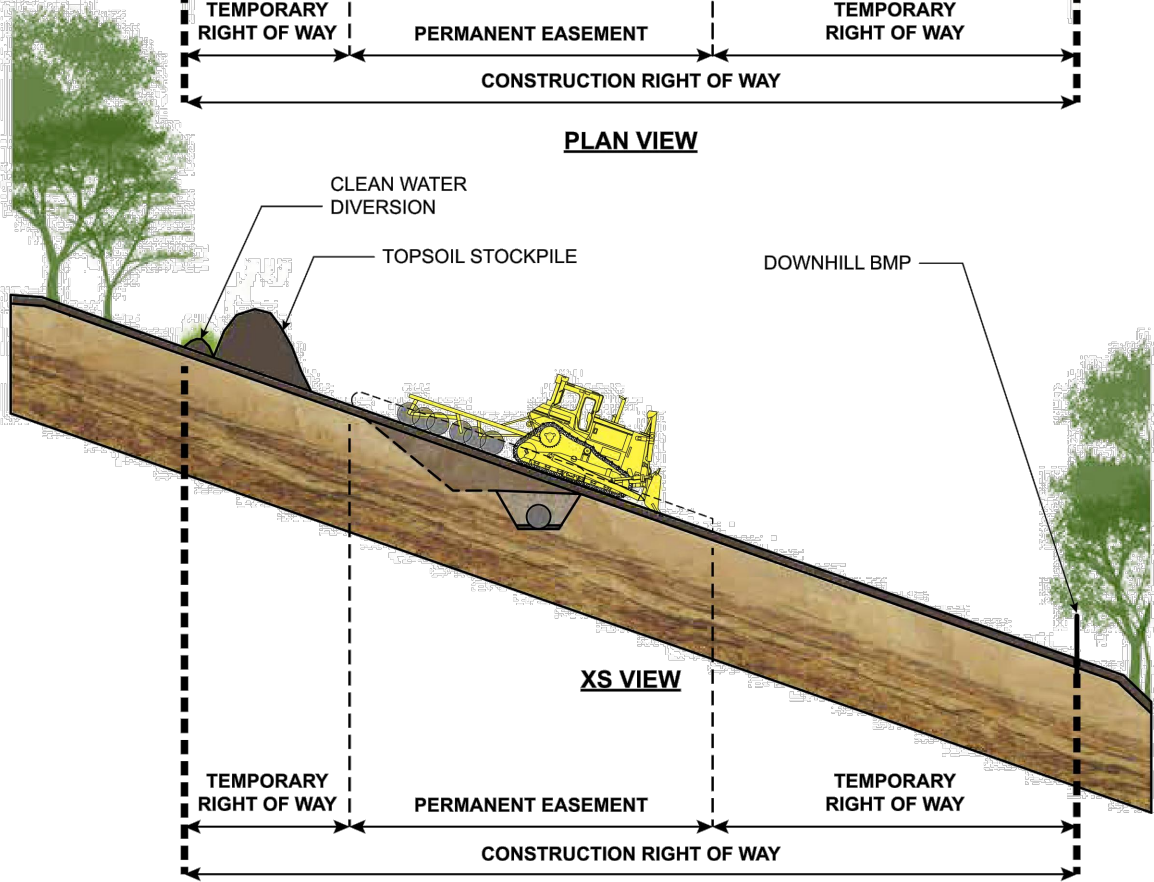
**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 9 OF 14

DRAWING NO.	REV.
MVP-ES56.9	P



**PLAN VIEW**



**CONSTRUCTION ACTIVITIES DURING STEP 10**

- RESPREAD TOPSOIL AND DISK
- FINAL CLEAN-UP
- INSTALL PERMANENT WATERBARS

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

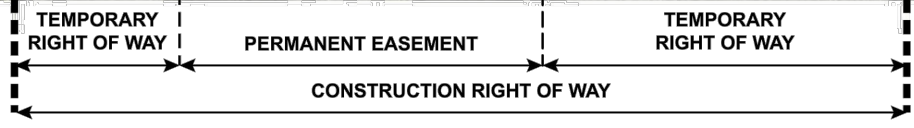
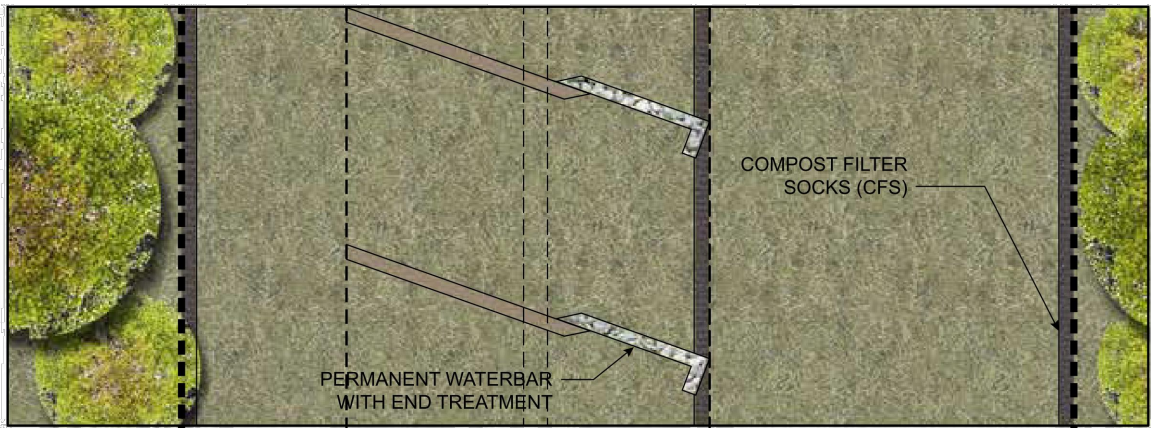
**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

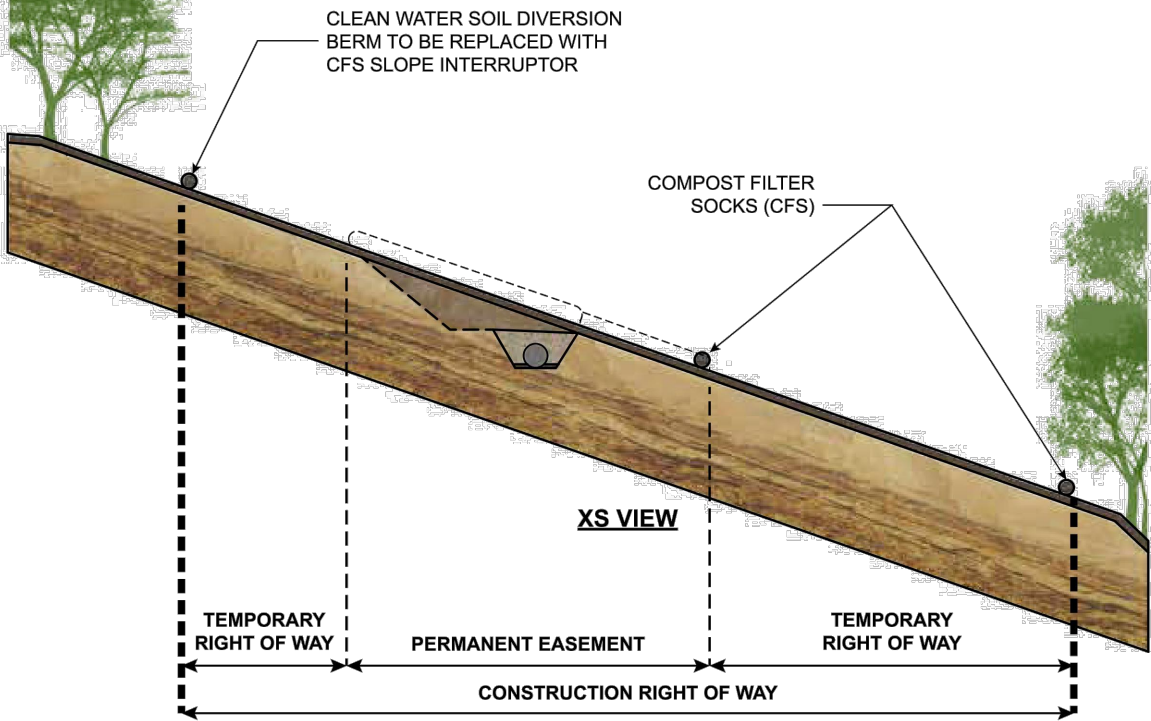
CONSTRUCTION SEQUENCE  
STEP 10 OF 14

DRAWING NO.	REV.
MVP-ES56.10	P





**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 11**

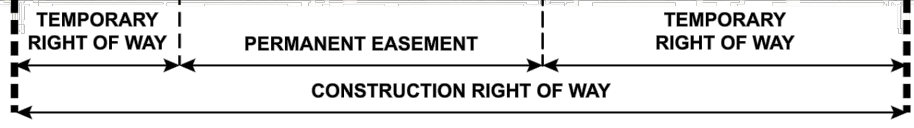
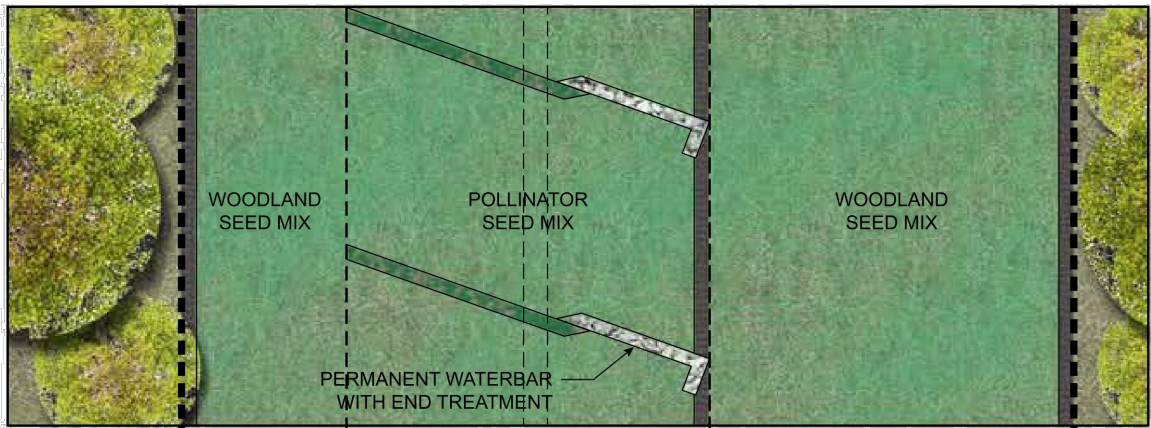
- REMOVE CLEAN WATER DIVERSION AND REPLACE WITH 12" CFS
- REMOVE DOWNHILL BMP AND REPLACE WITH 12" CFS
- FOR SLOPES >30% INSTALL 12" CFS AT DOWNHILL PERMANENT EASEMENT BOUNDARY AS WELL
- AREAS WITH 3:1 OR STEEPER SLOPES WILL HAVE HECF APPLIED

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

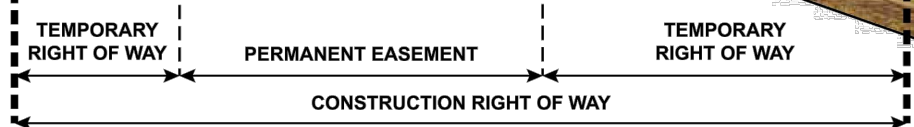
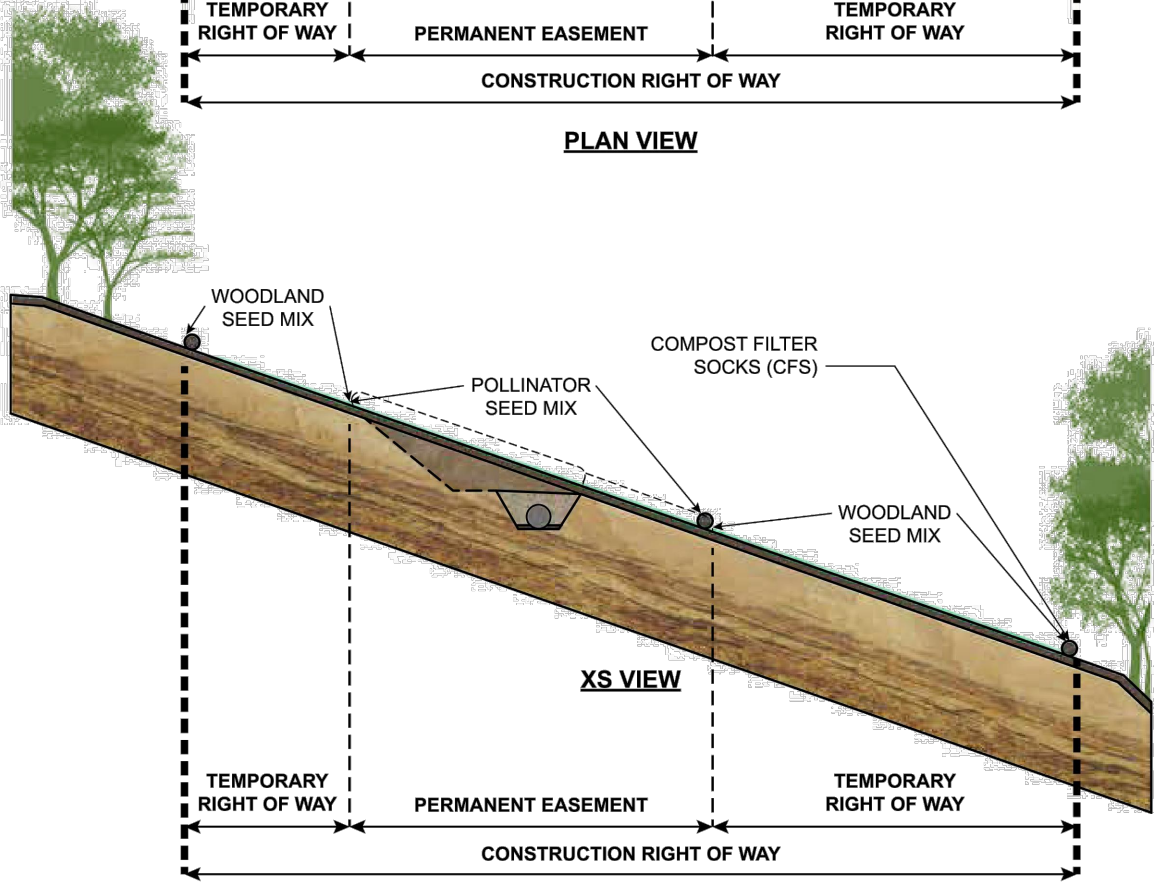


**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
CONSTRUCTION SEQUENCE STEP 11 OF 14	
DRAWING NO. MVP-ES56.11	REV. P



**PLAN VIEW**



**XS VIEW**

**CONSTRUCTION ACTIVITIES DURING STEP 12**

- APPLY PERMANENT SEED AND MULCH
- SEE MVP STANDARDS AND SPECIFICATIONS (MVP-ES11.1 - MVP-ES11.7, MVP-ES12.1 - MVP-ES12.3)

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**DESIGN ENGINEERING**

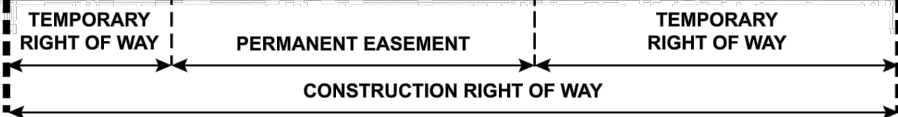
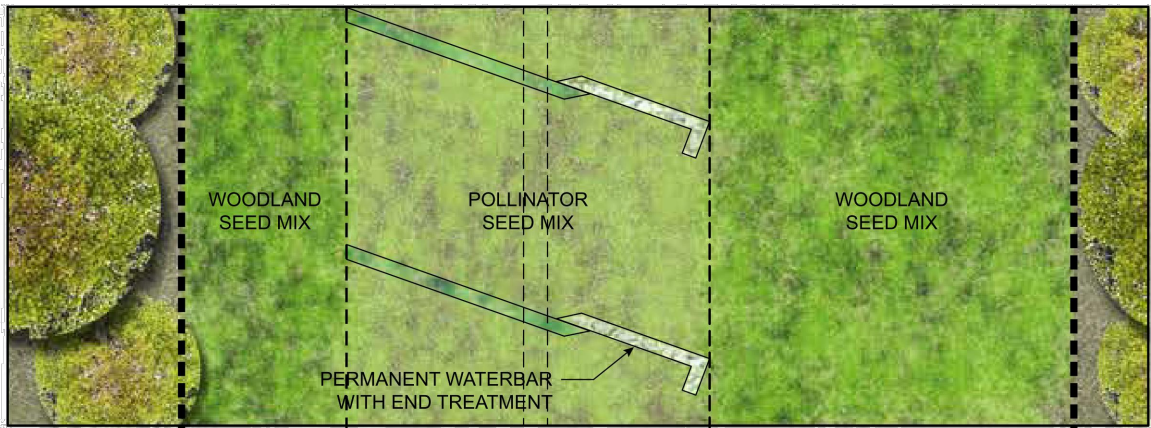
**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 12 OF 14

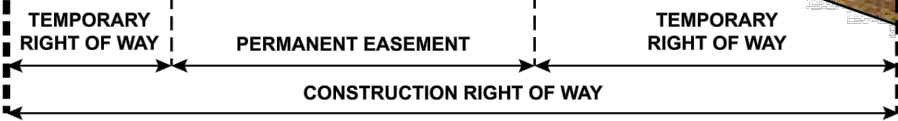
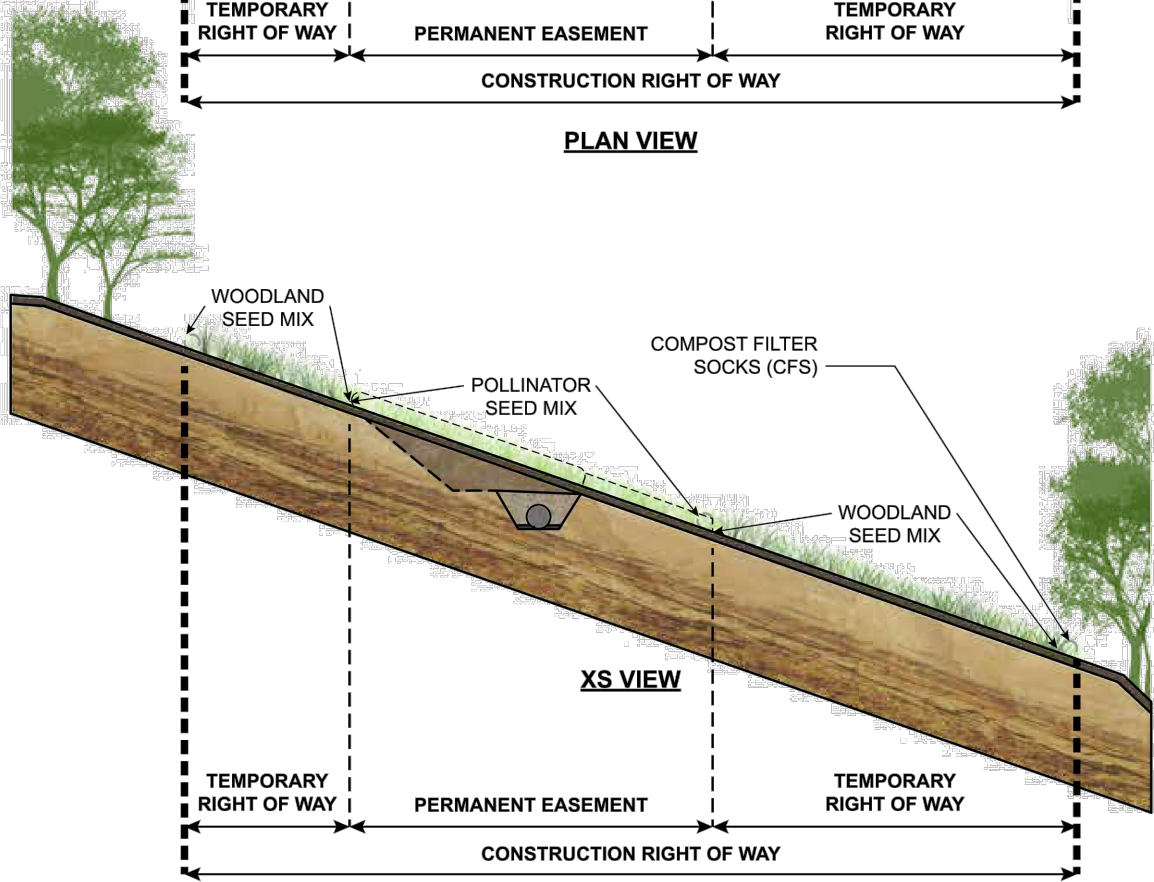
DRAWING NO.  
MVP-ES56.12

REV.  
P





**PLAN VIEW**



**CONSTRUCTION ACTIVITIES DURING STEP 13**

- REMOVE CFS AND DISTRIBUTE COMPOST
- RESEED AS NEEDED

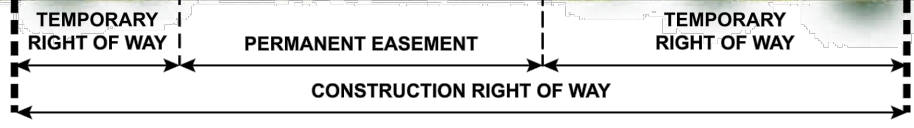
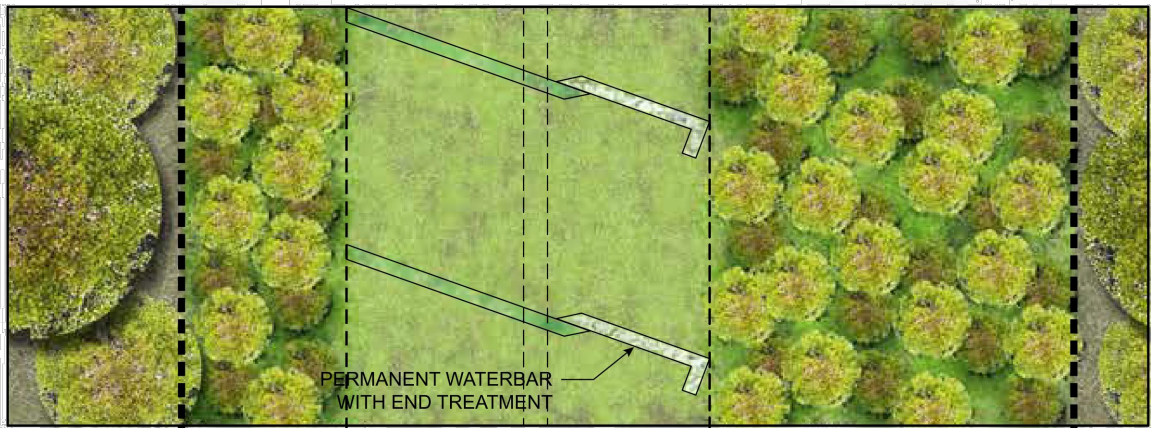
DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**DESIGN ENGINEERING**

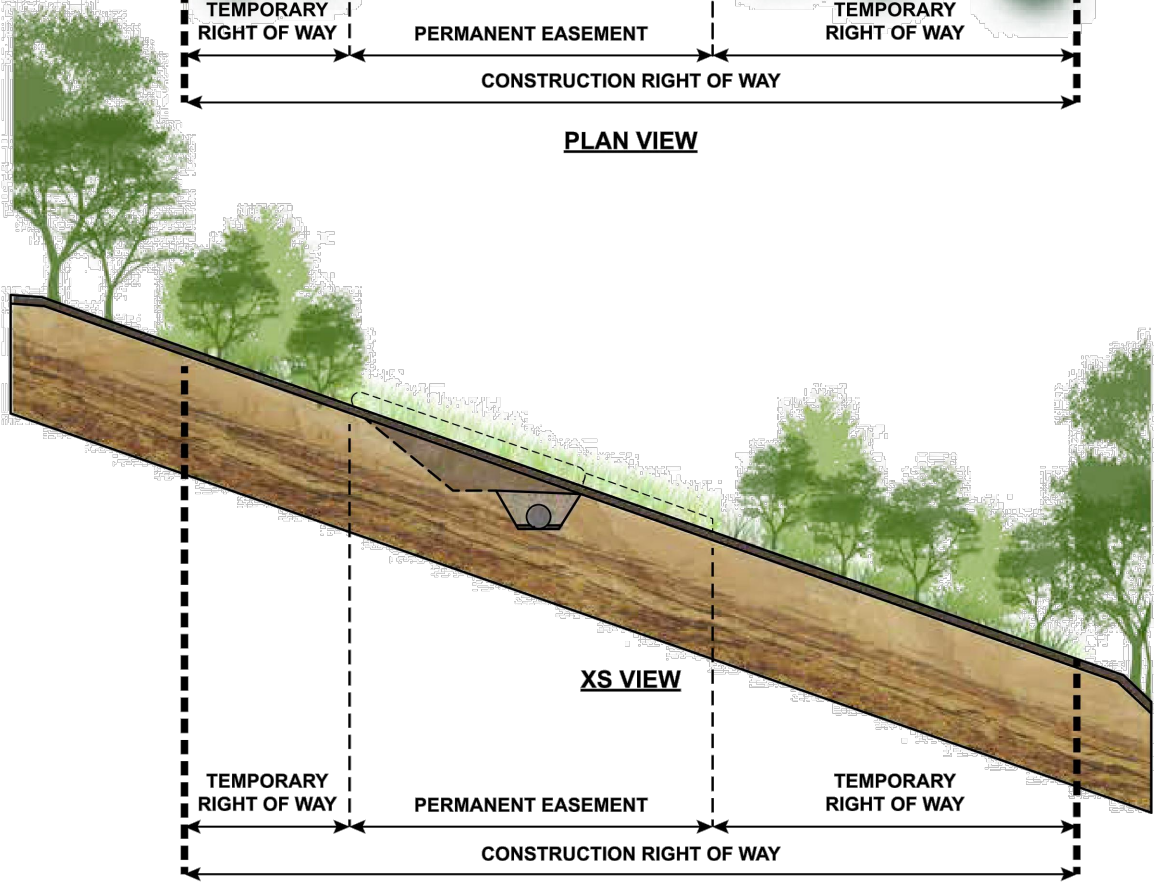
**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 13 OF 14

DRAWING NO.	REV.
MVP-ES56.13	P



**PLAN VIEW**



**CONSTRUCTION ACTIVITIES DURING STEP 14**

- MAINTAIN PERMANENT EASEMENT AS POLLINATOR MEADOW

DRAWN	DATE 12/19/17
CHECKED	DATE 12/19/17
APP'D	DATE 12/19/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	

**Mountain Valley PIPELINE**

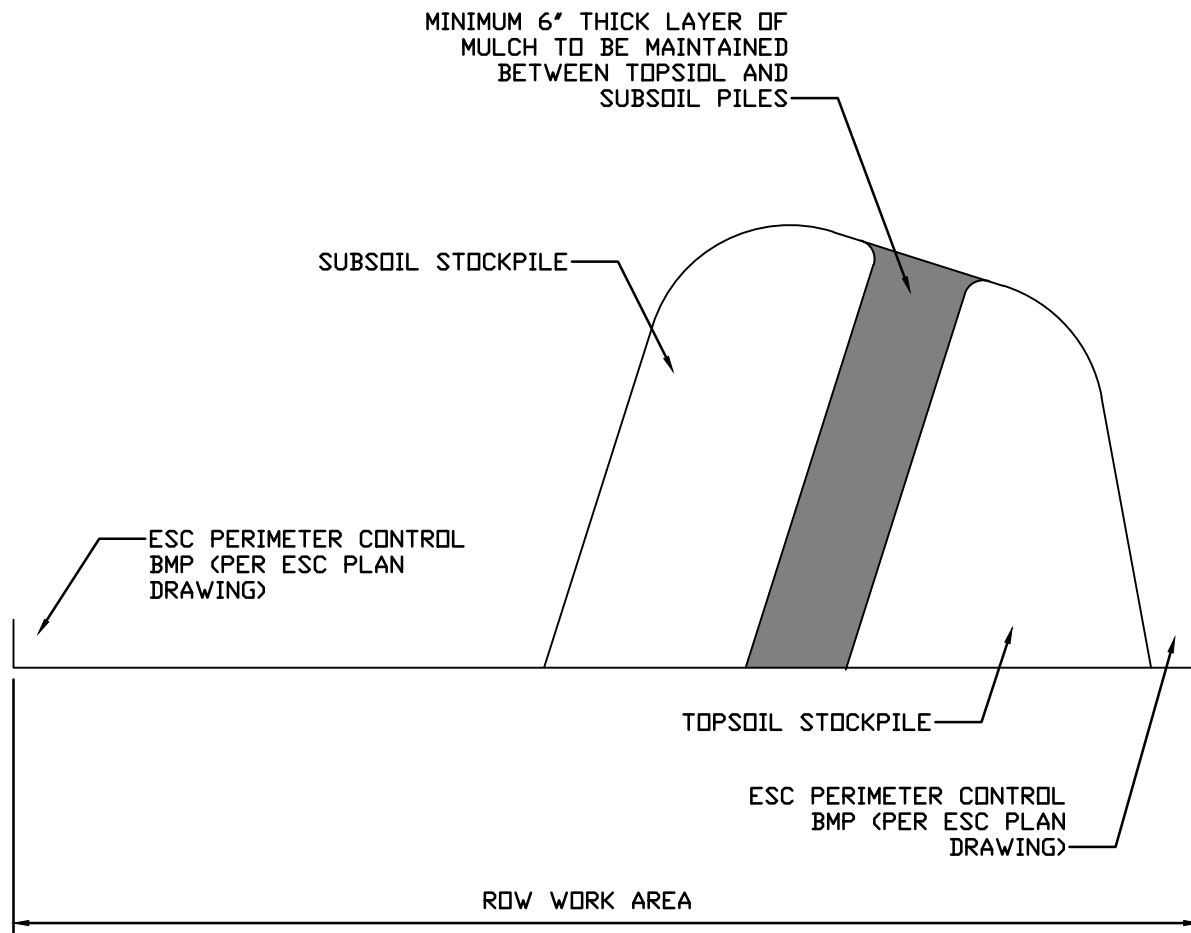
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

CONSTRUCTION SEQUENCE  
STEP 14 OF 14

DRAWING NO.  
MVP-ES56.14

REV.  
P



**NOTE:**

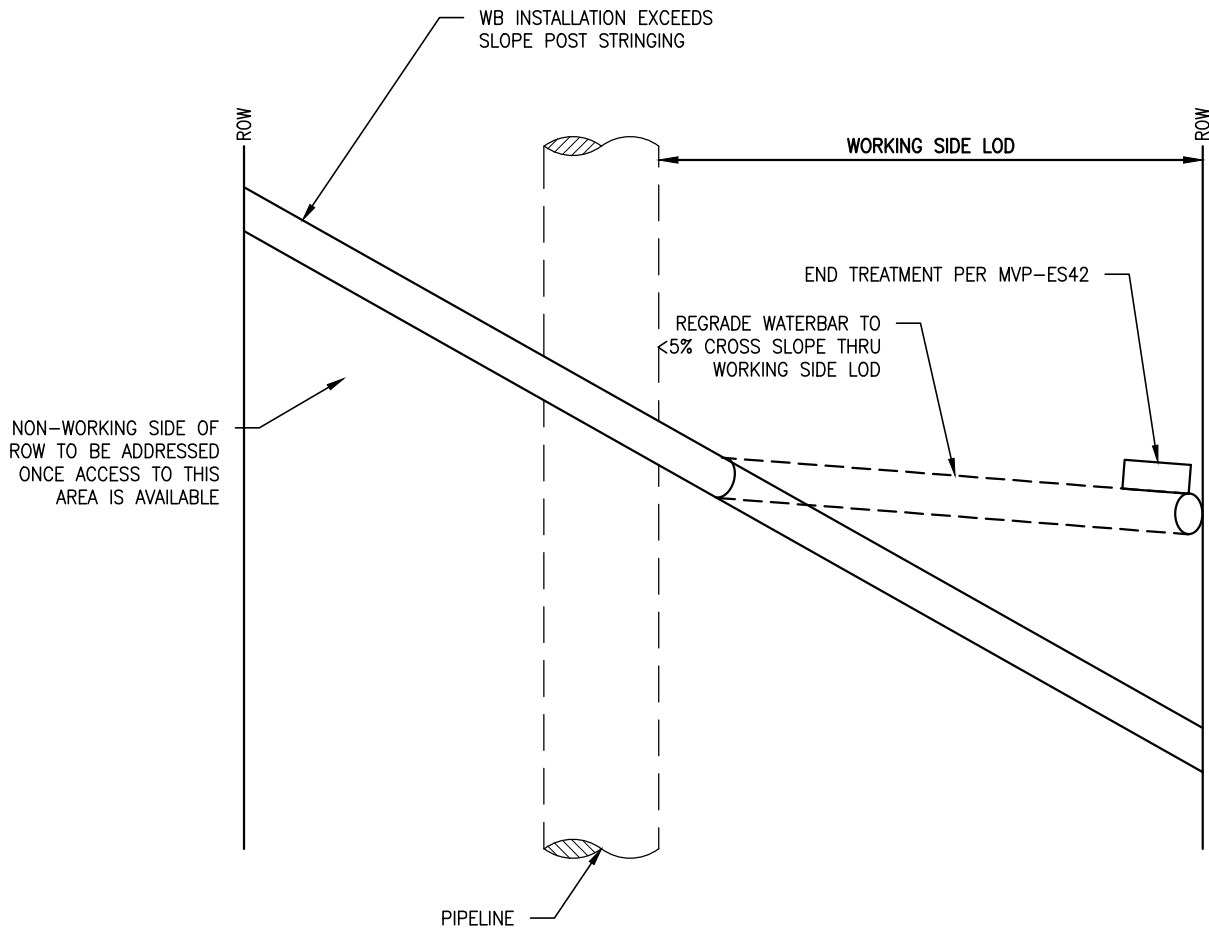
1. MULCH SHALL BE UTILIZED AS SEPARATION BETWEEN TOPSOIL PILES AND SUBSOIL STOCKPILES.
2. A MINIMUM 6" THICK LAYER OF MULCH SHALL BE UTILIZED TO PREVENT MIXING OF TOPSOIL AND SUBSOIL PILES.
3. FOLLOWING STACKING OF TOPSOIL AND SUBSOIL PILES, SPOIL PILES WILL BE TEMPORARILY SEEDED AND MULCHED WITHIN SEVEN DAYS OF SPOIL GENERATION.
4. FOLLOWING CONSTRUCTION, THE 6" THICK LAYER OF MULCH WILL BE MIXED IN WITH THE TOPSOIL DURING RESTORATION ACTIVITIES.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/11/17
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
TOPSOIL SEPARATION TYPICAL	
DRAWING NO.	REV.
MVP-ES57	P



**PLAN**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Rickabough, Greg on: July 5, 2018 - 3:18 PM

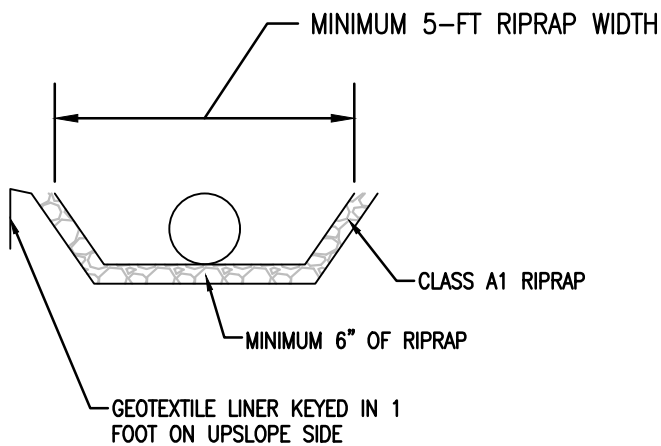
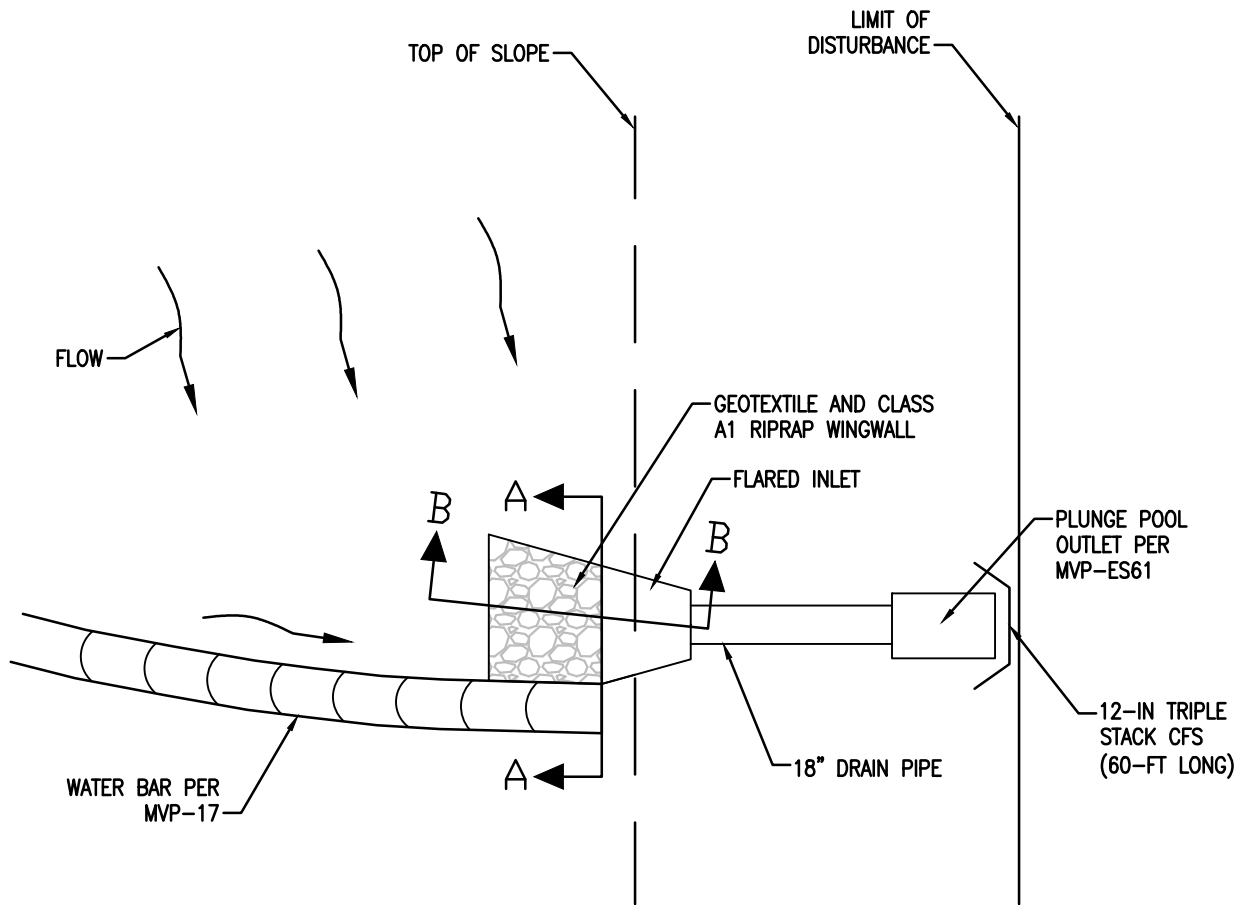
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CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



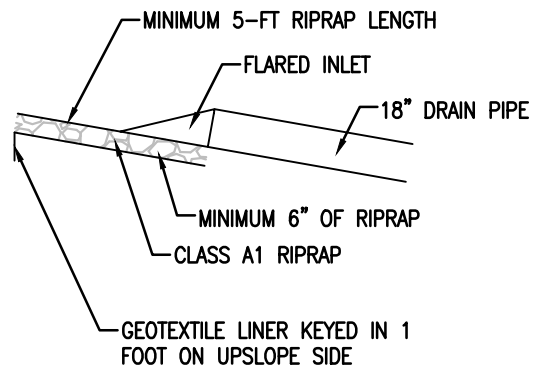
DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
POST STRINGING WATERBAR CORRECTIVE MEASURE	
DRAWING NO.	REV.
MVP-ES58	0





SECTION A-A



SECTION B-B

Plotted by: Rickabough, Greg on: July 18, 2018 - 11:39 AM

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 06/27/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



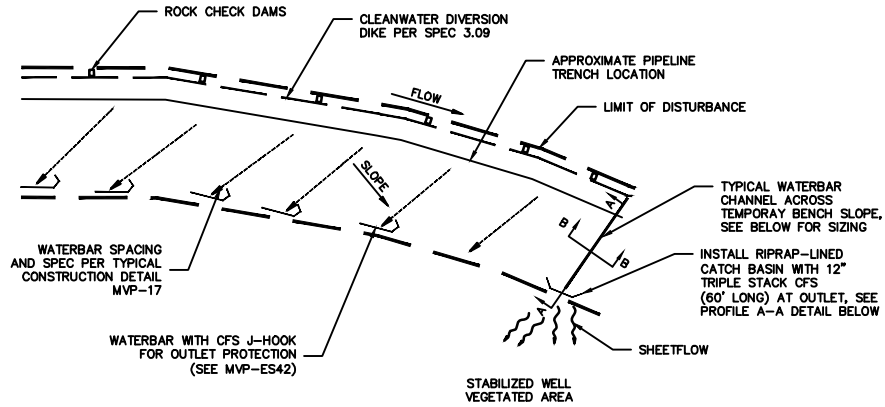
**Mountain Valley PIPELINE**

DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

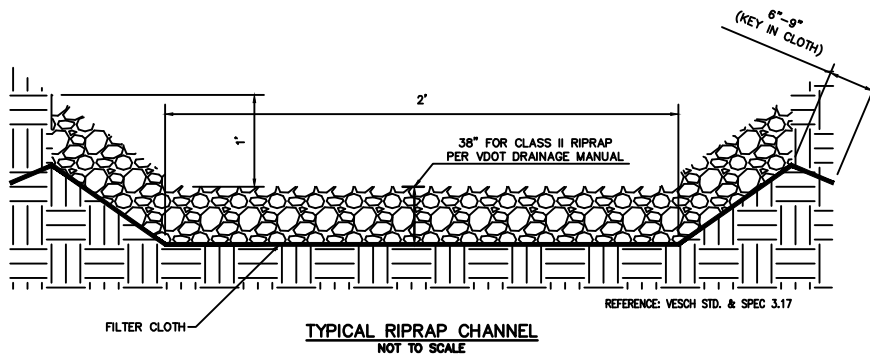
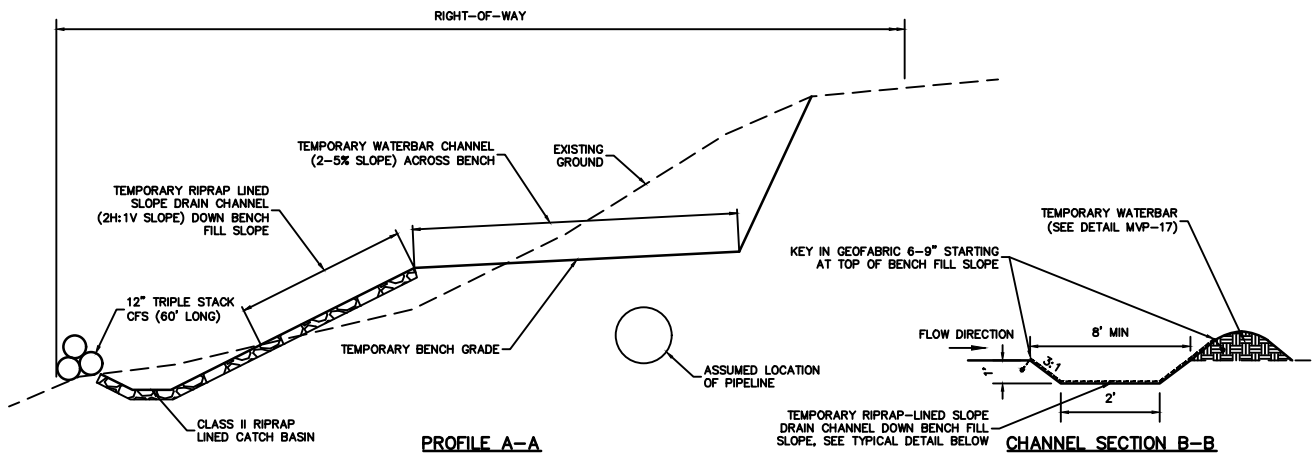
SIDE SLOPE FALSE WALL  
WATER BAR SLOPE DRAIN

DRAWING NO.	REV.
MVP-ES59	P



**NOTES:**

- 1) CLEAN WATER DIVERSION DIKE TO BE CONSTRUCTED PER VESCH STD & SPEC 3.09
- 2) AS NEEDED ON STEEP SLOPES INSTALL ROCK CHECK DAMS PER VESCH STD & SPEC 3.20, EXCEPT THAT NATIVE ROCK PRODUCED DURING EXCAVATION WILL BE SUBSTITUTED FOR THE STONE AND RIP RAP.
- 3) PER VESCH STD & SPEC 3.15 THE DIVERSION DIKE MUST BE 6-INCHES HIGHER THAN THE PIPE ON THE INLET SIDE AND THE DIKE MUST SLOPE NO GREATER THAN 3:1 TO RE-JOIN THE ADJACENT DIKE HEIGHT.
- 4) ALL ROCK CHECK DAMS TO BE A MINIMUM OF 1-FT HIGH AS MEASURED AT THE LOW POINT LOCATED AT THE CENTER OF THE STRUCTURE.



**NOTE:**

ALTHOUGH FILTER CLOTH IS PREFERRED, A GRANULAR FILTER MAY BE SUBSTITUTED FOR FILTER CLOTH. (FOR PHYSICAL REQUIREMENTS, SEE STD. & SPEC. 3.19 RIPRAP)

DRAWN	DATE
CHECKED	DATE
APP'D	DATE
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	PXXXX



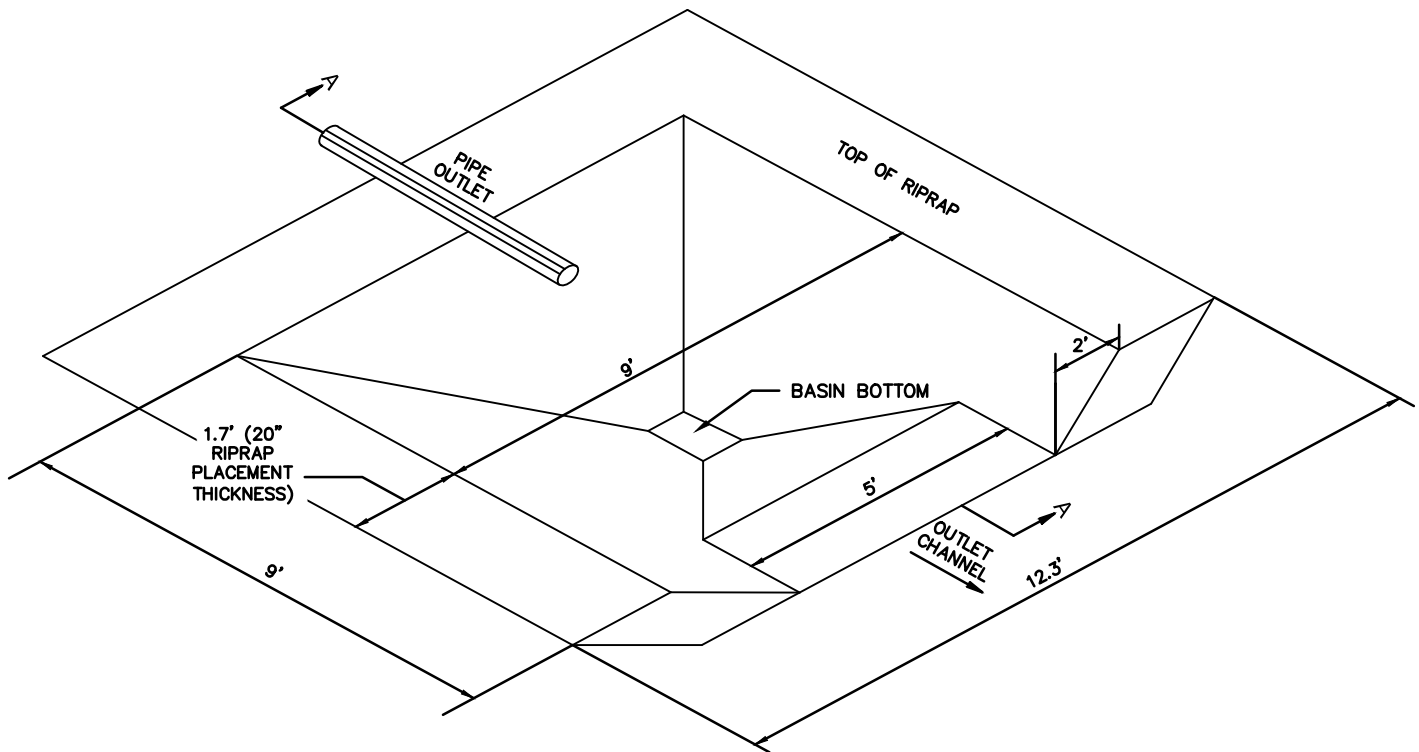
**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

TEMPORARY SLOPE DRAIN CHANNEL  
(SIDE HILL CONSTRUCTION)

DRAWING NO. MVP-ES60

REV. 0



**NOTE:**

1. PLUNGE POOL OUTLET TO BE CONSTRUCTED WITHIN THE LIMITS OF DISTURBANCE.
2. PLUNGE POOL TO BE KEYED INTO CONSTRUCTED SLOPE. STEEP SLOPES MAY REQUIRE ADDITIONAL MEASURES IF SITE CONDITIONS CREATE EROSION CONDITIONS.

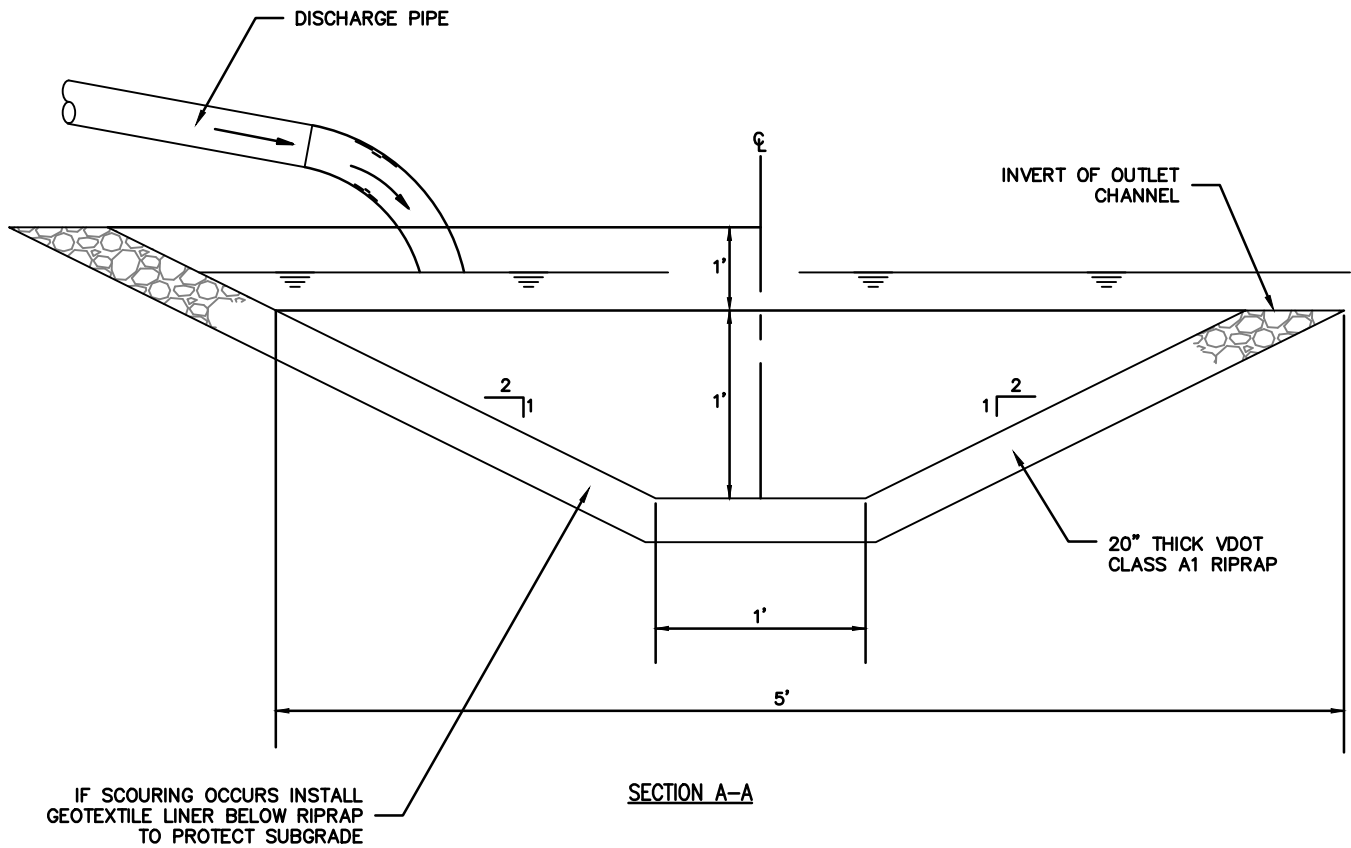
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 08/27/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP – VA PORTION	



**Mountain Valley**  
PIPELINE

DESIGN ENGINEERING


<b>ENVIRONMENTAL DETAIL</b>	
WATER BAR SLOPE DRAIN PLUNGE POOL OUTLET (ISOMETRIC VIEW)	
DRAWING NO.	REV.
MVP-ES61	P



**NOTE:**

1. USE NATIVE ROCK OR IMPORTED RIP-RAP SIZE D50 0.8- FEET (VDOT CLASS A1 RIPRAP), PLACEMENT THICKNESS 20-INCHES.

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 06/27/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley PIPELINE**

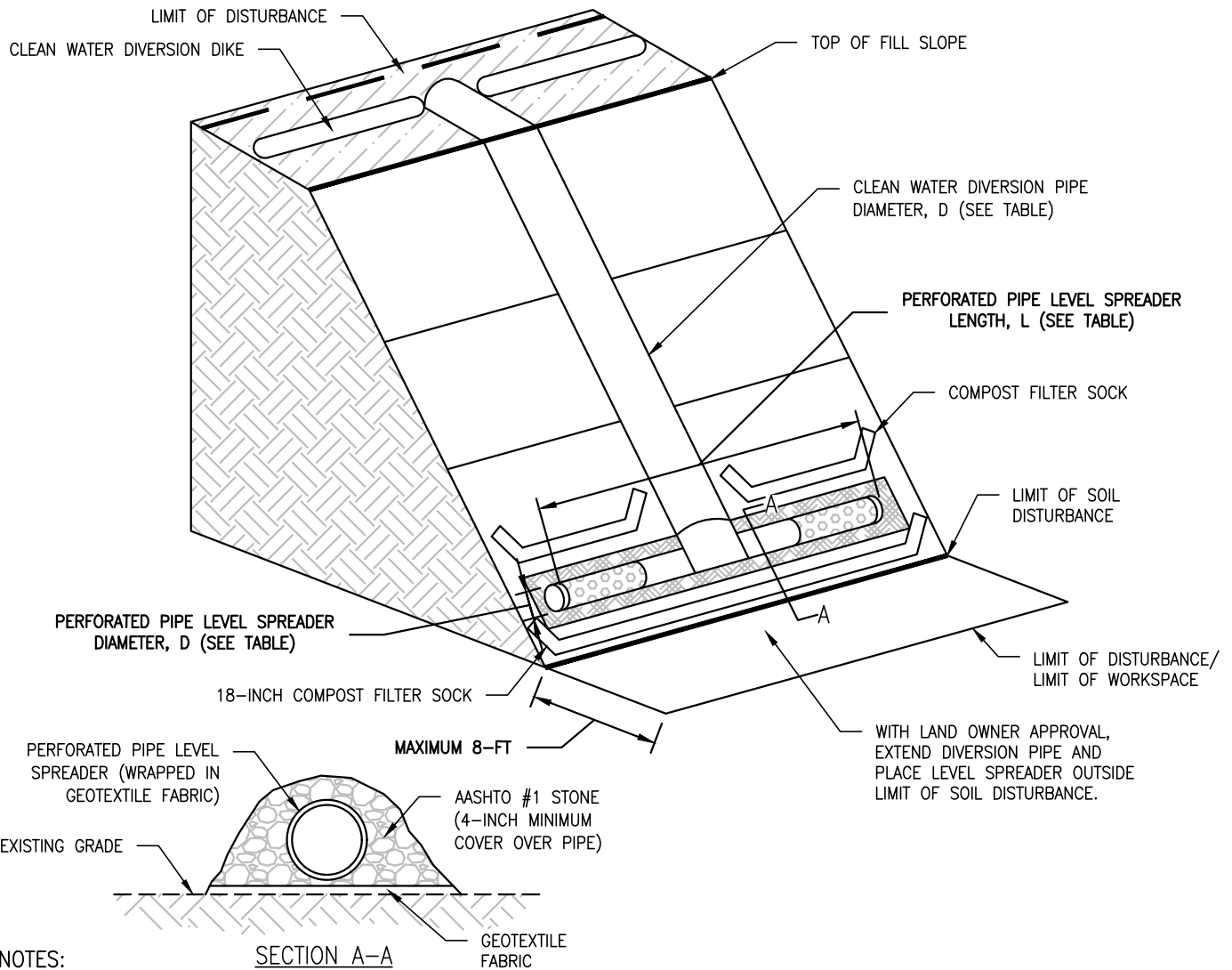
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

WATER BAR SLOPE DRAIN PLUNGE POOL OUTLET (SECTION VIEW)

DRAWING NO.	REV.
MVP-ES61.1	P





NOTES:

1. LEVEL SPREADER PERFORATED PIPES SHALL BE CAPPED AT BOTH ENDS.
2. LEVEL SPREADER TO BE INSTALLED PARALLEL TO CONTOURS AT LEVEL ELEVATION.
3. PERFORATED PIPE TO BE UNDERLAIN AND WRAPPED WITH GEOTEXTILE FABRIC AND COVERED WITH AASHTO NO. 1 STONE. MINIMUM STONE COVER SHALL BE 4-INCHES OVER PERFORATED PIPE.
4. ALL LEVEL SPREADER STONE WILL BE REMOVED AND DISTURBED AREA TO BE RESTORED IN ACCORDANCE WITH E&S PLAN.
5. LEVEL SPREADERS TO BE INSTALLED AT ALL TEMPORARY SLOPE PIPE DISCHARGES AT LOW POINTS OF DIVERSION DIKE.
6. LEVEL SPREADERS TO BE INSPECTED EVERY 4 BUSINESS DAYS OR AFTER MEASURABLE RAINFALL EVENT AND SHALL BE MAINTAINED IN GOOD CONDITION AT ALL TIMES.

Clean Water Diversion Drainage Area, DA (ac)	Length of Perforated Pipe Level Spreader, L (ft)	Diameter of Clean Water Diversion Pipe and Perforated Pipe Level Spreader, D (in)	Diameter of Perforations (in)	Number of Perforations Per Linear Foot
DA ≤ 1.0	10	12	0.313	36
1.0 < DA ≤ 5.0	20	24	0.5	32

Plotted by: Rickabough, Greg on: August 29, 2018 - 11:57 AM

DRAWN	JK	DATE	7/23/2018
CHECKED	DW	DATE	7/23/2018
APP'D		DATE	
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			

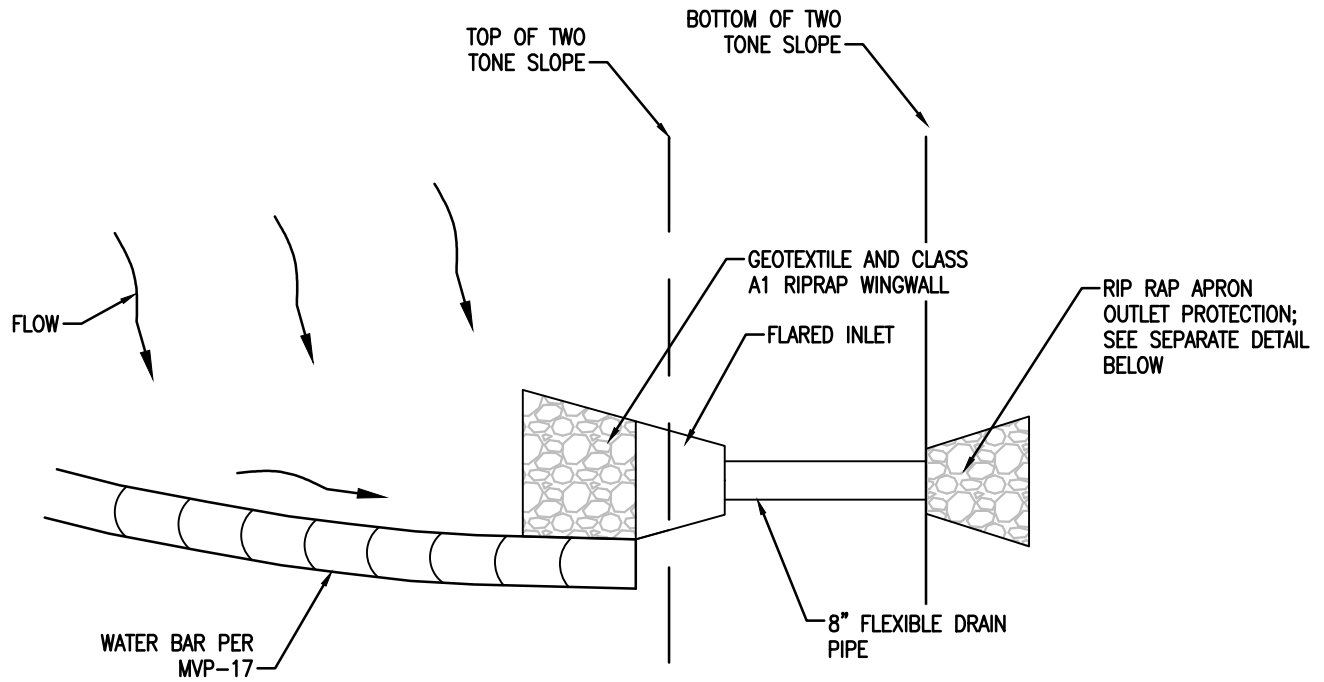


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

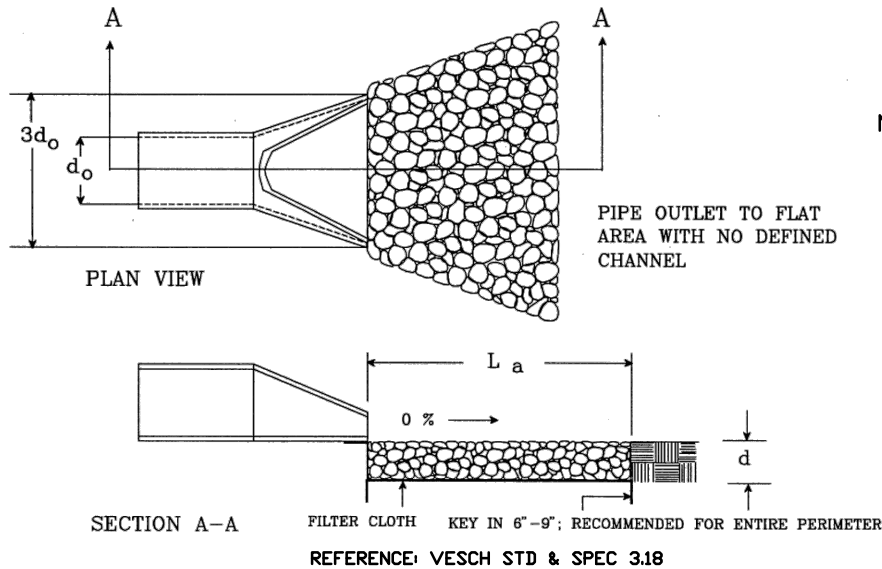
TEMPORARY LEVEL SPREADER DETAIL

DRAWING NO.	REV.
MVP-ES62	0



**NOTE:**

IF WATERBAR SPACING EXCEEDS 400 FEET AND WIDTH IS GREATER THAN 60 FEET, INSTALL TWO (2) 8" FLEXIBLE DRAIN PIPES



**NOTES:**

1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2.  $L_a$  IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3.  $d = 1.5$  TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

Waterbar Drainage Area, DA (ac)	Drain Pipe Diameter, $d_o$ (in)	VDOT Riprap Classification and Placement Thickness <sup>1</sup>			Riprap Apron Dimensions <sup>2</sup>		
		VDOT Riprap Classification	$d_{50}$ (ft)	Placement Thickness, $d$ (in)	Minimum Apron Length, $L_a$ (ft)	Apron Initial Width (ft)	Apron Terminal Width (ft)
$DA \leq 0.55^3$	8	Class A1	0.8	20	6	2.0	7.0
$DA > 0.55^4$	8 (x2)	Class A1	0.8	20	12	4.0	13.5

<sup>1</sup> Values from Appendix 7D-3 of the VDOT Drainage Manual (Chapter 7).

<sup>2</sup> Designed in accordance with VESCH STD & SPEC 3.18 assuming minimum tailwater condition ( $T_w < 0.5d_o$ ).

<sup>3</sup> Area equivalent to 400-ft Waterbar Spacing x 60-ft Width.

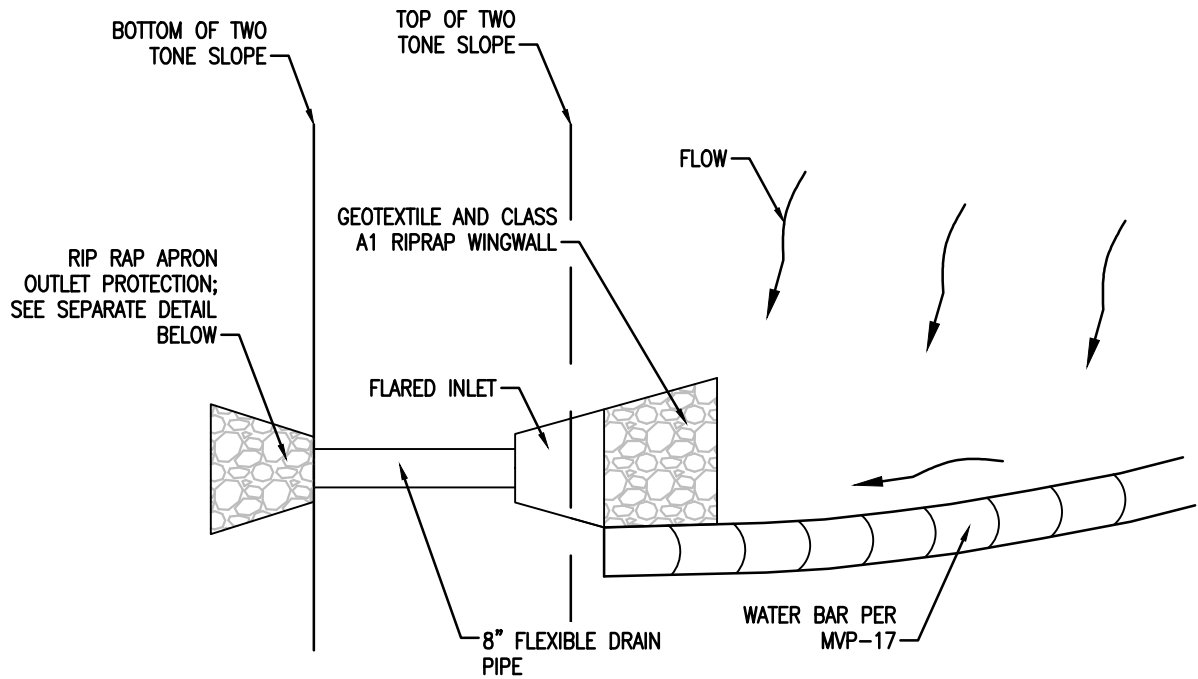
<sup>4</sup> If waterbar spacing exceeds 400-ft and width is greater than 60-ft, install two (2) 8-in diameter drain pipes and a riprap apron with the specified dimensions.

Plotted by: Rickabough, Greg on: August 17, 2018 - 2:25 PM

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 07/30/18</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP - VA PORTION	

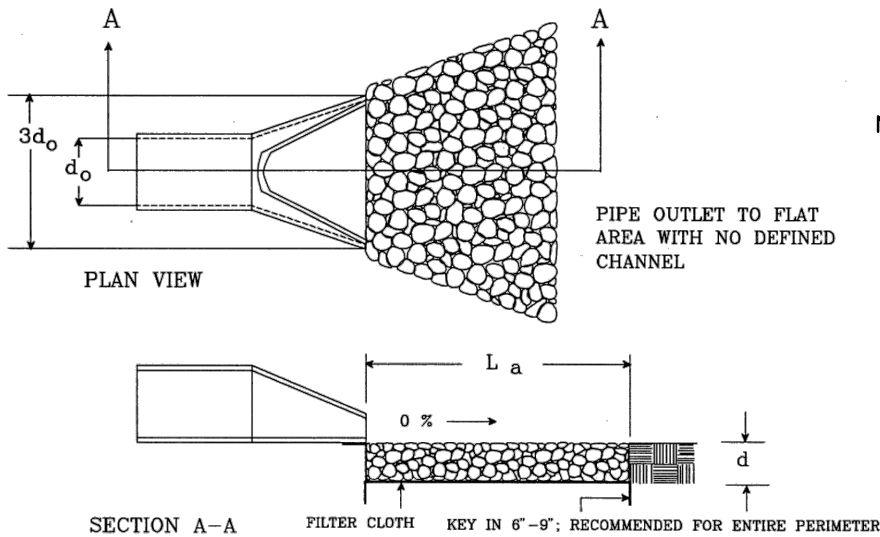
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
TWO TONE SLOPE DRAIN BETWEEN WATERBARS (DISCHARGE ACROSS ROW FROM LEFT TO RIGHT)	
<b>DRAWING NO.</b>	<b>REV.</b>
MVP-ES63	P



**NOTE:**

IF WATERBAR SPACING EXCEEDS 400 FEET AND WIDTH IS GREATER THAN 60 FEET, INSTALL TWO (2) 8" FLEXIBLE DRAIN PIPES



**NOTES:**

1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2.  $L_a$  IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3.  $d = 1.5$  TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

REFERENCE: VESCH STD & SPEC 3.18

Waterbar Drainage Area, DA (ac)	Drain Pipe Diameter, $d_o$ (in)	VDOT Riprap Classification and Placement Thickness <sup>1</sup>			Riprap Apron Dimensions <sup>2</sup>		
		VDOT Riprap Classification	$d_{50}$ (ft)	Placement Thickness, $d$ (in)	Minimum Apron Length, $L_a$ (ft)	Apron Initial Width (ft)	Apron Terminal Width (ft)
$DA \leq 0.55^3$	8	Class A1	0.8	20	6	2.0	7.0
$DA > 0.55^4$	8 (x2)	Class A1	0.8	20	12	4.0	13.5

<sup>1</sup> Values from Appendix 7D-3 of the VDOT Drainage Manual (Chapter 7).

<sup>2</sup> Designed in accordance with VESCH STD & SPEC 3.18 assuming minimum tailwater condition ( $T_w < 0.5d_o$ ).

<sup>3</sup> Area equivalent to 400-ft Waterbar Spacing x 60-ft Width.

<sup>4</sup> If waterbar spacing exceeds 400-ft and width is greater than 60-ft, install two (2) 8-in diameter drain pipes and a riprap apron with the specified dimensions.

Plotted by: Rickabough, Greg on: August 17, 2018 - 2:25 PM

<b>DRAWN</b>	<b>DATE</b>
<b>CHECKED</b>	<b>DATE</b>
<b>APP'D</b>	<b>DATE 07/30/18</b>
<b>SCALE N.T.S.</b>	<b>SHEET 1 OF 1</b>
<b>JOB NO.</b>	
<b>PROJECT ID:</b>	
MVP - VA PORTION	



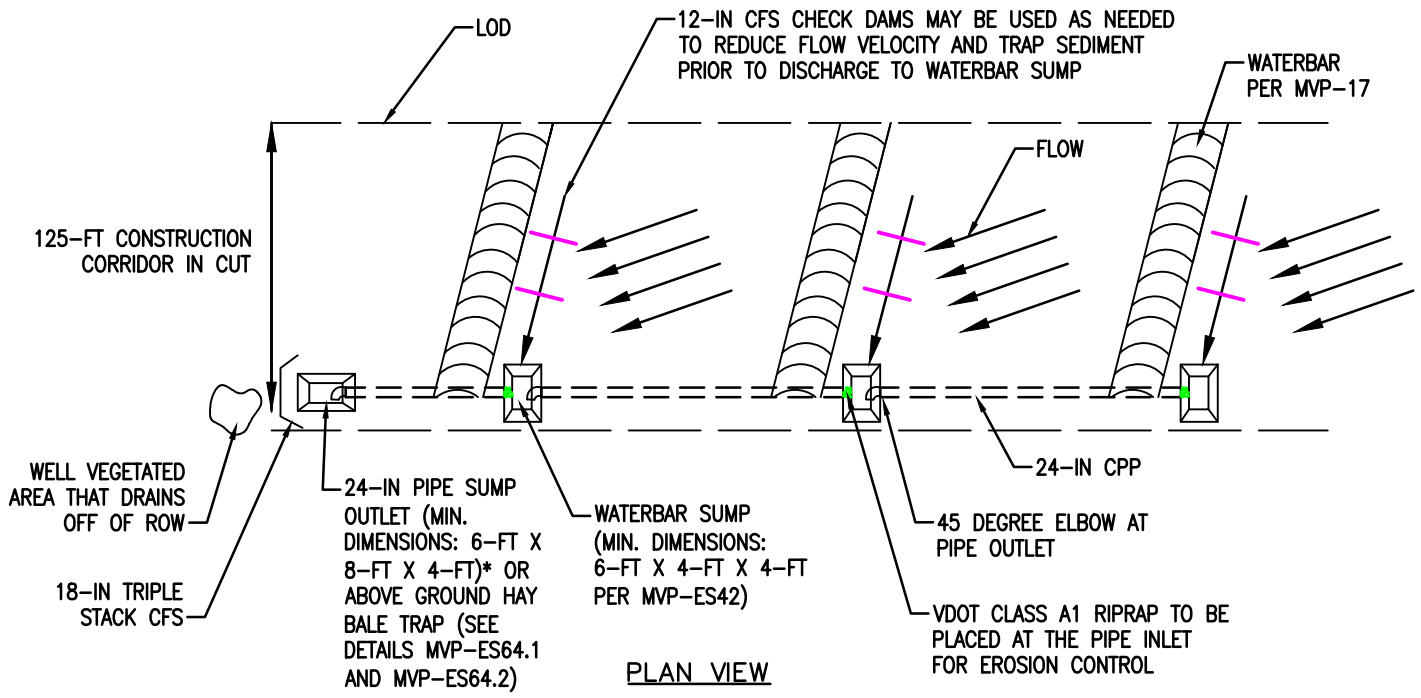
**DESIGN ENGINEERING**

**ENVIRONMENTAL DETAIL**

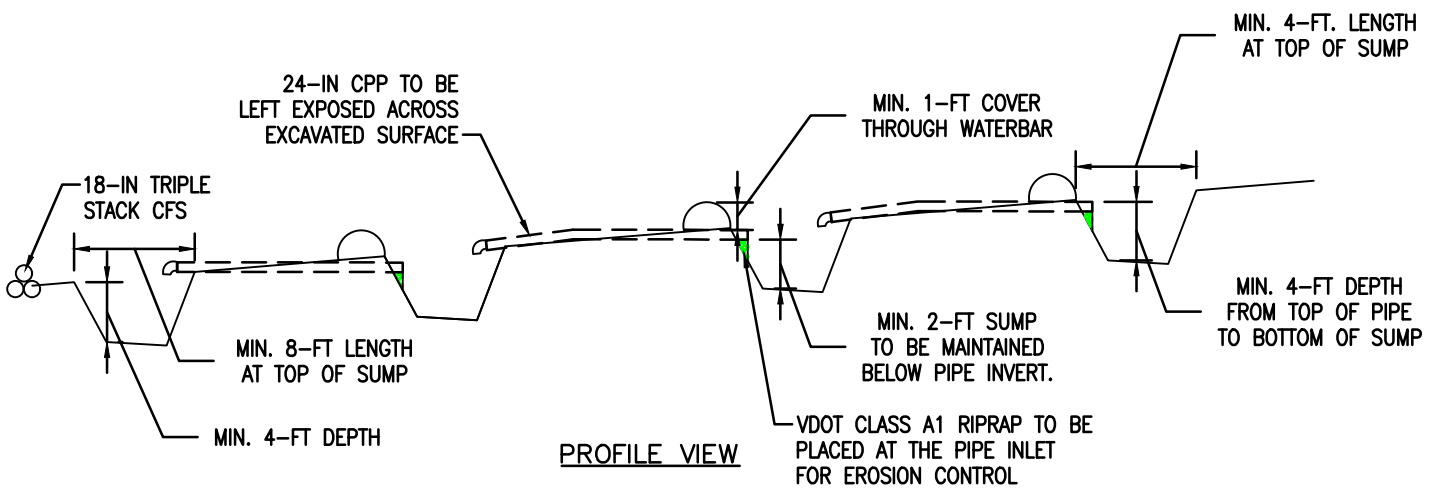
TWO TONE SLOPE DRAIN  
BETWEEN WATERBARS (DISCHARGE  
ACROSS ROW FROM RIGHT TO LEFT)

**DRAWING NO.**  
MVP-ES63.1

**REV.**  
P



PLAN VIEW



PROFILE VIEW

**\*NOTE:**

IT HAS BEEN DEMONSTRATED THAT THE MINIMUM 6-FT X 4-FT X 4-FT WATERBAR SUMP DIMENSIONS PER MVP-ES42 IS LARGER THAN WHAT IS NECESSARY BASED ON THE NRCS PLUNGE POOL DESIGN APPROACH. FURTHERMORE, THE VOLUME OF THE CLEAN WATER DIVERSION AND WATERBAR STANDARD PLUNGE POOL DESIGNS (I.E., DETAILS MVP-ES51 AND MVP-ES61, RESPECTIVELY) WERE CALCULATED, AND THE RELATIONSHIP BETWEEN THE CALCULATED VOLUME AND THE CORRESPONDING 10-YEAR DESIGN FLOW RATE WAS PLOTTED; USING THE CORRESPONDING R-SQUARED EQUATION, IT WAS DETERMINED THAT THE 6-FT X 4-FT X 4-FT SUMP DIMENSIONS ARE ACCEPTABLE UP TO A DRAINAGE AREA OF 1.5-ACRES. THE PROPOSED MINIMUM DIMENSIONS FOR THE 24-IN PIPE SUMP OUTLET (6-FT X 8-FT X 4-FT) PROVIDES TWICE THE VOLUME OF THE WATERBAR SUMP TO ENSURE THE SAFE RELEASE OF DISCHARGE FROM MULTIPLE WATERBARS.

Plotted by: Rickabough, Greg on: August 22, 2018 - 10:00 AM

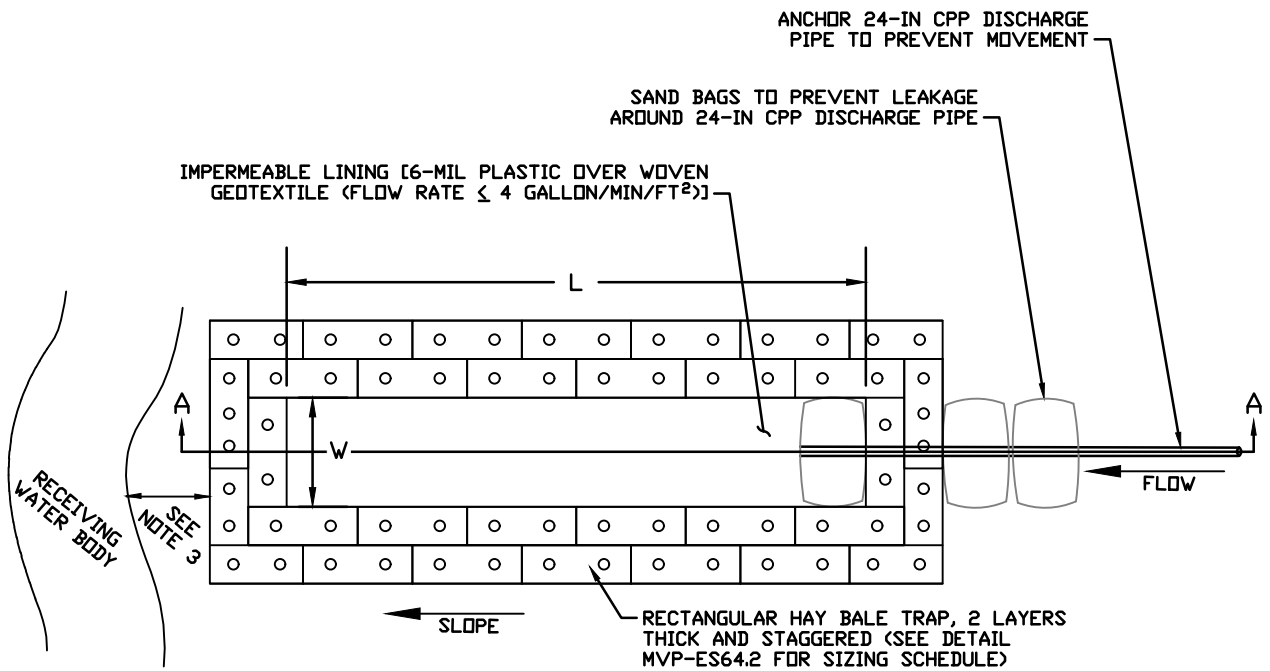
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 07/30/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley PIPELINE**

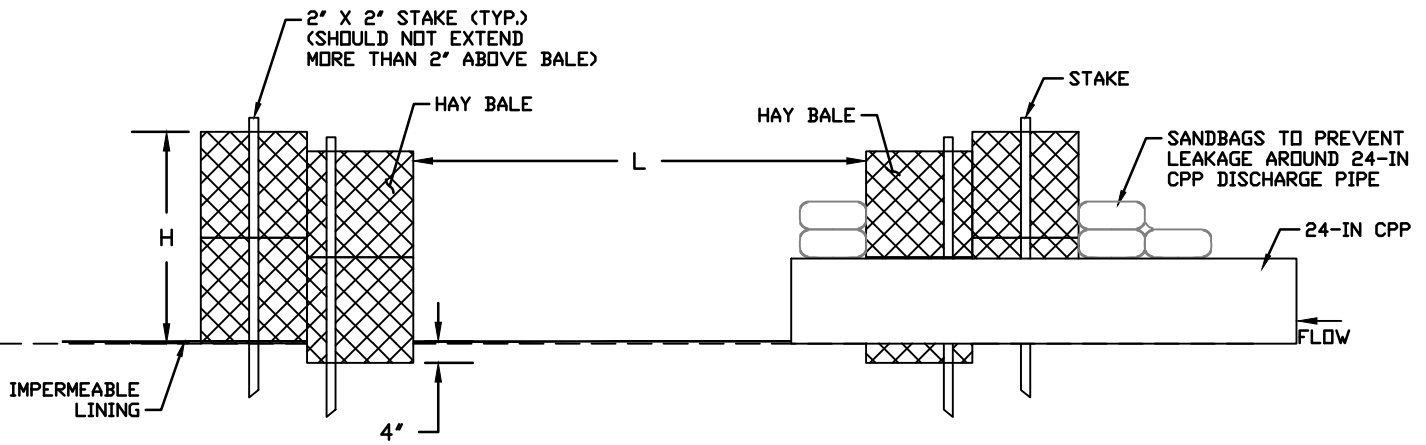
DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
24-IN PIPE DISCHARGE FOR WATERBARS IN CUT	
DRAWING NO.	REV.
MVP-ES64	P





PLAN VIEW



SECTION A-A

Plotted by: Rickabough, Greg on: August 22, 2018 - 10:00 AM

DRAWN	DATE
CHECKED	DATE
APP'D	DATE 07/30/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



**Mountain Valley PIPELINE**

DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

ABOVE GROUND HAY BALE TRAP  
PLAN AND SECTION VIEW

DRAWING NO.  
MVP-ES64.1

REV.  
P

**NOTES:**

1. ABOVE GROUND HAY BALE TRAP WILL BE LOCATED SUCH THAT IT DRAINS TO A WELL-VEGETATED AREA WITH SLOPES BETWEEN 1% AND 5% TOWARD THE RECEIVING WATERBODY.
2. ABOVE GROUND HAY BALE TRAP WILL BE LOCATED SUCH THAT THERE IS NO BACKUP OF FLOW ONTO THE SITE IN THE EVENT THAT THE TRAP IS FULL.
3. ABOVE GROUND HAY BALE TRAP SHALL BE INSPECTED WITHIN 24HRS OF A 0.5" RAINFALL.
4. SEDIMENT SHALL BE REMOVED WHEN IT HAS ACCUMULATED TO ONE QUARTER OF THE VOLUME REQUIRED, OR TO A DEPTH OF 0.75 FEET ASSUMING A TRAP HEIGHT OF 3 FEET (SEE SCHEDULE BELOW). SEDIMENT REMOVAL FROM THE TRAP SHALL BE DEPOSITED IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE AND CAUSE SEDIMENTATION PROBLEMS.

ABOVE GROUND HAY BALE TRAP						
<sup>1</sup> Drainage Area (Acres)	STORAGE			<sup>4</sup> Trap Length, L (Ft)	<sup>4</sup> Trap Width, W (Ft)	<sup>5</sup> Trap Height, H (Ft)
	<sup>2</sup> Volume Required (Cu. Yd.)	Volume Required (Cu. Ft.)	<sup>3</sup> Volume Provided (Cu. Ft.)			
1.00	134	3,618	3,750	50	25	3
2.00	268	7,236	7,350	70	35	3
3.00	402	10,854	11,094	86	43	3

<sup>1</sup> Per VESCH STD & SPEC 3.13, drainage area shall not exceed 3 acres.

<sup>2</sup> Per VESCH STD & SPEC 3.13, trap must have an initial storage volume of 134 cubic yards per acre of drainage area.

<sup>3</sup> Volume provided based on the specified trap length (L), width (W), and height (H).

<sup>4</sup> Assumes a minimum 2:1 length to width ratio, but the footprint dimensions can be adjusted so long as the storage volume requirement is satisfied. Triple stack CFS baffles can be installed as necessary in the event that a 2:1 length to width ratio is not achievable.

<sup>5</sup> Trap height can be adjusted so long as the storage volume requirement is satisfied, but the proposed design should be such that there is no backup of flow onto the site in the event that the trap is full.

Plotted by: Rickabough, Greg on: August 24, 2018 - 9:57 AM

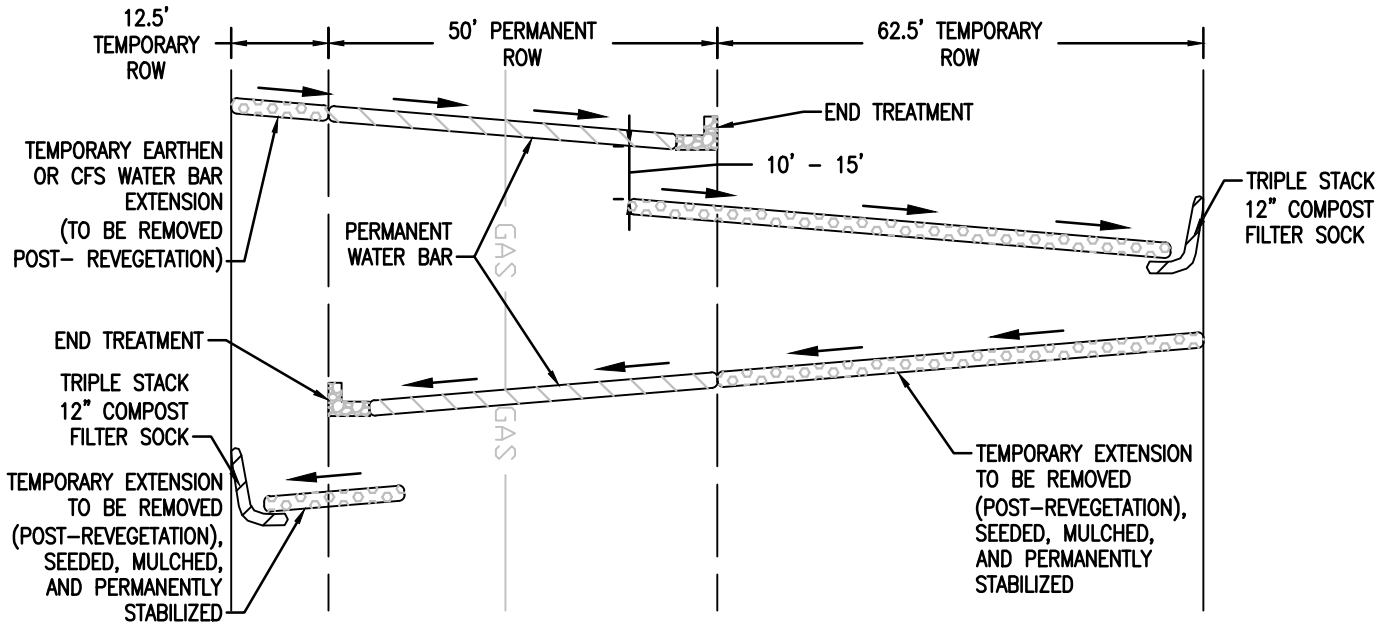
DRAWN	DATE
CHECKED	DATE
APP'D	DATE 07/30/18
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	



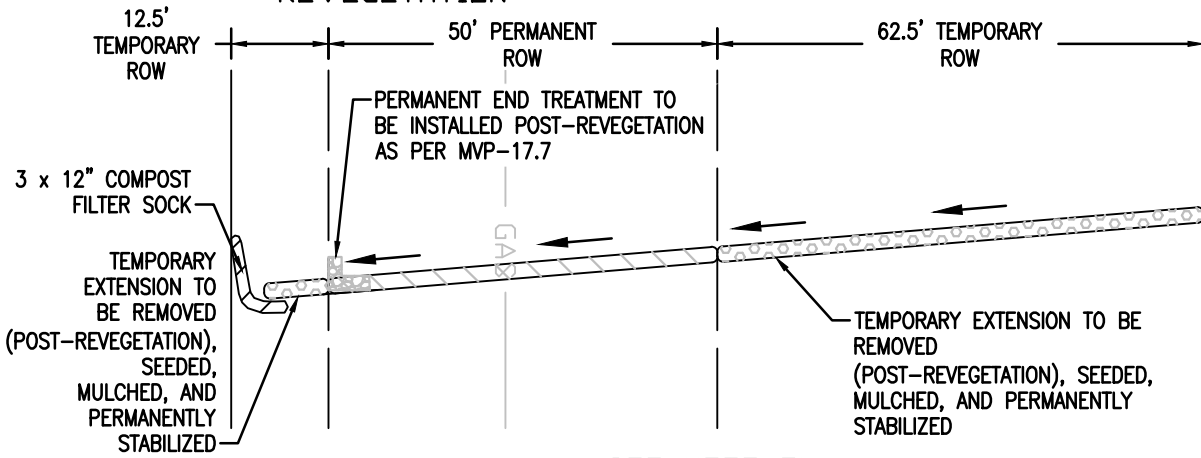
**DESIGN ENGINEERING**

<b>ENVIRONMENTAL DETAIL</b>	
ABOVE GROUND HAY BALE TRAP NOTES AND SIZING SCHEDULE	
DRAWING NO. MVP-ES64.2	REV. P

**SCENARIO 1: PERMANENT END TREATMENT INSTALLATION AT TIME OF RESTORATION**



**SCENARIO 2: PERMANENT END TREATMENT TO BE INSTALLED FOLLOWING REVEGETATION**



(SEE NOTE 5)

**NOTES:**

1. NEED FOR TEMPORARY WATER BAR EXTENSIONS TO BE DETERMINED BY MVP LEI/MVP ENV SR. COORDINATOR BASED ON SITE CONDITIONS AT TIME OF RESTORATION.
2. TEMPORARY WATER BAR EXTENSION TO BE INSTALLED IN ACCORDANCE WITH EITHER SCENARIO 1 OR SCENARIO 2.
3. FOR SCENARIO 1 AND SCENARIO 2, TEMPORARY EXTENSION TO BE REMOVED ONCE CONTRIBUTING DRAINAGE AREA HAS BEEN VEGETATIVELY STABILIZED.
4. FOR SCENARIO 1 AND SCENARIO 2, DOWNSLOPE END OF TEMPORARY WATER BAR EXTENSION IS TO HAVE TRIPLE STACK 12" COMPOST FILTER SOCK INSTALLED AS A TEMPORARY END TREATMENT.
5. FOR SCENARIO 2, CONTIGUOUS SEGMENT OF EARTHEN WATER BAR MAY BE INSTALLED ACROSS THE LIMIT OF DISTURBANCE. PERMANENT END TREATMENT (SEE DETAIL MVP-17.7) TO BE INSTALLED FOLLOWING REVEGETATION AT TIME OF TEMPORARY WATER BAR EXTENSION REMOVAL.
6. FOR SCENARIO 1 AND SCENARIO 2 FOLLOWING REMOVAL OF TEMPORARY WATER BAR EXTENSIONS, DISTURBED AREAS ARE TO BE SEEDED, MULCHED, AND EROSION CONTROL BLANKET TO BE INSTALLED.
7. PERMANENT END TREATMENTS (SEE DETAIL MVP-17.7) INSTALLED UNDER SCENARIO 2 WILL BE COMPLETED FOLLOWING ESTABLISHMENT OF PERMANENT VEGETATION IN THE WATERSHED CONTRIBUTING TO THIS BMP. INSTALLATION OF PERMANENT END TREATMENT TO OCCUR (TYPICALLY) WITHIN 1-YEAR FOLLOWING RESTORATION.

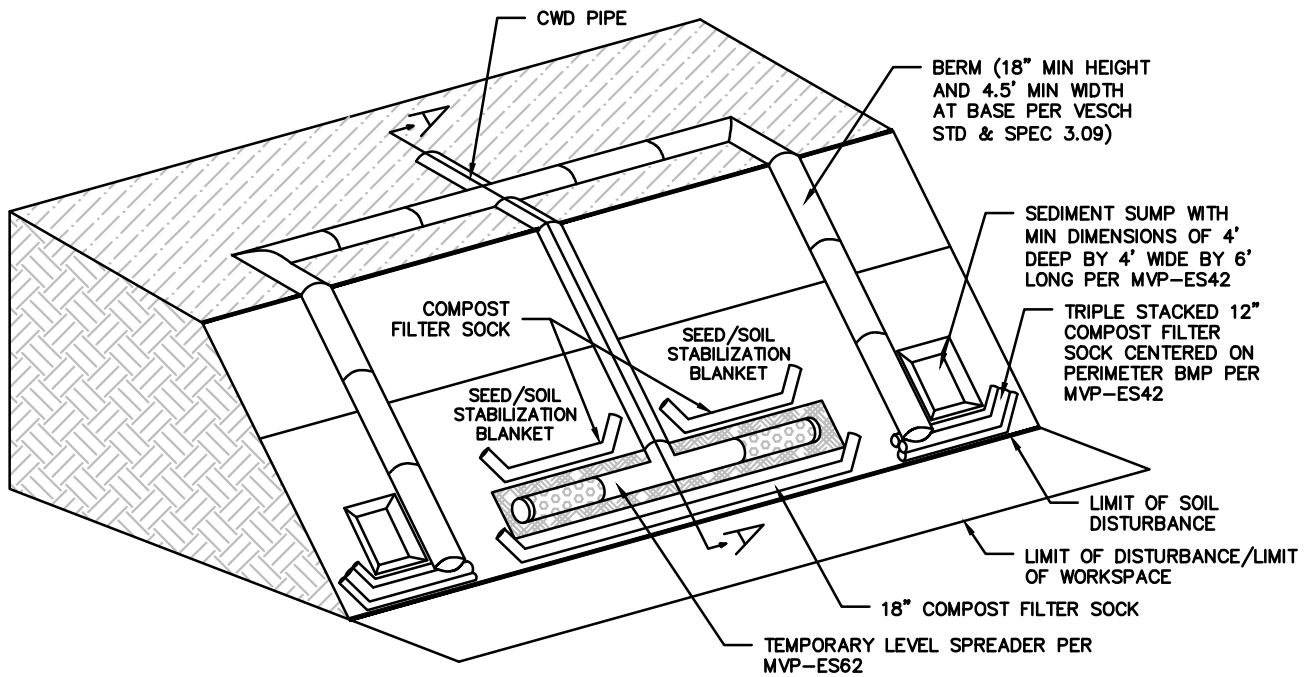
Plotted by: Kustowski, Jim on: June 16, 2020 - 2:22 PM

DRAWN	JWK	DATE	06/16/2020
CHECKED	RJE	DATE	06/16/2020
APP'D	DJW	DATE	06/16/2020
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

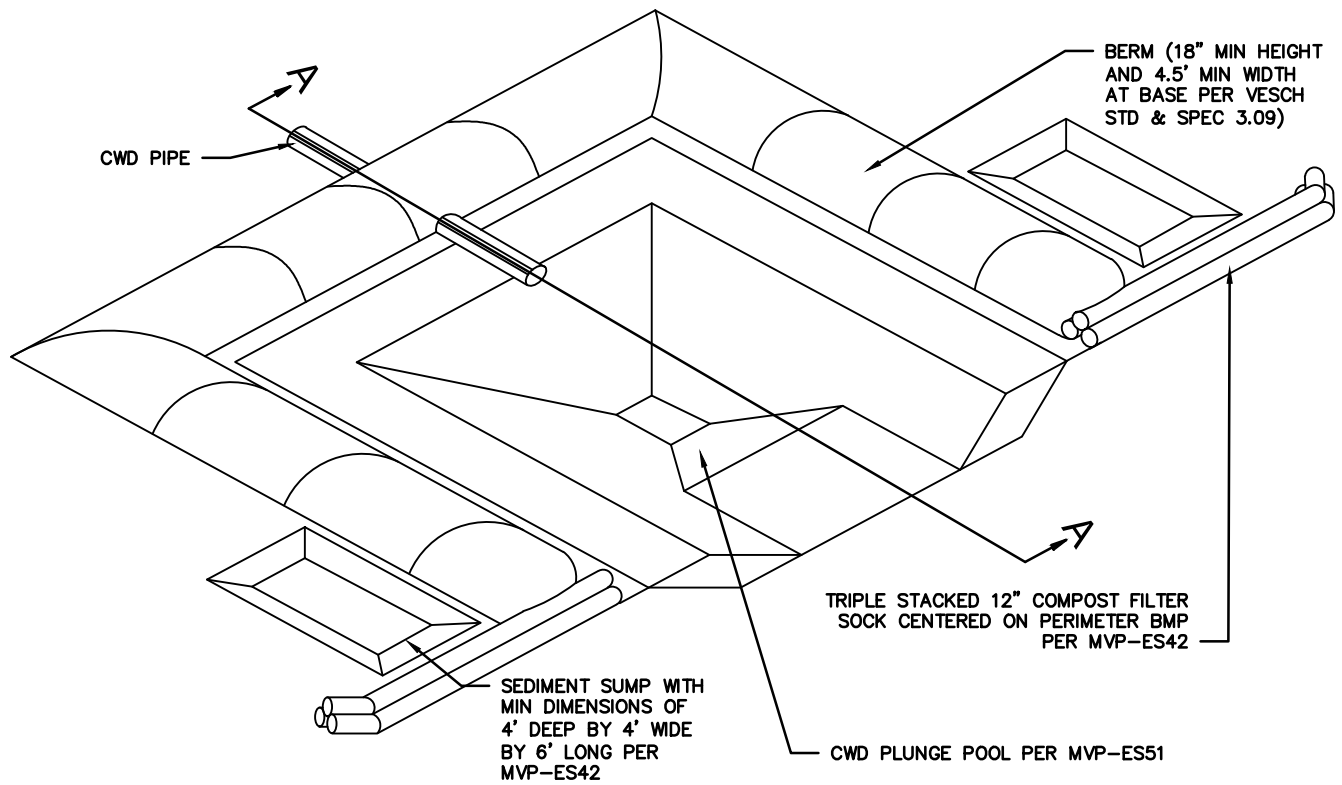
**Mountain Valley PIPELINE**

DESIGN ENGINEERING

<b>ENVIRONMENTAL DETAIL</b>	
POST-RESTORATION TEMPORARY WATER BAR EXTENSION	
DRAWING NO.	REV.
MVP-ES65	P




TEMPORARY LEVEL SPREADER OUTLET SEDIMENT CONTROL



PLUNGE POOL OUTLET SEDIMENT CONTROL

DRAWN	DATE	3/17/20
CHECKED	DATE	3/17/20
APP'D	DATE	3/17/20
SCALE	N.T.S.	SHEET 1 OF 1
JOB NO.		
PROJECT ID:		
MVP - VA PORTION		



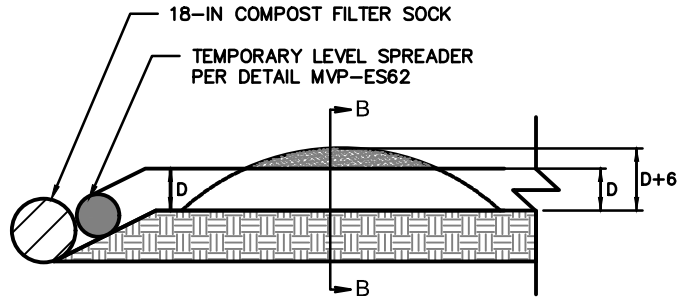
**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

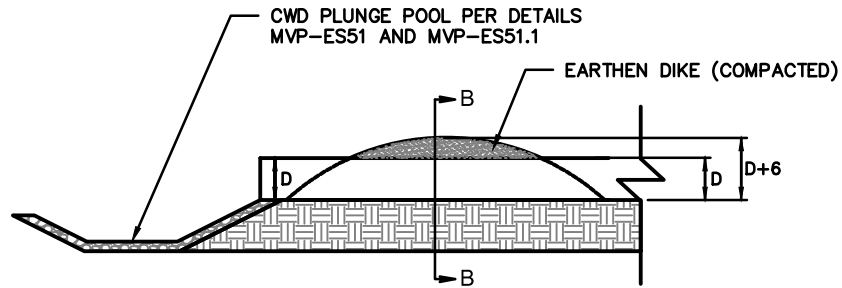
CLEAN WATER DIVERSION OUTLET  
SEDIMENT CONTROL

DRAWING NO.	REV.
MVP-ES67	0

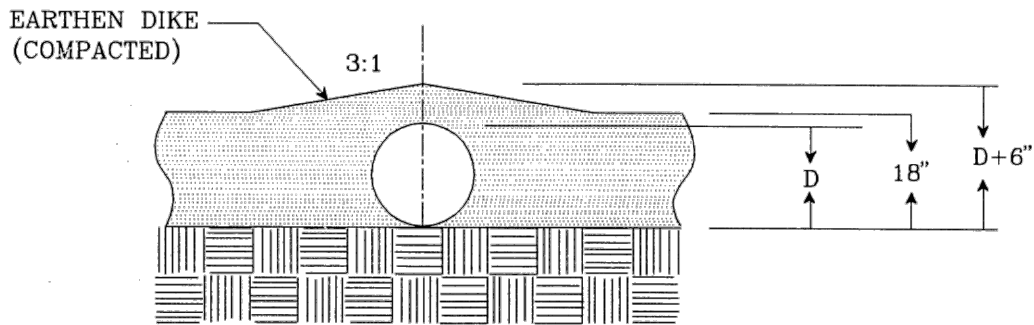




SECTION A - A  
(TEMPORARY LEVEL SPREADER OUTLET)



SECTION A-A  
(PLUNGE POOL OUTLET)



SECTION B - B

CWD PIPE DIAMETER (D)	MIN. BERM HEIGHT	D+6"
12"	18"	18"
18"	18"	24"
24"	18"	30"

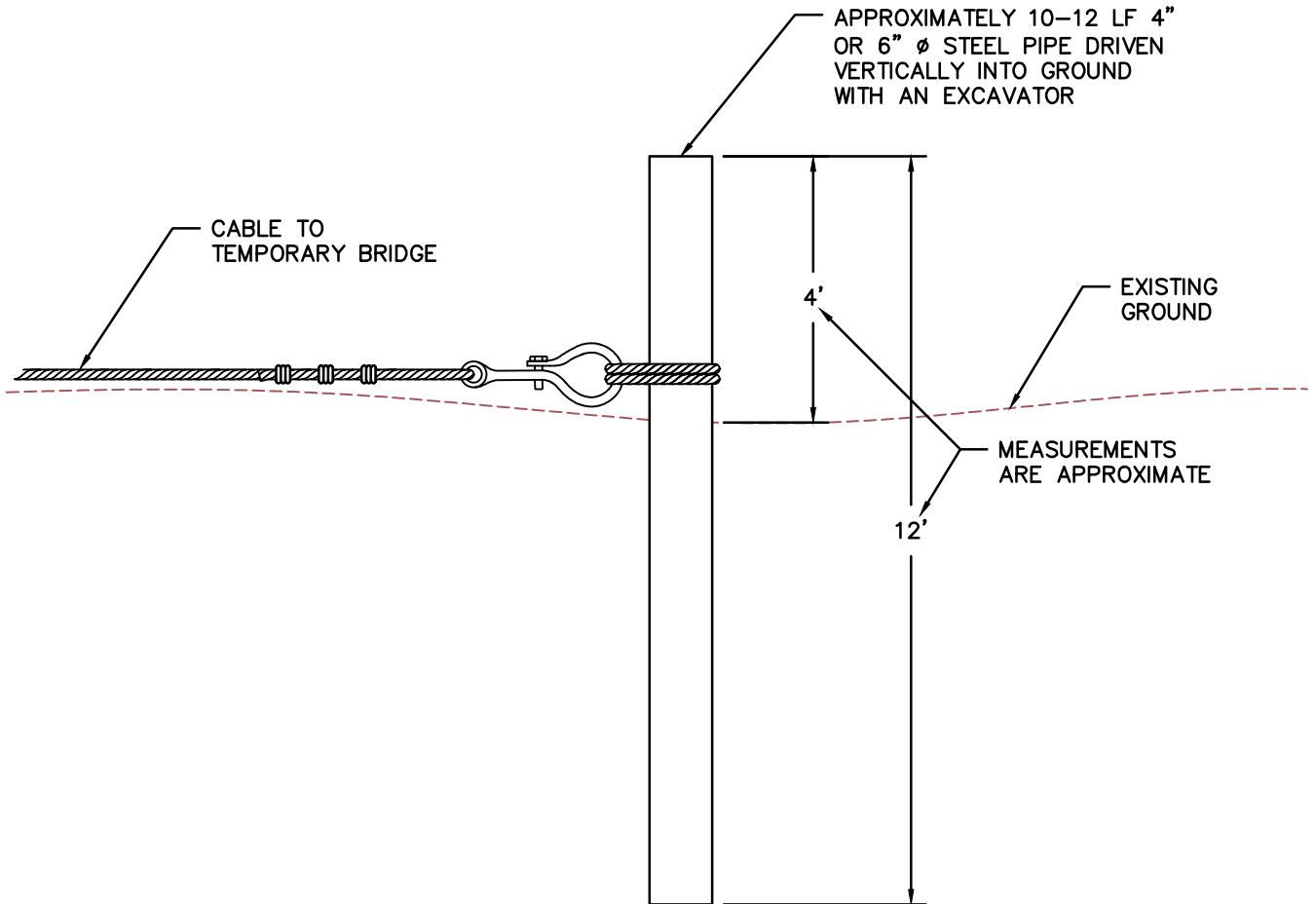
DRAWN	DATE 3/17/20
CHECKED	DATE 3/17/20
APP'D	DATE 3/17/20
SCALE N.T.S.	SHEET 1 OF 1
JOB NO.	
PROJECT ID:	
MVP - VA PORTION	

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

CLEAN WATER DIVERSION OUTLET  
SEDIMENT CONTROL

DRAWING NO.	REV.
MVP-ES67.1	0



NOTE:  
 TEMPORARY BRIDGE/TIMBER MATS TO BE CABLED TOGETHER AND SECURED TO THE DEADMAN AS SHOWN ABOVE OR SUITABLE EQUIVALENT. REFER TO VESCH PLATE 3.24-1 FOR ADDITIONAL ANCHORING MEASURES.

DRAWN	JWK	DATE	02/03/20
CHECKED	RJE	DATE	02/03/20
APP'D	DJW	DATE	02/03/20
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



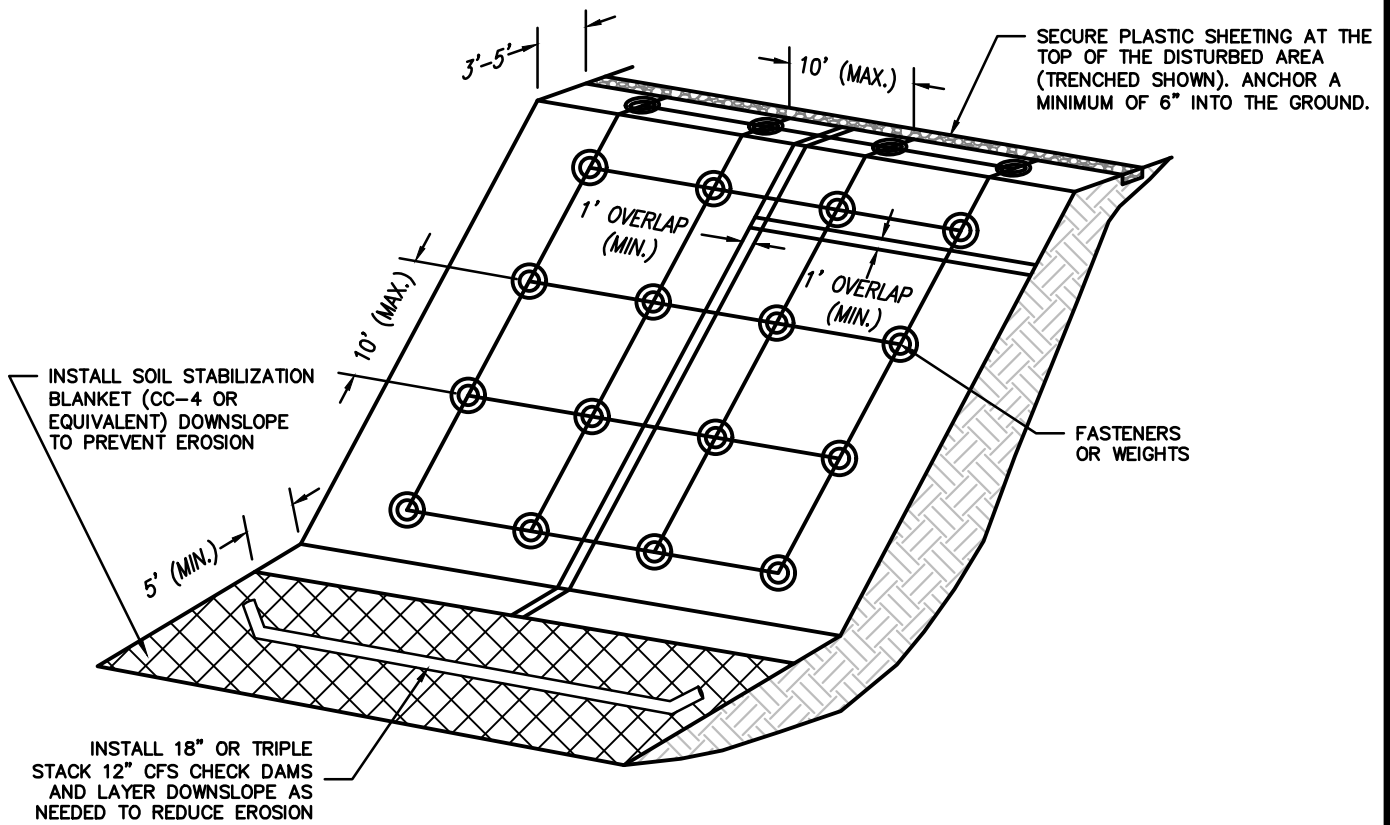
**Mountain Valley**  
 PIPELINE

DESIGN ENGINEERING

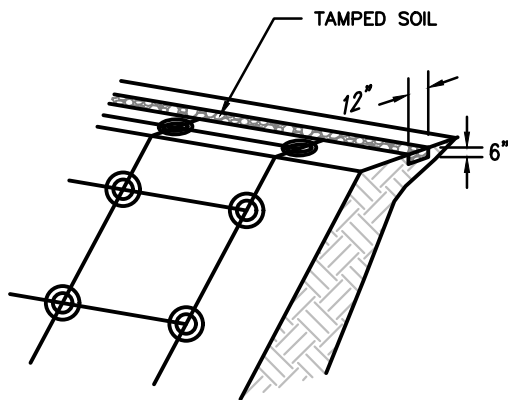
**ENVIRONMENTAL DETAIL**

TYPICAL DEAD MAN ANCHOR FOR TEMPORARY BRIDGE

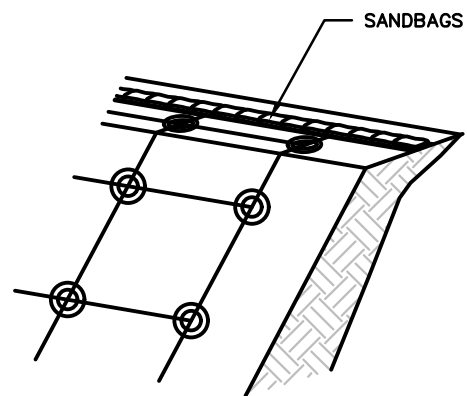
DRAWING NO.	REV.
MVP-ES68	0



PERSPECTIVE



TRENCHED DETAIL



WEIGHTED DETAIL

DRAWN	JWK	DATE	02/21/20
CHECKED	RJE	DATE	02/21/20
APP'D	DJW	DATE	02/21/20
SCALE	N.T.S.	SHEET	1 OF 2

JOB NO.

PROJECT ID:

MVP - VA PORTION



DESIGN ENGINEERING

**ENVIRONMENTAL DETAIL**

TEMPORARY STABILIZATION  
PLASTIC COVERING

DRAWING NO.	MVP-ES69A
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REV.	0
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## PLASTIC COVERING NOTES:

### MATERIALS

**PLASTIC COVERING (SHEETING):** MATERIAL SHALL BE GRIP-RITE 620100CSRF (OR APPROVED EQUIVALENT) 6.0 MIL CLEAR STRING REINFORCED 20-FT BY 100-FT.

### GENERAL USAGE NOTES:

1. PLASTIC COVERING TO BE USED AS TEMPORARY PROTECTION FOR SOILS, SLOPES AND STOCKPILES WHERE SOIL CONDITIONS DO NOT ALLOW TRADITIONAL MULCHING/SEEDING OR SOIL STABILIZATION BLANKET TO BE INSTALLED.
2. USE OF SHEETING SHALL BE LIMITED TO STOCKPILES OR SMALL AREAS REQUIRING URGENT PROTECTION AND ONLY REMAIN IN PLACE UNTIL TRADITIONAL MEASURES SUCH AS MULCHING/SEEDING OR SOIL STABILIZATION BLANKET CAN BE INSTALLED.
3. SHEETING MUST BE INSTALLED IN A MANNER THAT PREVENTS EROSION TO SUSCEPTIBLE SURFACE, INCLUDING KEYING AT THE TOP, OVERLAPPING SEAMS AND FASTENED OR WEIGHTED DOWN IN A GRID PATTERN.

**FASTENERS OR WEIGHTS:** FASTENERS OR WEIGHTING OBJECTS, SUCH AS SANDBAGS OR OTHER SIMILAR MATERIALS.

### INSTALLATION

1. INSTALL PLASTIC PARALLEL WITH THE SLOPE, NOT PERPENDICULAR. PLASTIC MAY BE INSTALLED PERPENDICULAR TO A SLOPE IF THE SLOPE LENGTH IS LESS THAN 10 FEET. OVERLAP UPHILL SHEET OVER DOWNHILL SHEET A MINIMUM OF 1-FOOT.
2. SECURE THE PLASTIC SHEETING AT THE TOP OF THE SLOPE BY KEYING INTO A TRENCH OR WEIGHT WITH A CONTINUOUS LINE OF SANDBAGS SO THAT NO WATER CAN FLOW UNDERNEATH.
3. INSTALL WEIGHTS ON ROPES OR FASTENERS IN A 10-FOOT MAXIMUM GRID TO SECURE THE PLASTIC TIGHTLY AGAINST THE SOIL.
4. INSPECT WEIGHTS TO MAKE SURE THEY ARE STILL IN PLACE. REPLACE AS NEEDED OR ADD ADDITIONAL WEIGHT IF THERE IS NOT A SUFFICIENT AMOUNT ON THE SLOPE.
5. TAPE, FASTEN, OR WEIGHT SEAMS ALONG THEIR ENTIRE LENGTH WITH A 12"-24" OVERLAP AT ALL SEAMS.
6. SECURE EDGES TO PREVENT WATER FROM ERODING GROUND UNDERNEATH AND WIND FROM LIFTING THE COVER.
7. INSTALL SOIL STABILIZATION BLANKET (SSB) AND CHECK DAMS DOWNSLOPE TO MINIMIZE EROSION.

### INSPECTION

1. INSPECT SHEETING AFTER INSTALLATION AND ACCORDING TO ESTABLISHED SCHEDULES.
2. CHECK FOR EROSION, UNDERMINING, ANCHORAGE (KEYING AND EMBEDDING) FAILURE, TORN SHEETS, AND DETERIORATION.

### MAINTENANCE

1. REPAIR ANY ISSUES AS SOON AS PRACTICABLE.
2. IF WASHOUT OR BREAKAGES OCCUR, REPAIR DAMAGE TO THE SLOPE AND REINSTALL THE MATERIAL AS SOON AS PRACTICABLE.

### REMOVAL

1. REMOVE PLASTIC SHEETING AND WEIGHTS PRIOR TO STABILIZING THE AREA.

<b>DRAWN</b>	<b>JWK</b>	<b>DATE</b>	02/21/20
<b>CHECKED</b>	<b>RJE</b>	<b>DATE</b>	02/21/20
<b>APP'D</b>	<b>DJW</b>	<b>DATE</b>	02/21/20
<b>SCALE</b>	<b>N.T.S.</b>	<b>SHEET</b>	2 OF 2
<b>JOB NO.</b>			
<b>PROJECT ID:</b>			
MVP – VA PORTION			



DESIGN ENGINEERING

## **ENVIRONMENTAL DETAIL**

TEMPORARY STABILIZATION  
PLASTIC COVERING

**DRAWING NO.**

MVP-ES69B

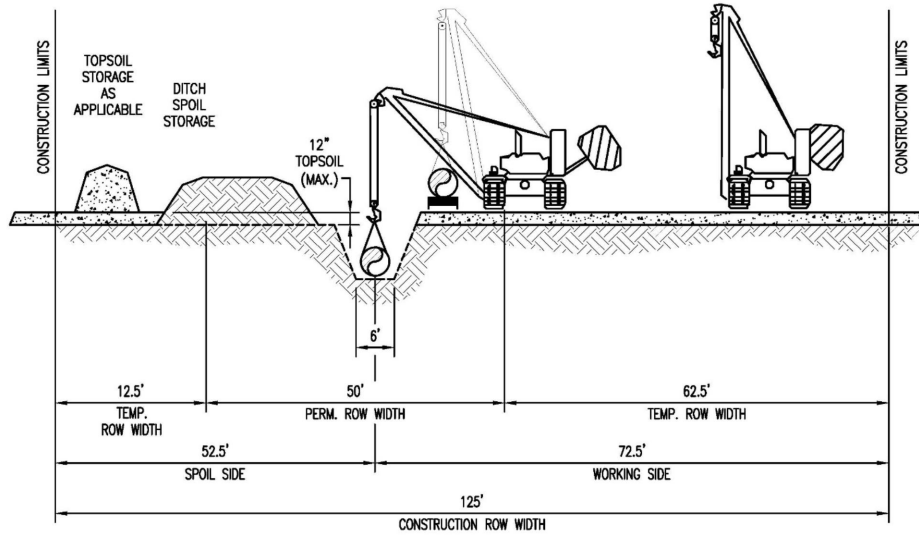
**REV.**

0



WORKING AREA

TRAVEL AREA



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



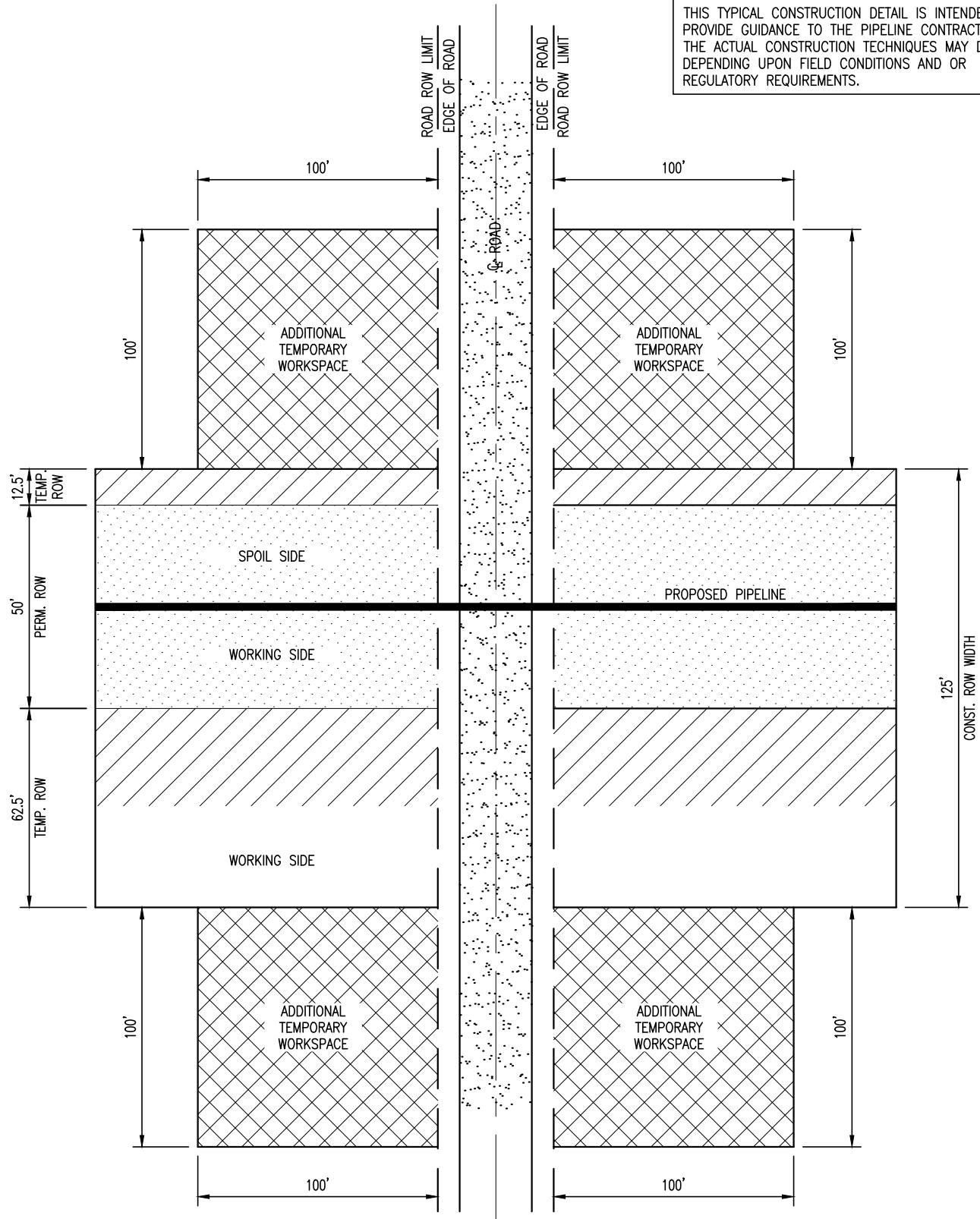
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
NON-PARALLEL CONSTRUCTION WITH  
TOPSOIL SEGREGATION

DRAWING NO.	MVP-2	REV.	0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	11/14/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			



DESIGN ENGINEERING

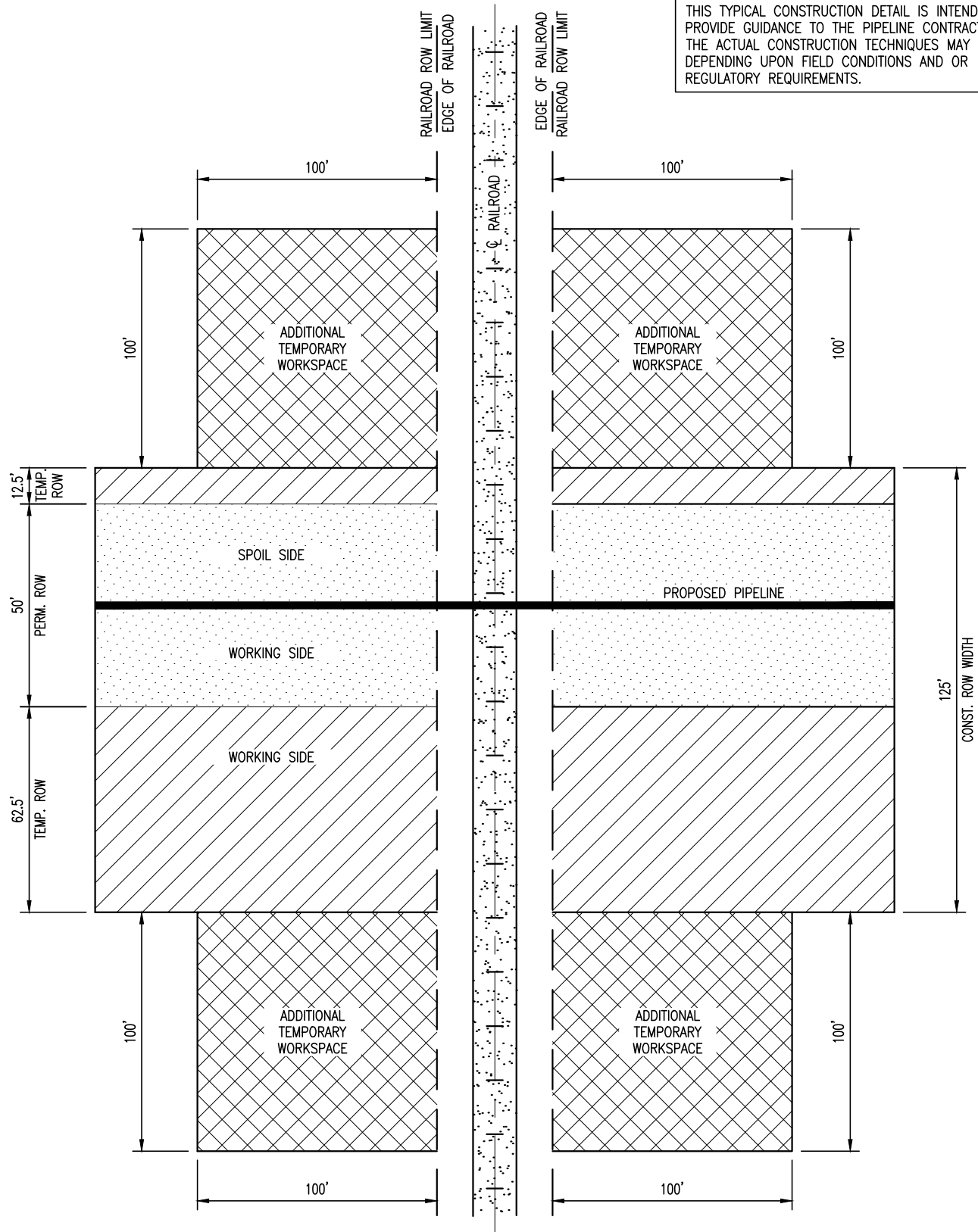
**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
ROAD CROSSING BORED  
TYPICAL

DRAWING NO.  
MVP-4

REV.  
0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



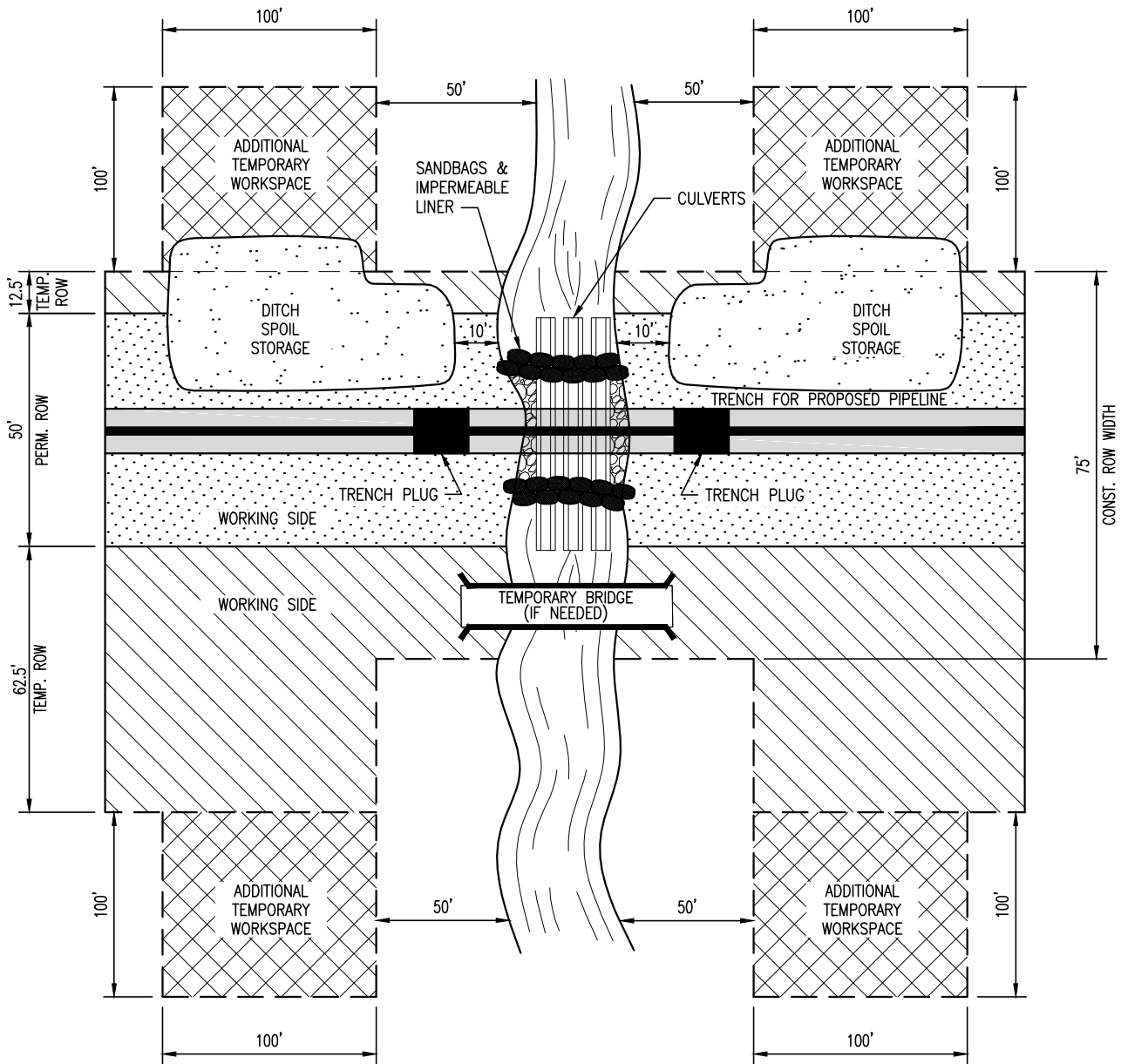
DRAWN	JDM	DATE	11/14/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
MAINLINE CONSTRUCTION RAILROAD CROSSING BORED	
DRAWING NO.	REV.
MVP-5	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	11/17/14
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
WATERBODY CROSSING  
OPEN CUT – FLUME

DRAWING NO.

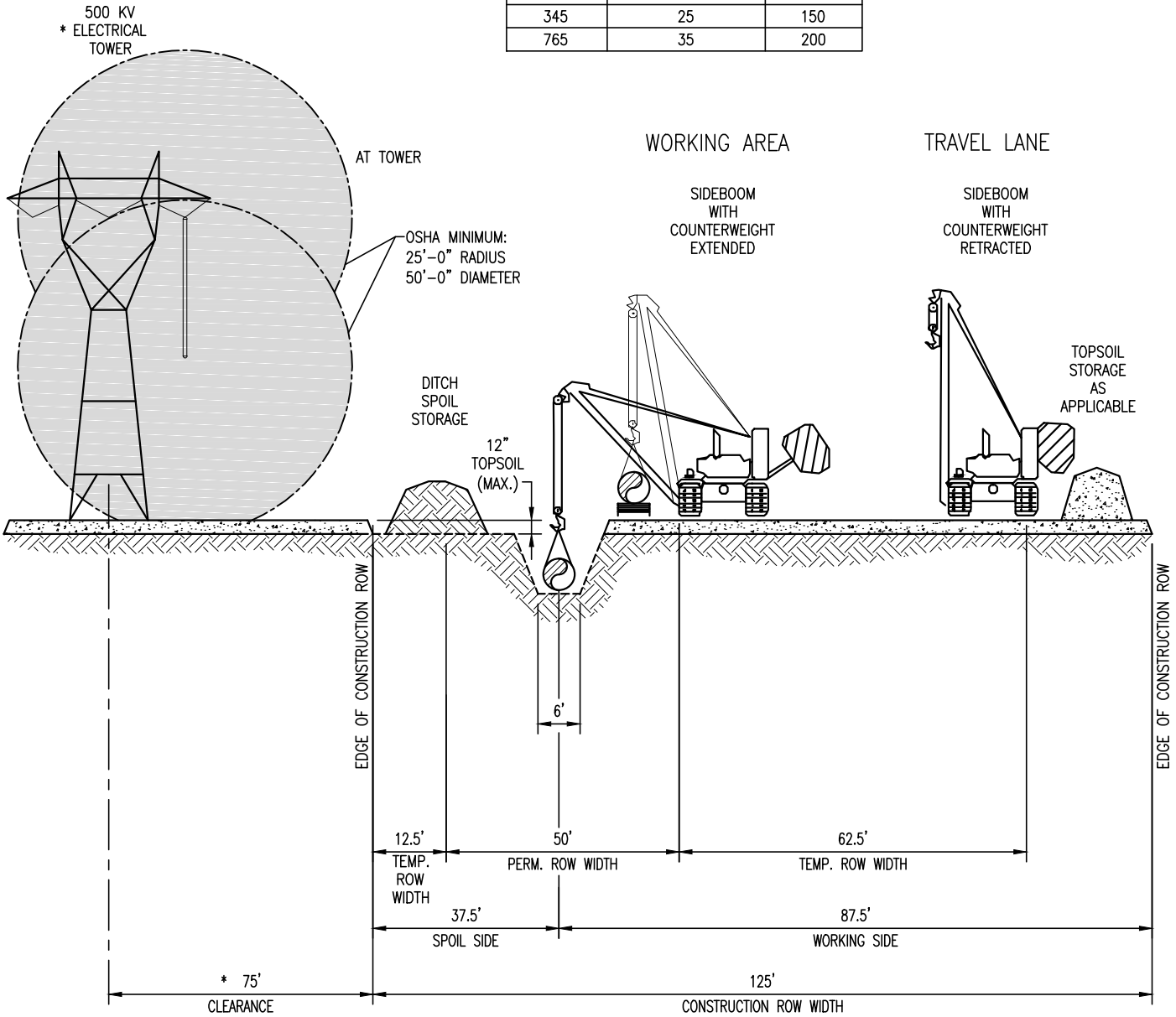
MVP-6

REV.

0



POWER LINE VOLTAGE KV	MINIMUM ALLOWABLE APPROACH DISTANCE FEET	TYPICAL ROW WIDTH FEET
34	10	50
69	12	70
138	15	100
345	25	150
765	35	200



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

\* SEE TABLE AT TOP OF PAGE

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

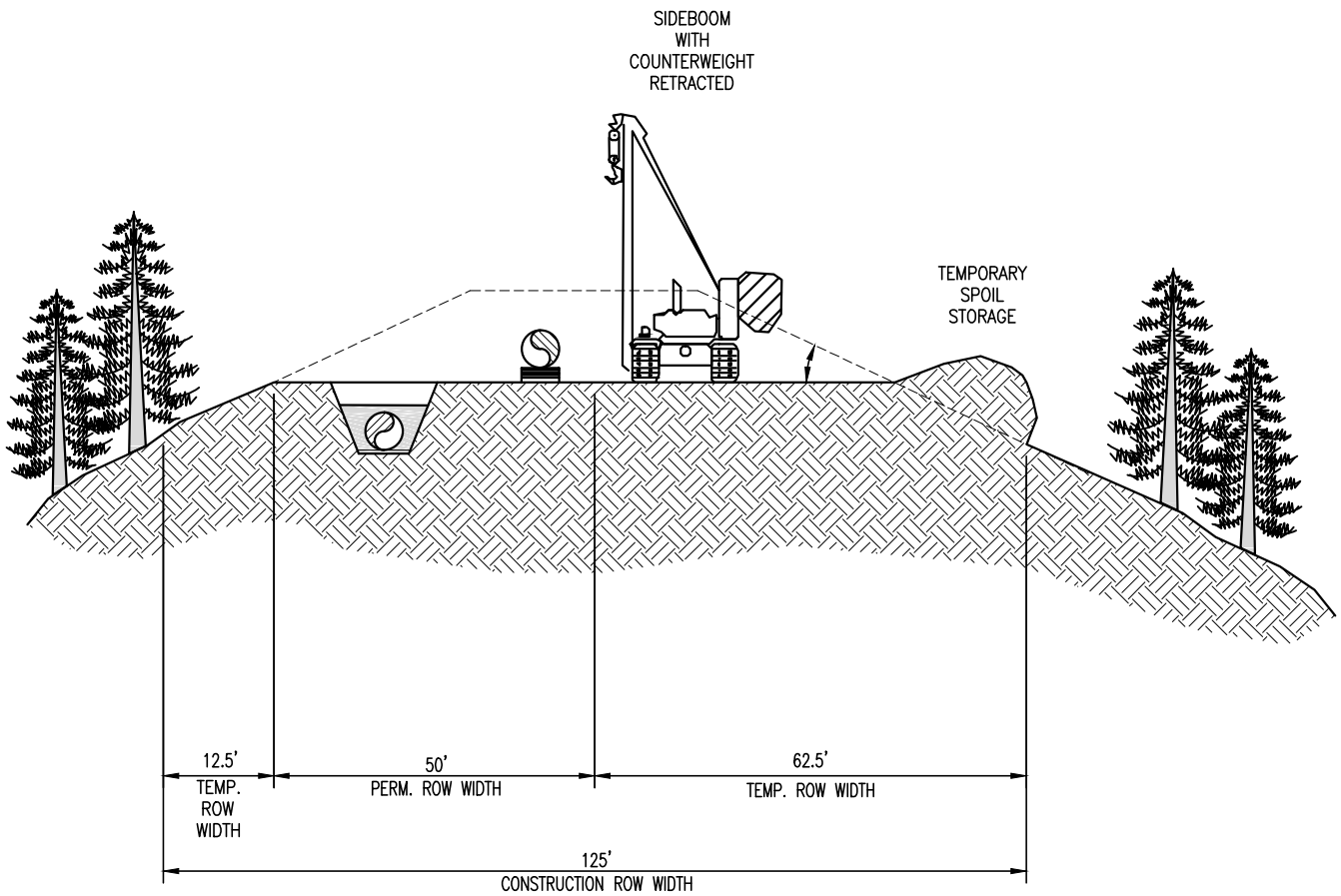


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO.	MVP-7	REV.	0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



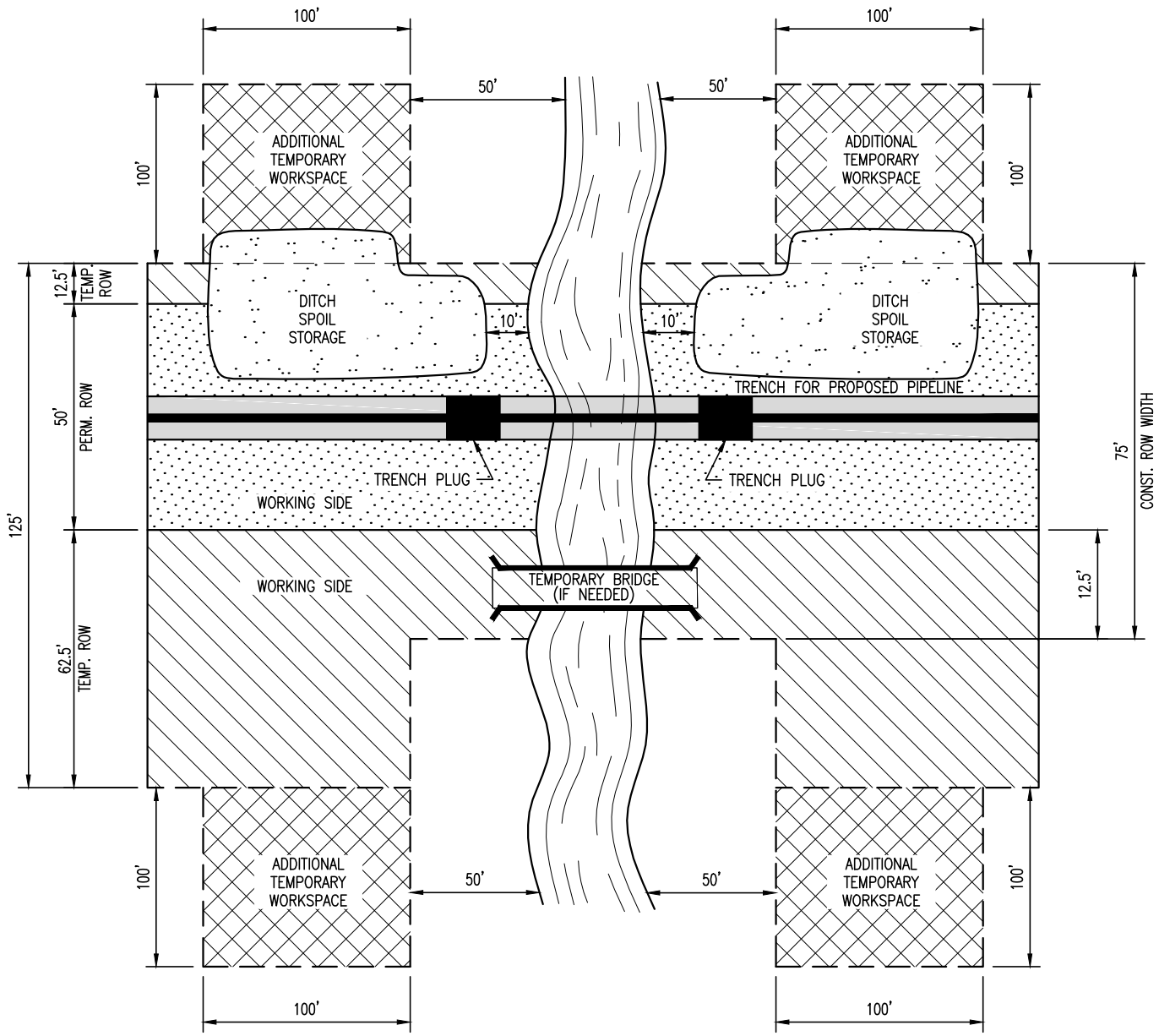
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
TYPICAL CROSS SECTION  
FOR LARGE DIAMETER PIPE  
RIDGE

DRAWING NO.	REV.
MVP-8	0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			



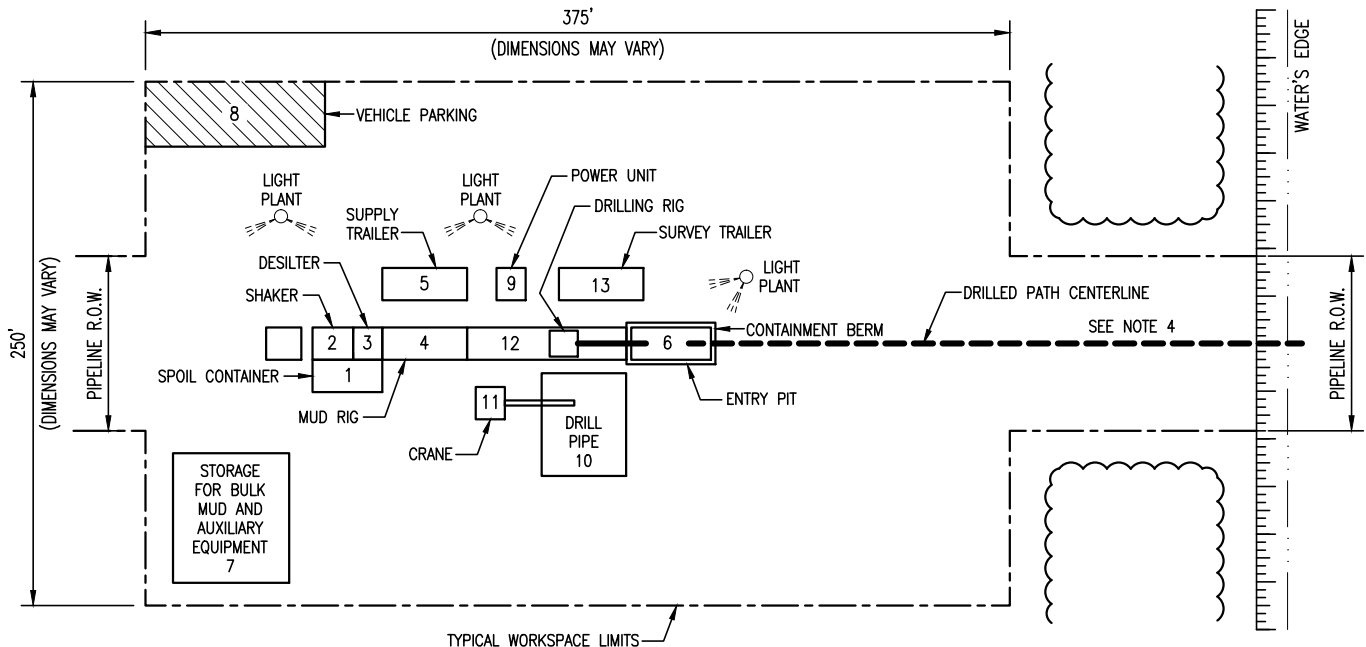
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
WATERBODY CROSSING  
OPEN CUT – WET DITCH  
RIGHT-OF-WAY

DRAWING NO. MVP-9
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REV. 0
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**EQUIPMENT:**

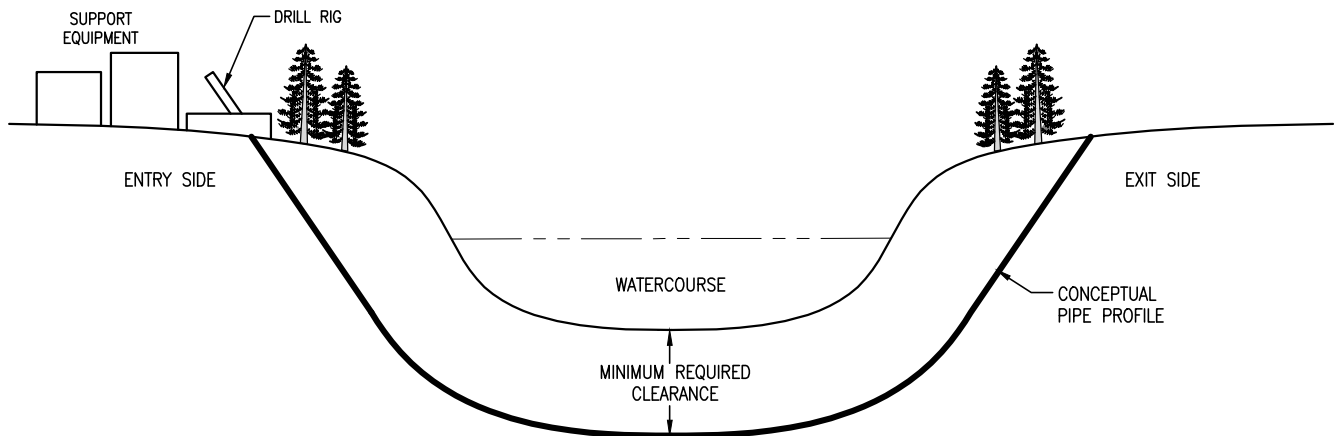
1. SPOIL CONTAINER: 8' X 20'
2. SHAKER: 8' X 12'
3. DESILTER: 8' X 8'
4. MUD RIG: 8' X 25'
5. SUPPLY TRAILER: 8' X 25'
6. ENTRY PIT: 8' X 20'
7. STORAGE: 30' X 30'
8. VEHICLE PARKING: 15' X 50'
9. POWER UNIT: 8' X 10'
10. DRILL PIPE: 30' X 30'
11. CRANE: 8' X 8'
12. DRILLING RIG: 8' X 45'
13. SURVEY TRAILER: 8' X 25'

**NOTES:**

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

**ENTRY SITE PLAN**

SCALE: N.T.S.



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

**PROFILE**  
SCALE: N.T.S.

**GENERAL NOTES:**

1. PIPE DEPTHS MAY VARY.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: <b>PXXXX</b>			



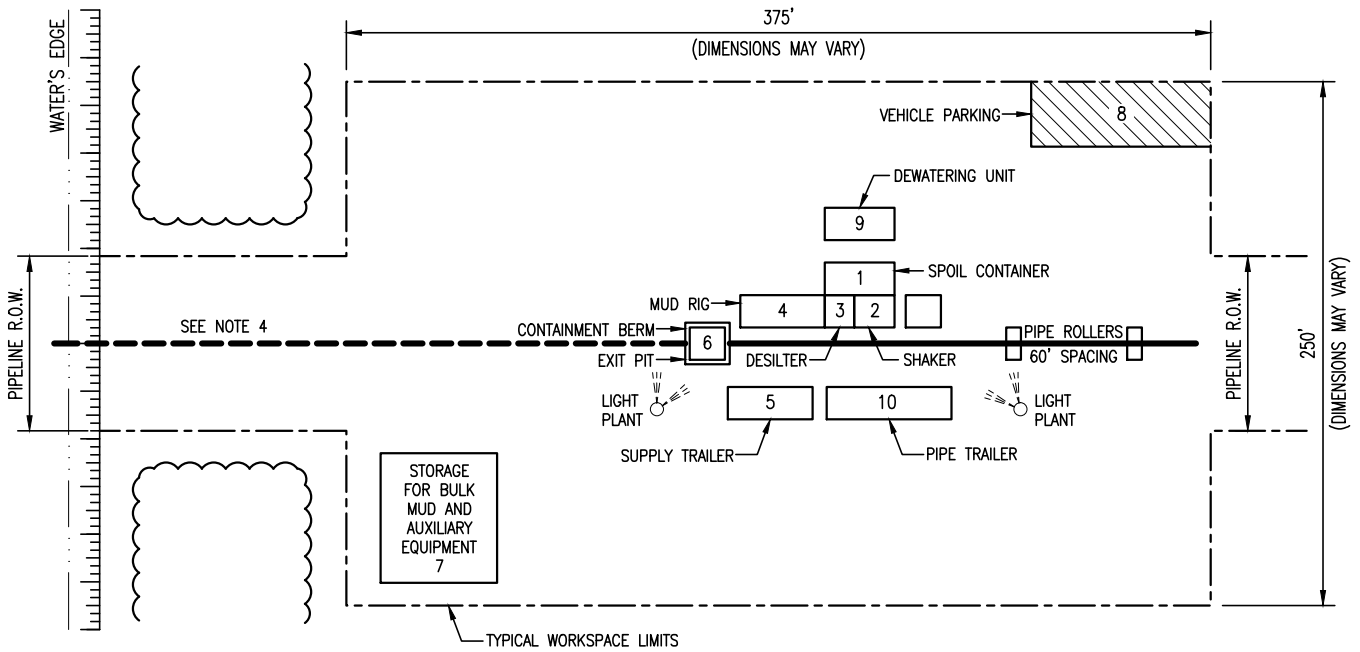
**DESIGN ENGINEERING**

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
TYPICAL DIRECTIONAL DRILL  
ENTRY SITE PLAN & PROFILE

DRAWING NO. <b>MVP-10</b>	REV. <b>0</b>
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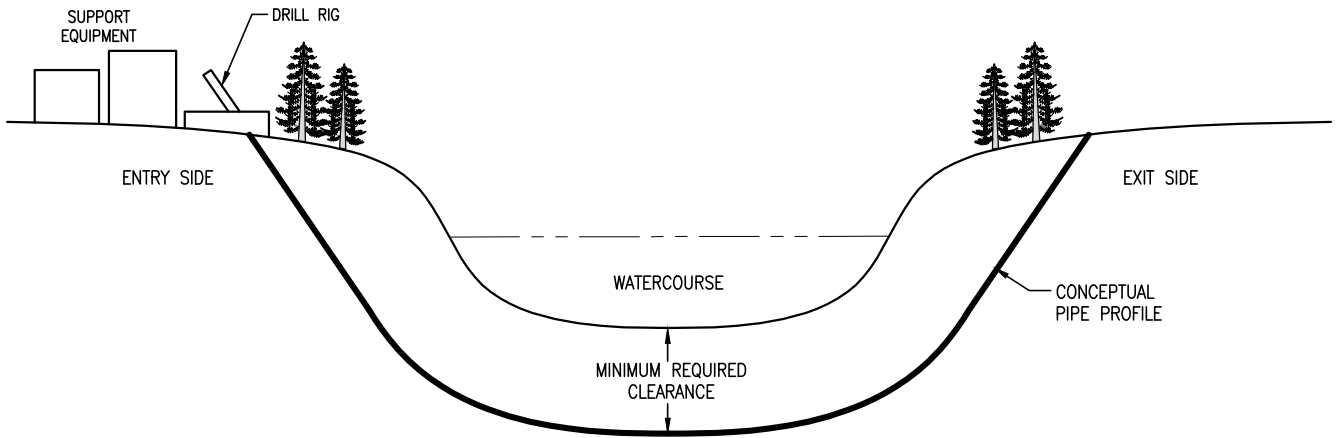
**EQUIPMENT:**

1. SPOIL CONTAINER: 8' X 20'
2. SHAKER: 8' X 12'
3. DESILTER: 8' X 8'
4. MUD RIG: 8' X 25'
5. SUPPLY TRAILER: 8' X 25'
6. EXIT PIT: 8' X 10'
7. STORAGE: 30' X 30'
8. VEHICLE PARKING: 15' X 50'
9. DEWATERING UNIT: 8' X 20'
10. PIPE TRAILER: 8' X 40'

**NOTES:**

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

**EXIT SITE PLAN**  
SCALE: N.T.S.



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

**PROFILE**  
SCALE: N.T.S.

**GENERAL NOTES:**

1. PIPE DEPTHS MAY VARY.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:  PXXXX			



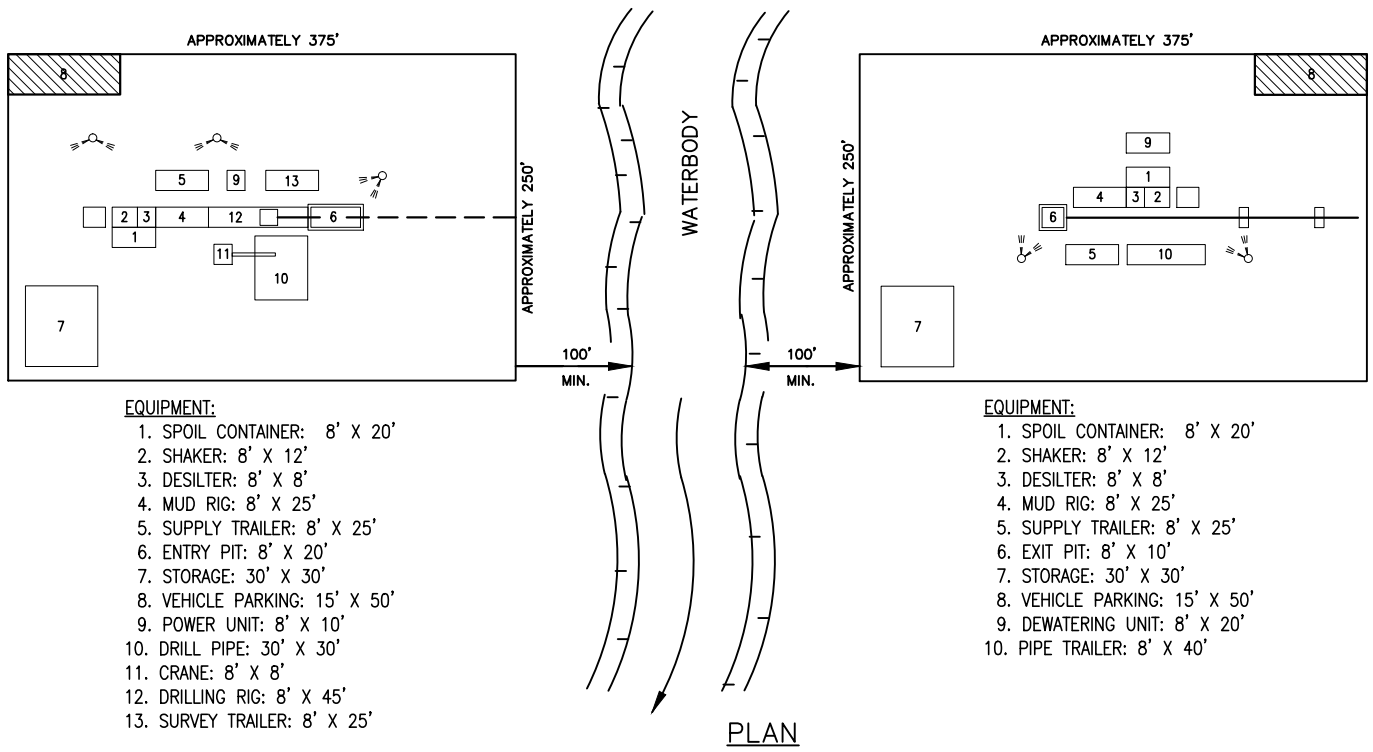
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
TYPICAL DIRECTIONAL DRILL  
EXIT SITE PLAN & PROFILE

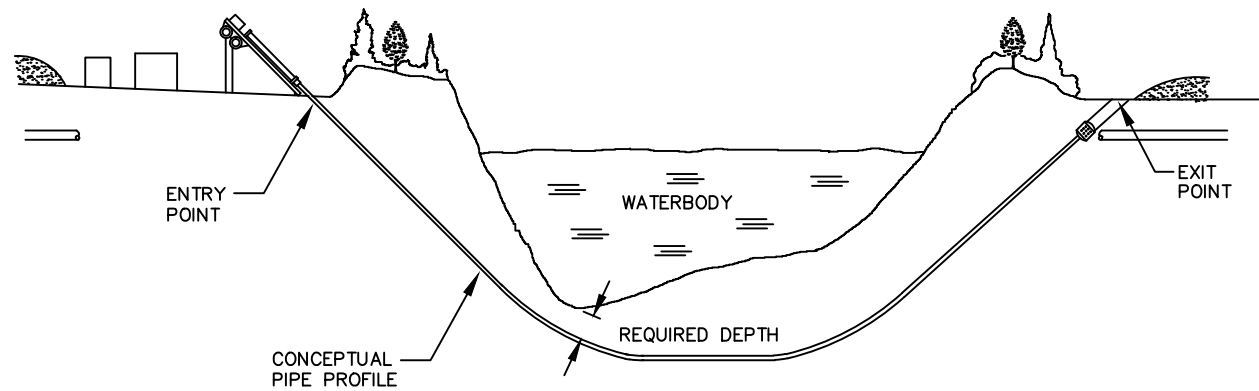
DRAWING NO.  MVP-11	REV.  0
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# HORIZONTAL DIRECTIONAL DRILL METHOD 7



- EQUIPMENT:**
1. SPOIL CONTAINER: 8' X 20'
  2. SHAKER: 8' X 12'
  3. DESILTER: 8' X 8'
  4. MUD RIG: 8' X 25'
  5. SUPPLY TRAILER: 8' X 25'
  6. ENTRY PIT: 8' X 20'
  7. STORAGE: 30' X 30'
  8. VEHICLE PARKING: 15' X 50'
  9. POWER UNIT: 8' X 10'
  10. DRILL PIPE: 30' X 30'
  11. CRANE: 8' X 8'
  12. DRILLING RIG: 8' X 45'
  13. SURVEY TRAILER: 8' X 25'

- EQUIPMENT:**
1. SPOIL CONTAINER: 8' X 20'
  2. SHAKER: 8' X 12'
  3. DESILTER: 8' X 8'
  4. MUD RIG: 8' X 25'
  5. SUPPLY TRAILER: 8' X 25'
  6. EXIT PIT: 8' X 10'
  7. STORAGE: 30' X 30'
  8. VEHICLE PARKING: 15' X 50'
  9. DEWATERING UNIT: 8' X 20'
  10. PIPE TRAILER: 8' X 40'



**NOTES:**

1. SET UP DRILLING EQUIPMENT A MINIMUM OF 100 FEET FROM THE EDGE OF THE WATERCOURSE. DO NOT CLEAR OR GRADE WITHIN THE 100 FOOT ZONE.
2. ENSURE THAT ONLY BENTONITE BASED DRILLING MUD IS USED. DO NOT ALLOW THE USE OF ANY ADDITIVES TO THE DRILLING MUD WITHOUT THE APPROVAL OF COMPANY INSPECTOR.
3. INSTALL SUITABLE DRILLING MUD TANKS OR SUMPS TO PREVENT CONTAMINATION OF WATERCOURSE.
4. INSTALL BERMS DOWNSLOPE FROM THE DRILL ENTRY AND ANTICIPATED EXIT POINTS TO CONTAIN ANY RELEASE OF DRILLING MUD.
5. DISPOSE OF DRILLING MUD IN ACCORDANCE WITH THE APPROPRIATE REGULATORY AUTHORITY REQUIREMENTS.
6. A SEDIMENT BARRIER SHALL BE PLACED ON THE DOWN SLOPE SIDE OF RIGHT-OF-WAY, PER THE PROJECT NARRATIVE.

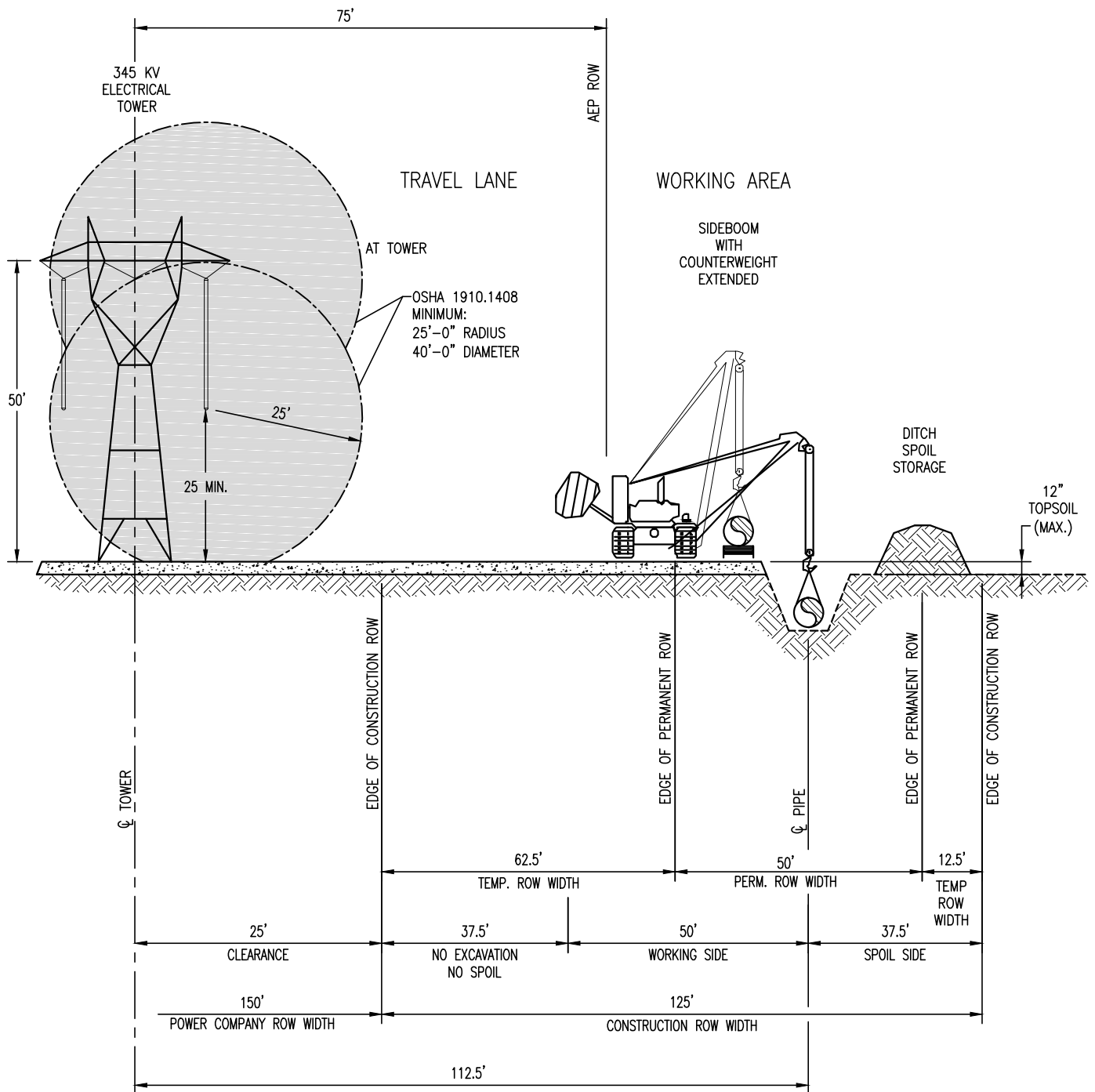
THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	3/18/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:  PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL	
HORIZONTAL DIRECTIONAL DRILL (HDD)	
DRAWING NO.  MVP-12	REV.  0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	5/27/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

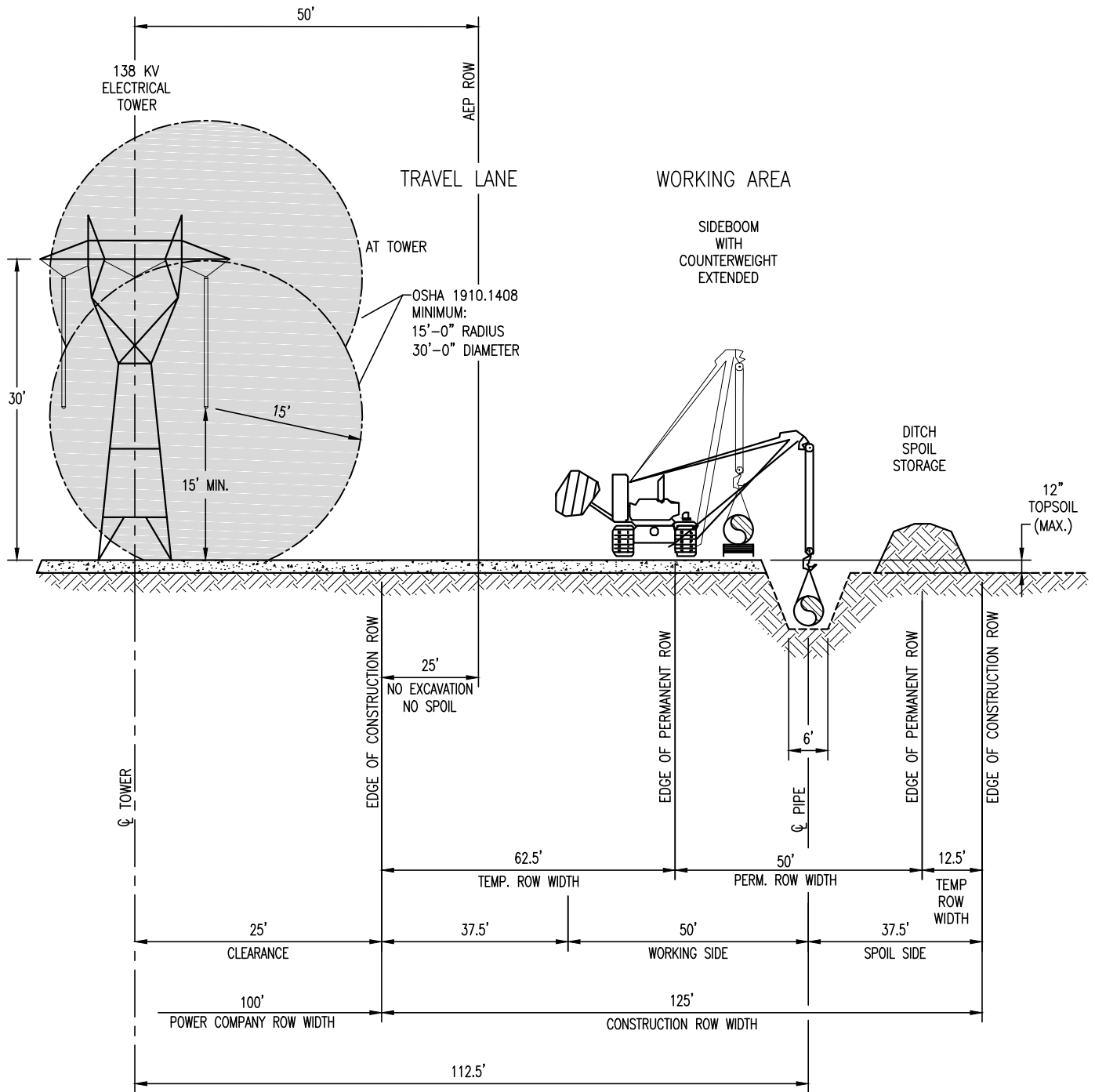


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES - 345KV  
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-13	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	5/27/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



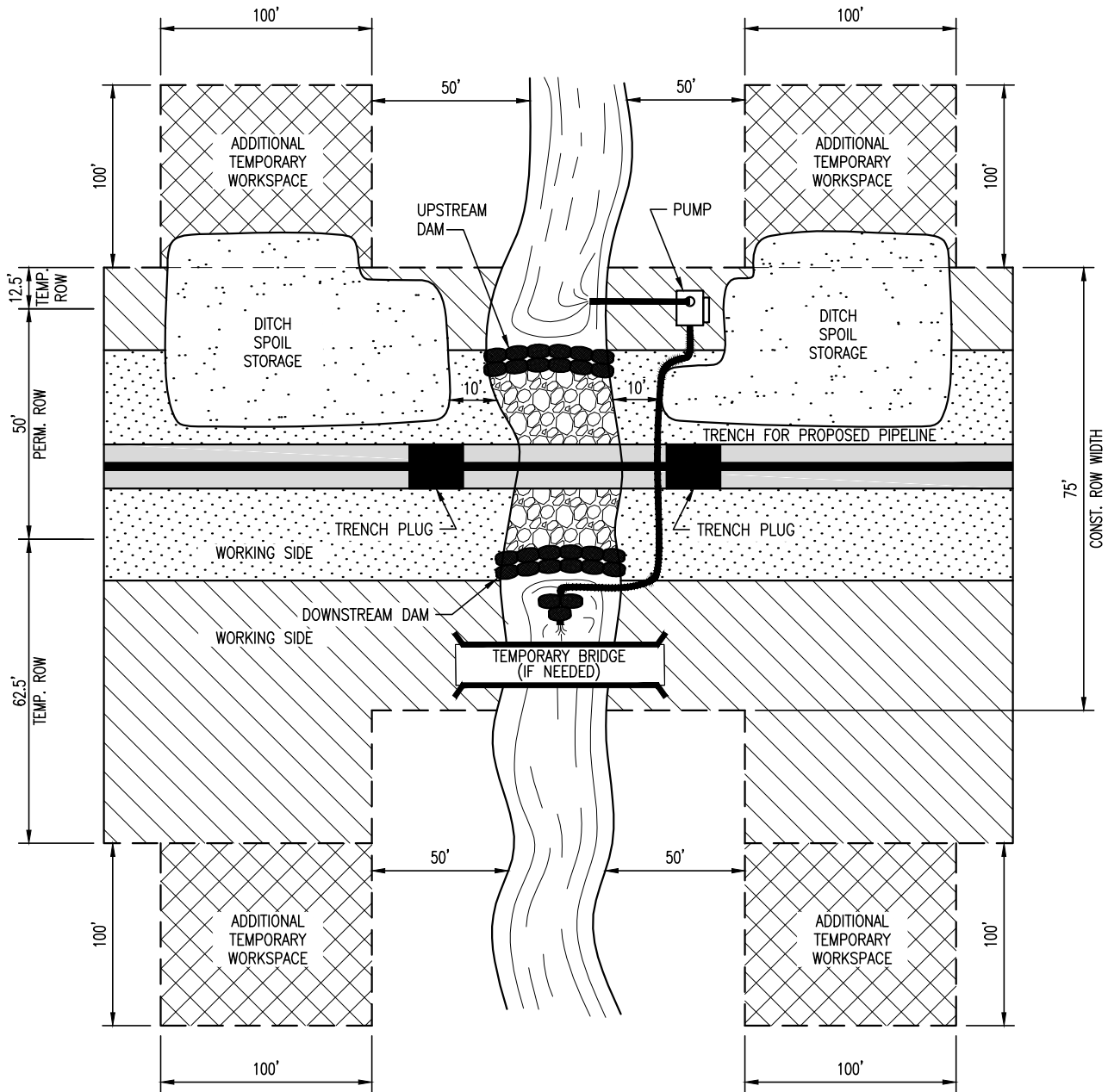
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES - 138KV  
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-14	0





THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	08/20/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
WATERBODY CROSSING  
OPEN CUT – DRY/DAM AND PUMP  
RIGHT-OF-WAY

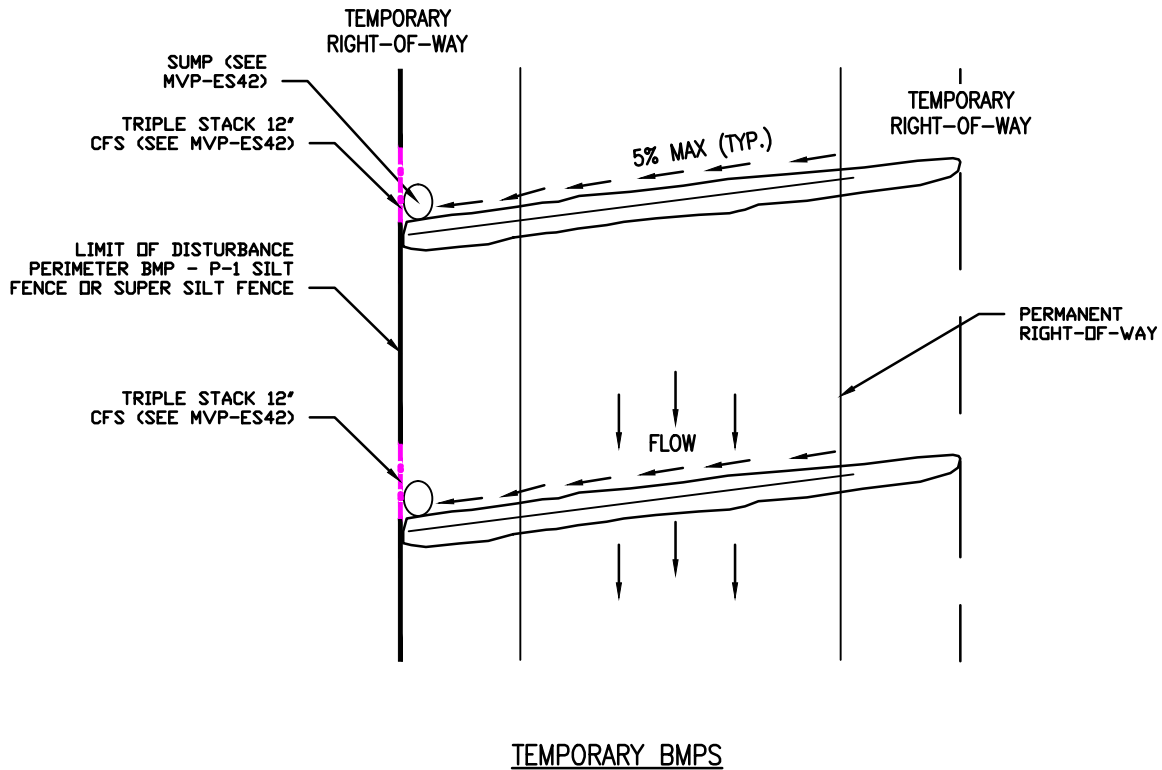
DRAWING NO.

MVP-15

REV.

0

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



**NOTES:**

1. SLOPE BREAKERS SHALL BE CONSTRUCTED OF COMPACTED NATIVE SOIL AND INSTALLED AT LOCATIONS AS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE COMPANY'S INSPECTOR.
2. SLOPE BREAKERS SHALL BE ORIENTED AS SHOWN OR OTHER PATTERN AS DIRECTED BY THE COMPANY'S INSPECTOR TO DIRECT THE WATER OFF THE R.O.W.
3. SLOPE BREAKERS SHALL BE CONSTRUCTED AT A 5% MAXIMUM GRADIENT ACROSS THE SLOPE.
4. THE SLOPE BREAKERS SHALL BE 18" DEEP (AS MEASURED FROM THE TROUGH TO THE TOP OF THE SLOPE BREAKER). THE TROUGH WILL BE A MINIMUM OF 5' WIDE ACROSS THE WIDTH OF THE RIGHT-OF-WAY.
5. THE OUTLET OF THE SLOPE BREAKER MUST FREELY DISCHARGE RUNOFF OFF FROM THE DISTURBED RIGHT-OF-WAY INTO A STABLE, WELL VEGETATED AREA OR INTO AN ENERGY DISSIPATER.

DRAWN	JIL	DATE	08/21/19
CHECKED	MMF	DATE	08/21/19
APP'D	XXX	DATE	08/21/19
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

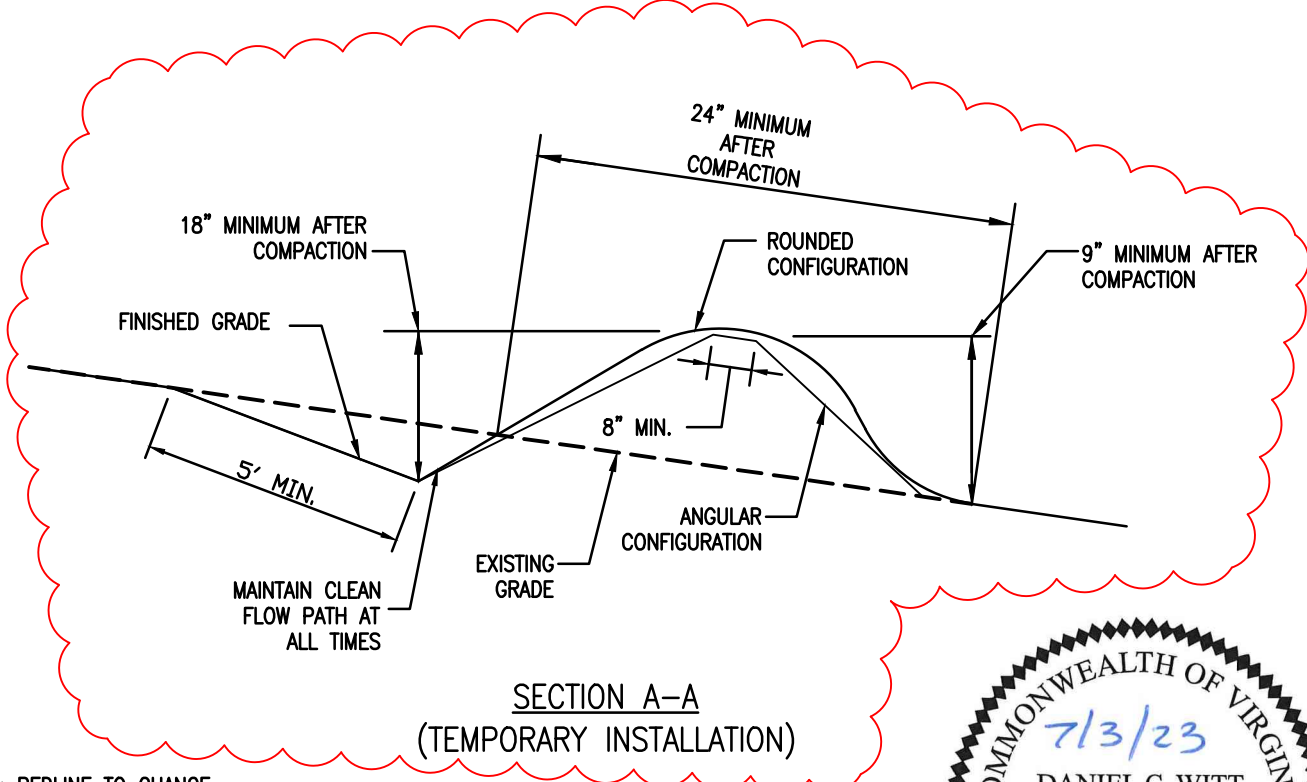


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

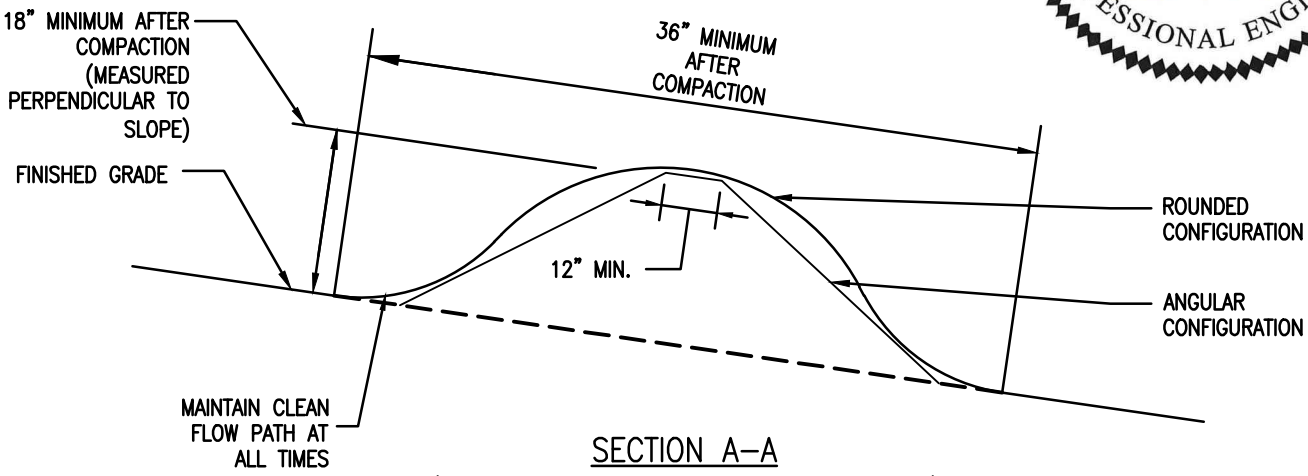
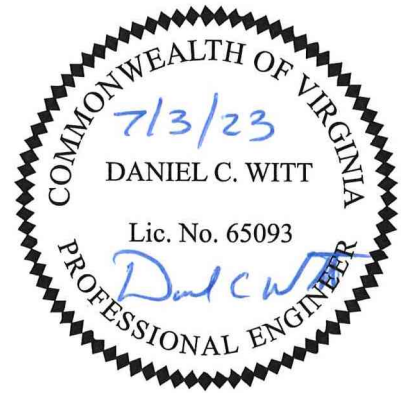
SLOPE BREAKER/RIGHT-OF-WAY DIVERSION/WATERBAR

DRAWING NO.	MVP-17	REV.	0
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SECTION A-A  
(TEMPORARY INSTALLATION)

NOTE: REDLINE TO CHANGE  
TEMPORARY WATER BAR  
CONFIGURATION TO ORIGINALLY  
APPROVED VERSION.



SECTION A-A  
(POST CONSTRUCTION INSTALLATION)

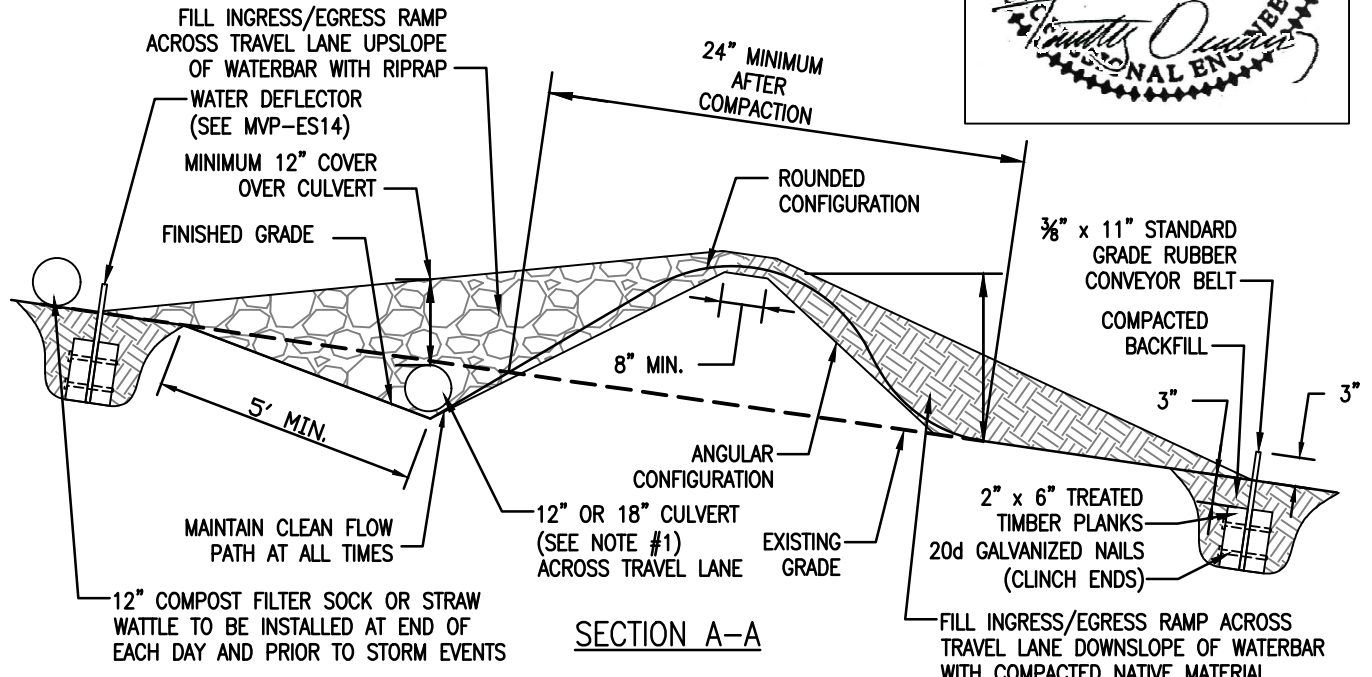
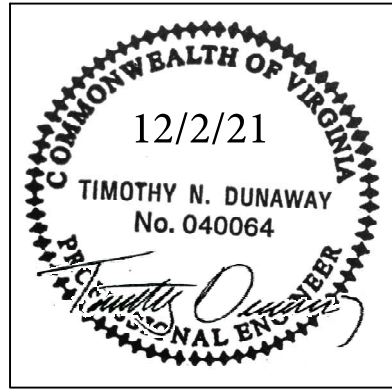
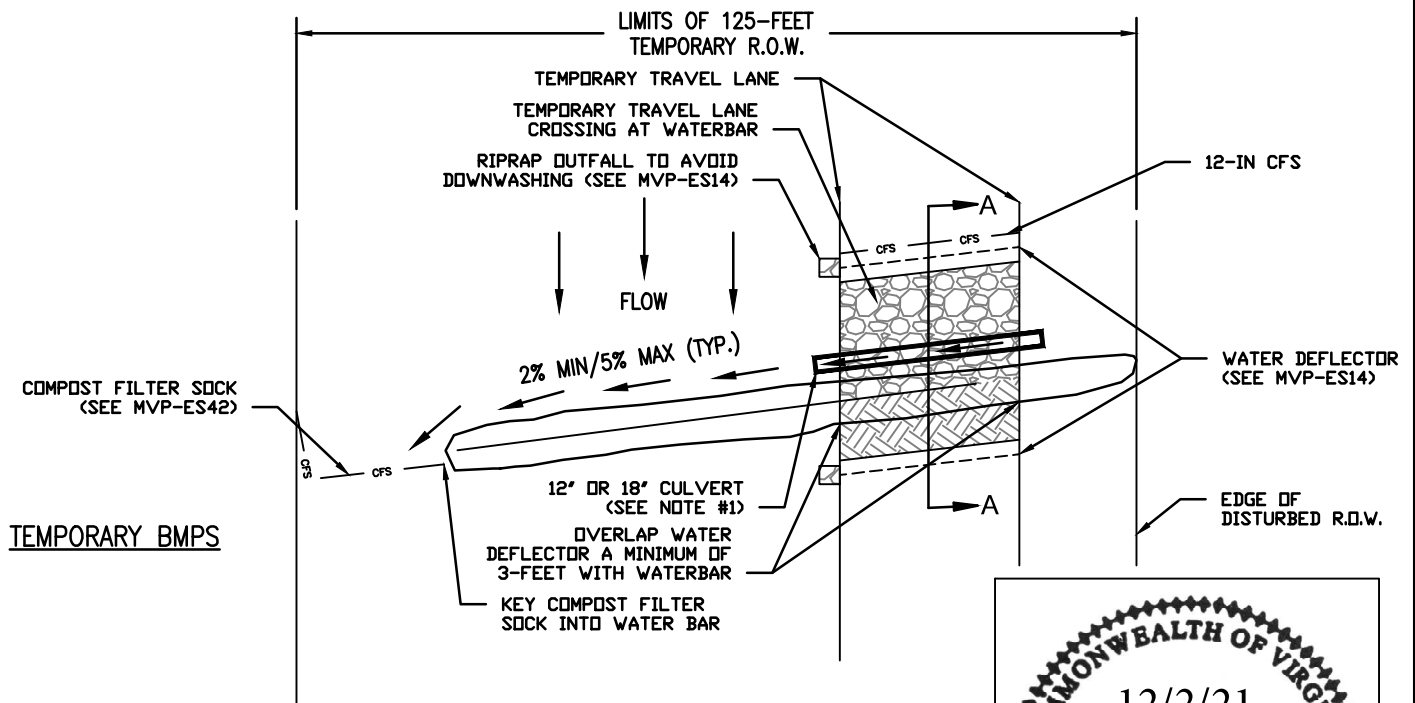
THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JJZ	DATE	07/05/2023
CHECKED	IHH	DATE	07/05/2023
APP'D	DCW	DATE	07/05/2023
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
SLOPE BREAKER/RIGHT-OF-WAY DIVERSION/WATERBAR	
DRAWING NO.	REV.
MVP-17.1	2



- NOTES:**
1. INSTALL 18" CULVERT WHEN PIPELINE GRADE <6%, AND INSTALL 12" CULVERT WHEN PIPELINE GRADE ≥6% (SEE DETAIL MVP-17.2).
  2. ACCUMULATED SEDIMENT SHALL BE REMOVED FROM COMPOST FILTER SOCK AND WATER DEFLECTORS WITHIN 24 HOURS OF INSPECTION. DAMAGED COMPOST FILTER SOCK AND WATER DEFLECTORS SHALL BE REPLACED, AND SEDIMENT-CLOGGED RIPRAP SHALL BE REPLACED WITH CLEAN RIPRAP, WITHIN 24 HOURS OF INSPECTION.

DRAWN	JWK	DATE	7/01/2020
CHECKED	RJE	DATE	7/01/2020
APP'D	DJW	DATE	7/01/2020
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

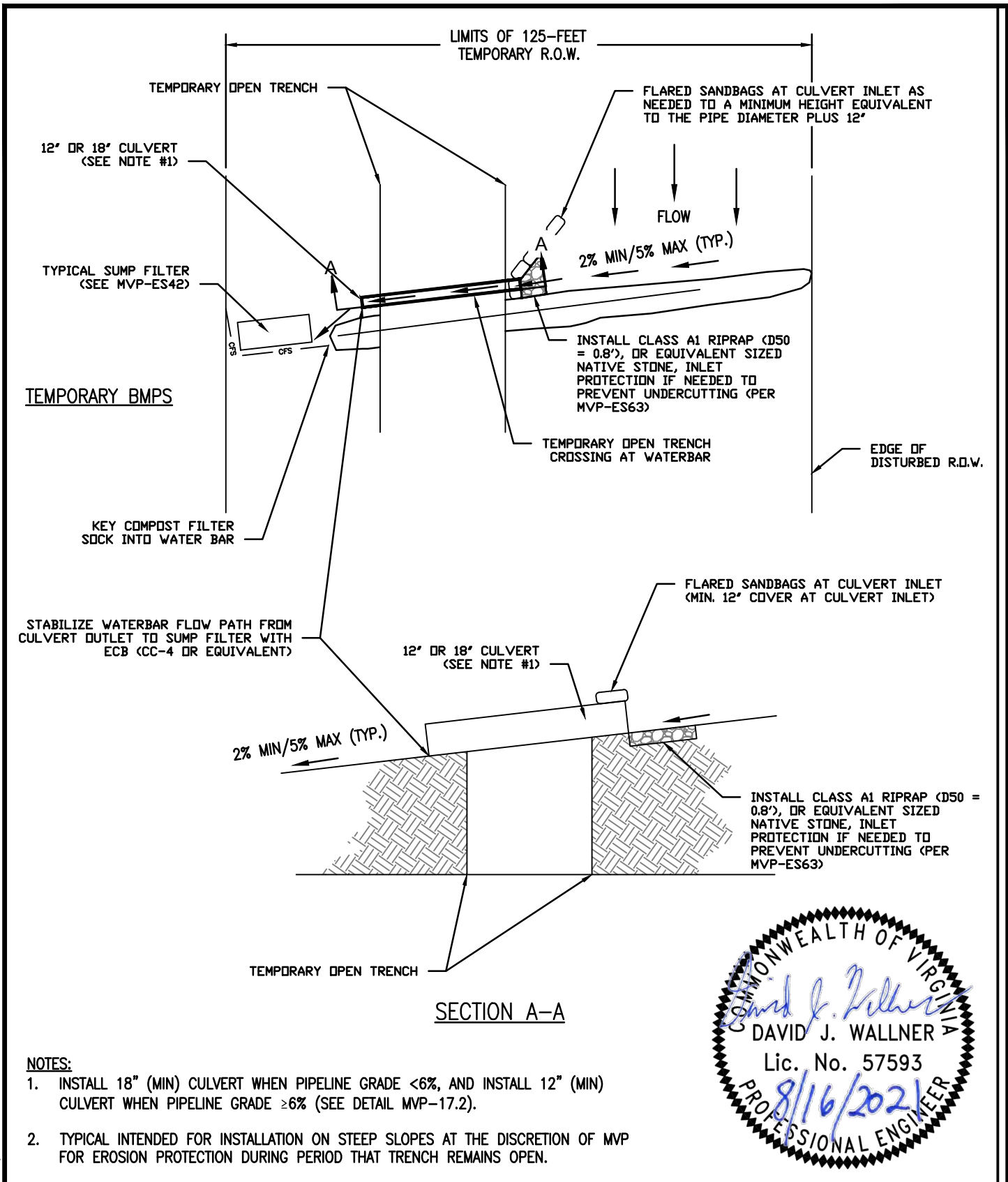


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

TEMPORARY TRAVEL LANE CROSSING AT WATERBAR	
DRAWING NO.	REV.
MVP-17.1A	0

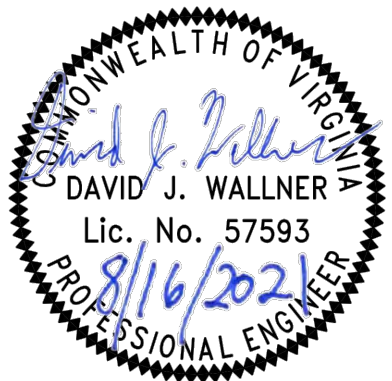




SECTION A-A

NOTES:

1. INSTALL 18" (MIN) CULVERT WHEN PIPELINE GRADE <6%, AND INSTALL 12" (MIN) CULVERT WHEN PIPELINE GRADE ≥6% (SEE DETAIL MVP-17.2).
2. TYPICAL INTENDED FOR INSTALLATION ON STEEP SLOPES AT THE DISCRETION OF MVP FOR EROSION PROTECTION DURING PERIOD THAT TRENCH REMAINS OPEN.



Plotted by: Rickabough, Greg on: August 16, 2021 - 3:47 PM

DRAWN	JWK	DATE	08/16/2021
CHECKED	RJE	DATE	08/16/2021
APP'D	DJW	DATE	08/16/2021
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TEMPORARY OPEN TRENCH CROSSING AT WATERBAR

DRAWING NO.	MVP-17.1B	REV.	0
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RECOMMENDED MAXIMUM SPACING FOR PERMANENT SLOPE BREAKERS	
PIPELINE GRADE	DISTANCE (FEET)
<2%	- 1, 2
2-5%	400
6-15%	200
16-30%	100
>31%	50 <sup>3</sup>

<sup>1</sup> PERMANENT SLOPE BREAKERS WILL BE INSTALLED AS NEEDED BASED ON FIELD CONDITIONS.

<sup>2</sup> PERMANENT SLOPE BREAKERS WILL BE INSTALLED 25 FEET FROM EACH WATERBODY BOUNDARY REGARDLESS OF SLOPE CONDITIONS.

<sup>3</sup> SLOPES GREATER THAN 65% MAY REQUIRE SITE SPECIFIC STABILIZATION MEASURES BASED ON FIELD CONDITIONS AS APPROVED BY MVP DESIGN ENGINEERING AND MVP ENVIRONMENTAL INSPECTOR.

**NOTES:**

1. WATERBARS SHALL BE INSPECTED EVERY 4 BUSINESS DAYS (DAILY ON ACTIVE ROADS). DAMAGED OR ERODED WATERBARS SHALL BE RESTORED TO ORIGINAL DIMENSIONS WITHIN 24 HOURS OF INSPECTION
2. MAINTENANCE OF WATERBARS SHALL BE PROVIDED UNTIL ROADWAY, SKIDTRAIL, OR RIGHT-OF-WAY HAS ACHIEVED PERMANENT STABILIZATION
3. WATERBARS ON RIGHT-OF-WAYS SHALL BE LEFT IN PLACE AFTER PERMANENT STABILIZATION HAS BEEN ACHIEVED
4. SUMP FILTERS TO BE INSTALLED AT END OF TEMPORARY WATERBARS. REFER TO SUMP FILTER DETAIL MVP-ES42.
5. OUTLET PROTECTION/COMPOST FILTER SOCK SHOULD BE INSTALLED AT THE OUTLET OF ALL TEMPORARY WATERBARS PER DETAIL MVP-ES42.
6. WATERBAR END TREATMENTS WILL BE INSTALLED FOR PERMANENT WATERBARS PER DETAILS MVP-17.3 THROUGH MVP-17.7.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			



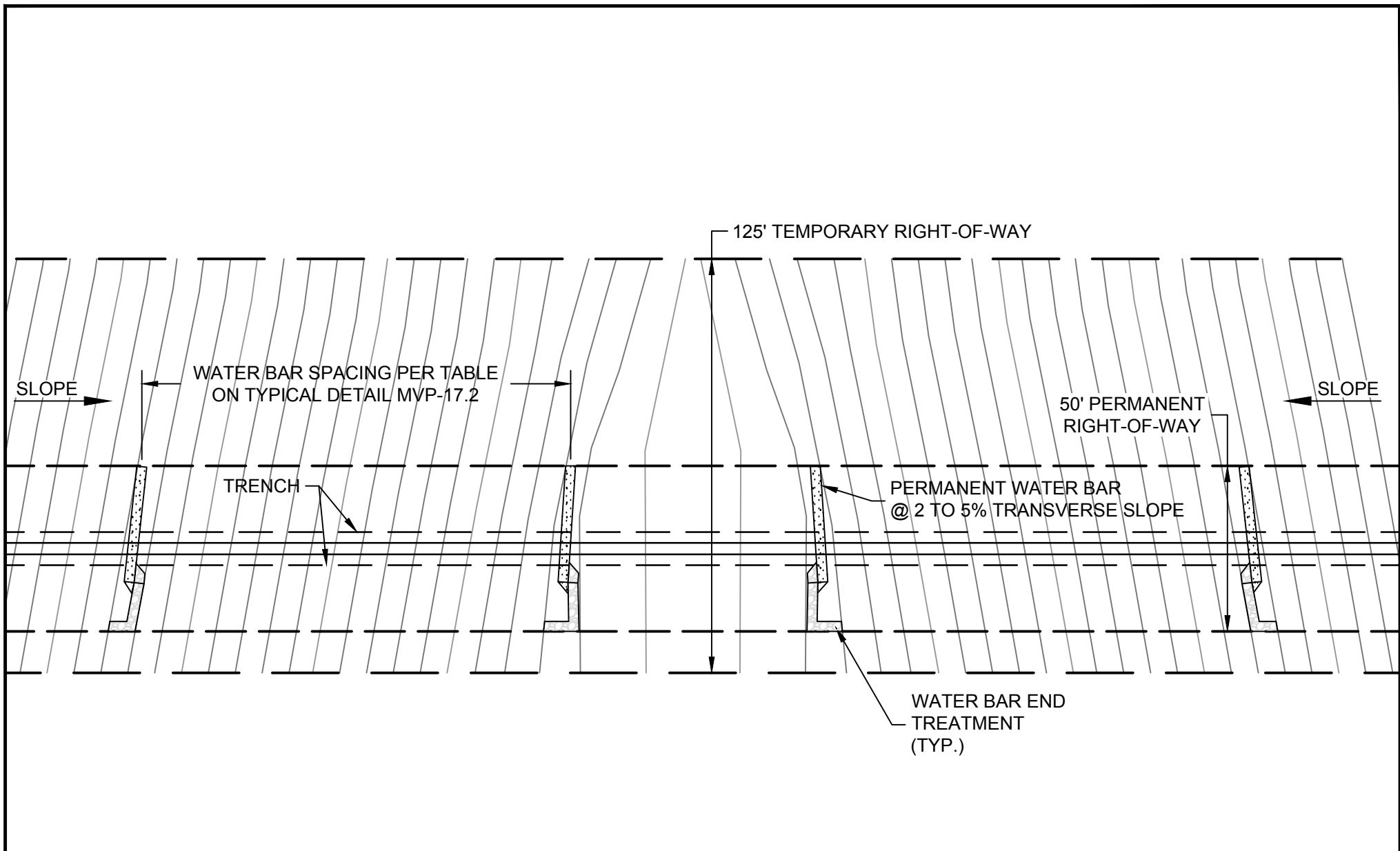
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

SLOPE BREAKER/RIGHT-OF-WAY  
DIVERSION/WATERBAR

DRAWING NO.  
MVP-17.2

REV.  
0



DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

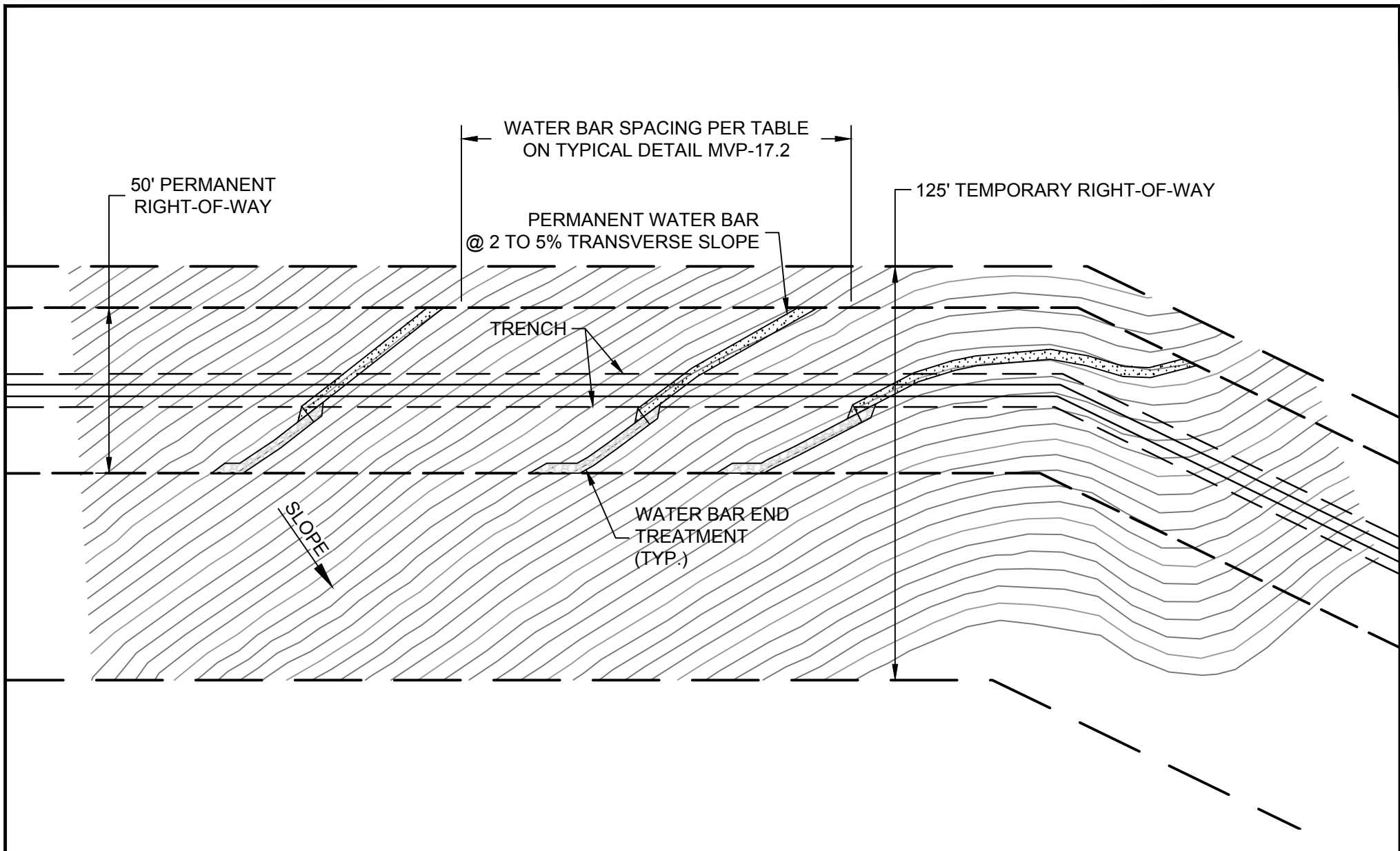


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

WATERBAR END TREATMENT  
PERPENDICULAR TO SLOPE EXAMPLE

DRAWING NO.	REV.
MVP-17.3	0



DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

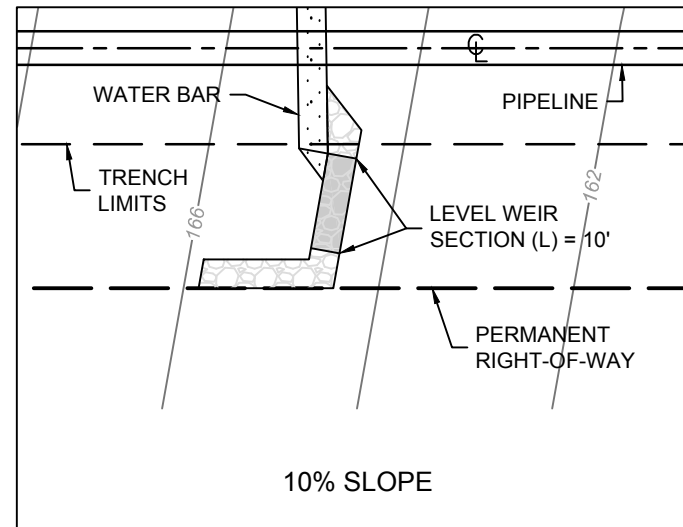
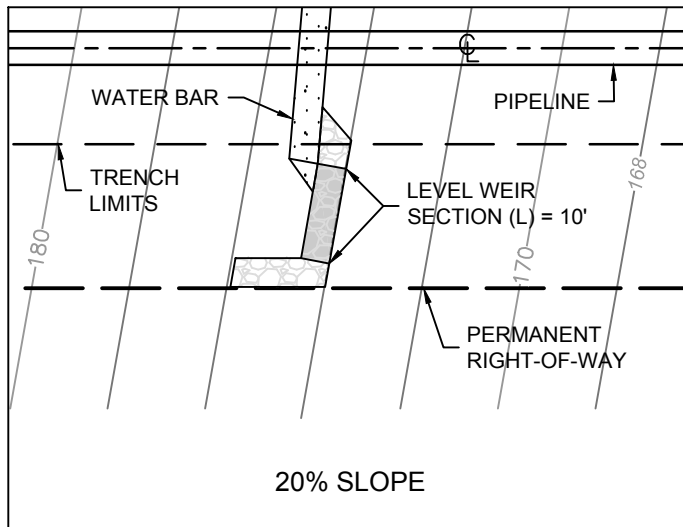
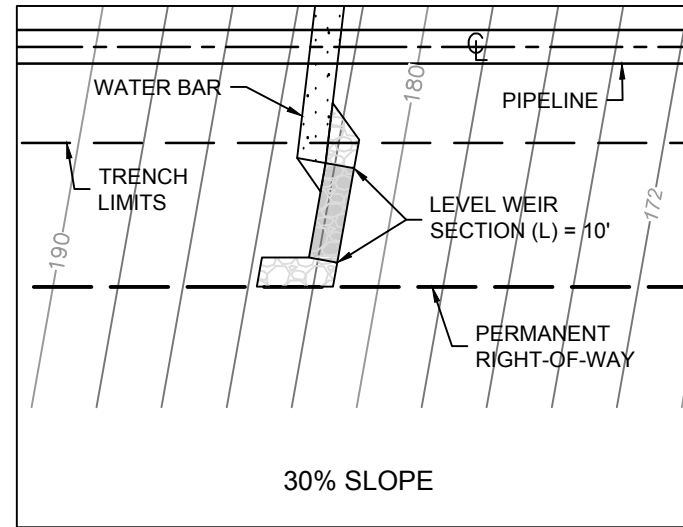
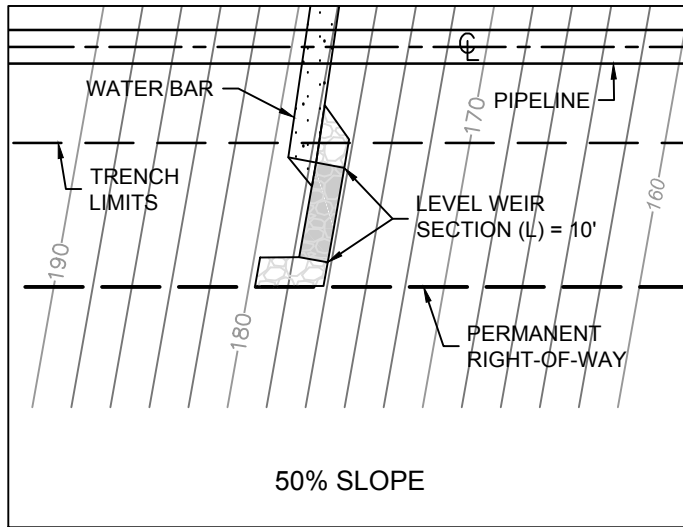


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

WATERBAR END TREATMENT  
CROSS SLOPE EXAMPLE

DRAWING NO.	REV.
MVP-17.4	0



DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



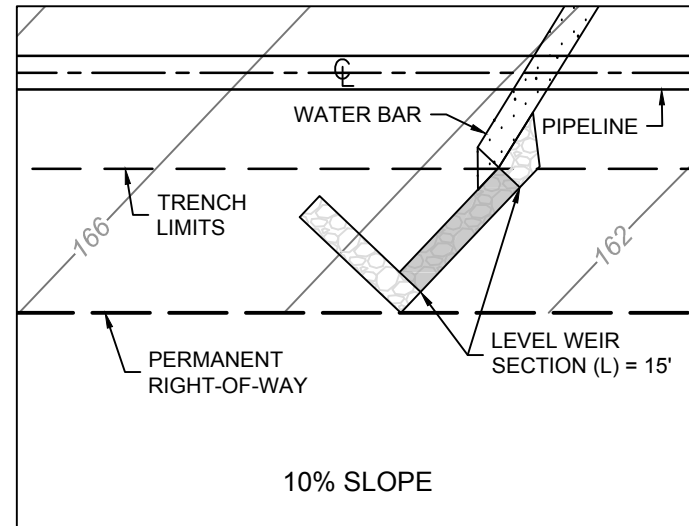
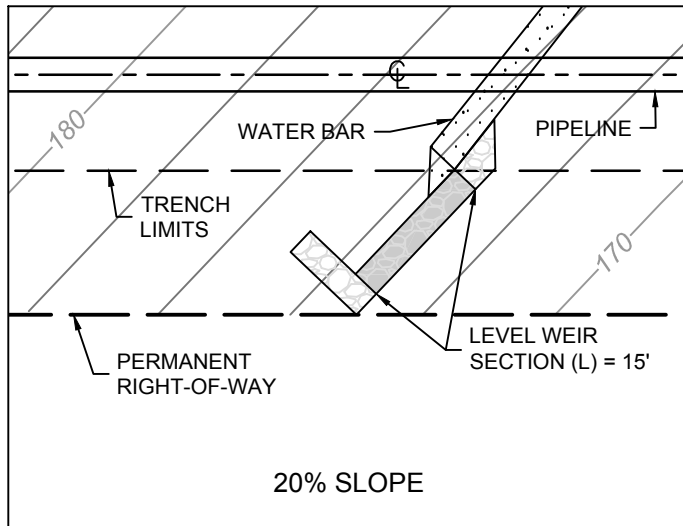
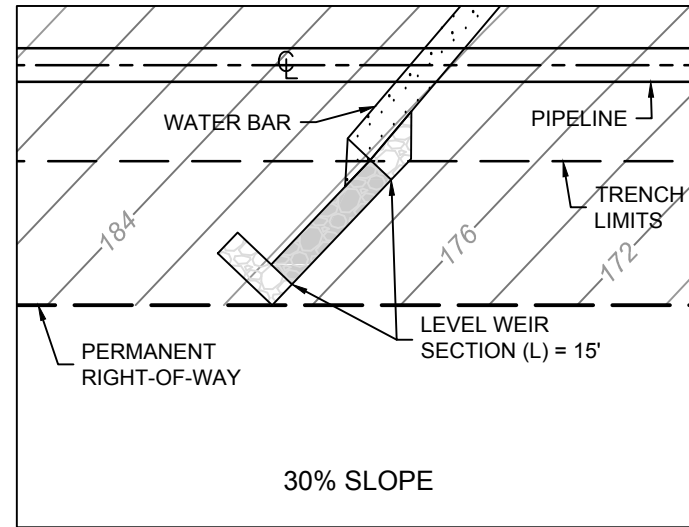
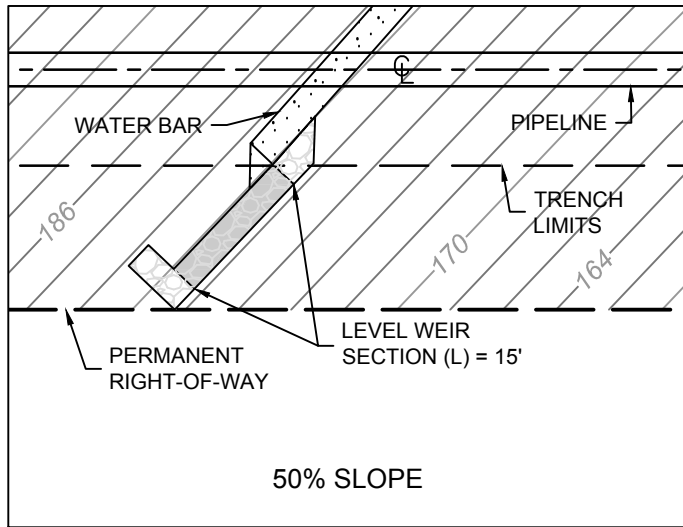
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

DETAILED EXAMPLES  
PERPENDICULAR TO SLOPE CONDITION

DRAWING NO.	REV.
MVP-17.5	0





DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

DETAILED EXAMPLES  
CROSS SLOPE CONDITION

DRAWING NO.	REV.
MVP-17.6	0

WATER BAR  
(REFER TO MVP-17, MVP-17.1,  
AND MVP-17.2 DETAILS)

INSTALL JUTE MAT AS  
NEEDED BASED ON  
SOIL CONDITIONS (AS  
DIRECTED BY E/I/LEI)

WATER BAR END TREATMENT  
TO BE KEYED (4 INCHES  
MINIMUM) INTO EXISTING  
GROUND THAT IS 6" MIN  
HIGHER GRADE THAN LEVEL  
WEIR SECTION

LEVEL WEIR  
SECTION (L),

KEY INTO EXISTING  
SOIL TO PREVENT  
BYPASSING

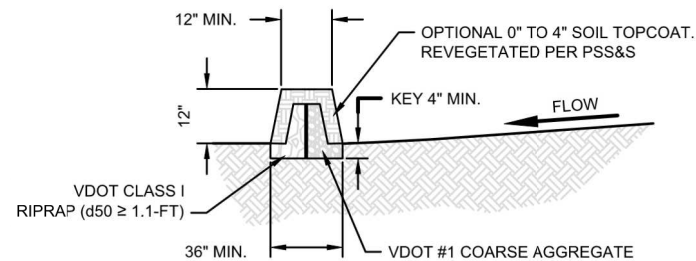
WELL  
VEGETATED  
AREA

INSTALL JUTE MAT ON AREAS  
DOWNSLOPE ALONG FLOW PATH. JUTE  
MAT WILL BE 8" WIDE ON CONTOUR  
ALONG THE WEIR SECTION OF THE END  
TREATMENT. JUTE TO BE KEYED INTO  
BASE OF RIPRAP.

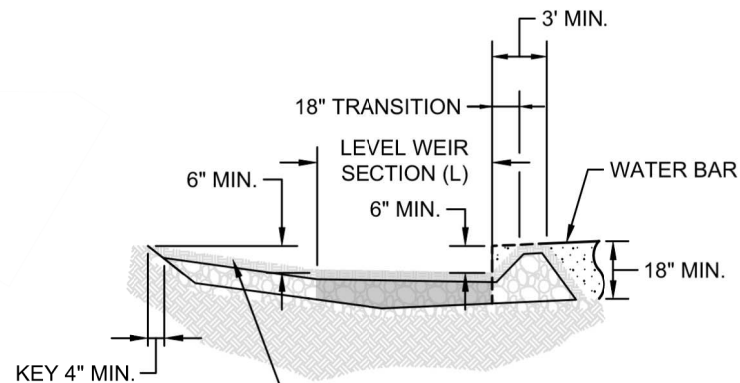
MAINTAIN 12" WEIR HEIGHT ACROSS  
ENTIRE LENGTH, INCLUDING THE  
EXTENT BEYOND THE LEVEL WEIR  
SECTION KEYED INTO EXISTING  
GROUND.

LEVEL WEIR  
SECTION  
LENGTHS

D.A. [AC]	LENGTH ,L (FT) [SEE NOTE #1]
$\leq 0.5$	10
$0.5 \leq 1.0$	15
$1.0 \leq 1.5$	20
$> 1.5$	SITE SPECIFIC



XS: A-A'



XS: B-B'

OPTIONAL 0" TO 4" SOIL TOPCOAT.  
REVEGETATED PER PSS&S.

NOTE: LEVEL WEIR SECTION OF WATERBAR END TREATMENT TO BE CONSTRUCTED ON CONTOUR AS SHOWN ON DETAILS MVP-17.3, MVP-17.4, MVP-17.5, AND MVP-17.6.

DRAWN	JZ	DATE	05/09/2022
CHECKED	DCW	DATE	05/09/2022
APP'D	TD	DATE	05/09/2022
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	MVP - VA PORTION		



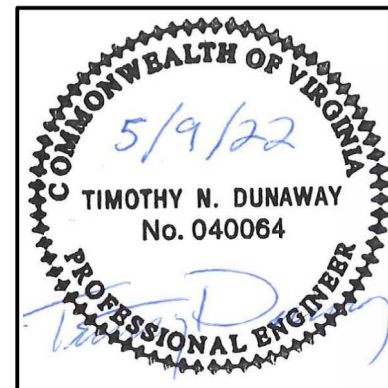
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

PERMANENT WATERBAR END  
TREATMENT DETAIL

DRAWING NO.  
MVP-17.7

REV.  
1



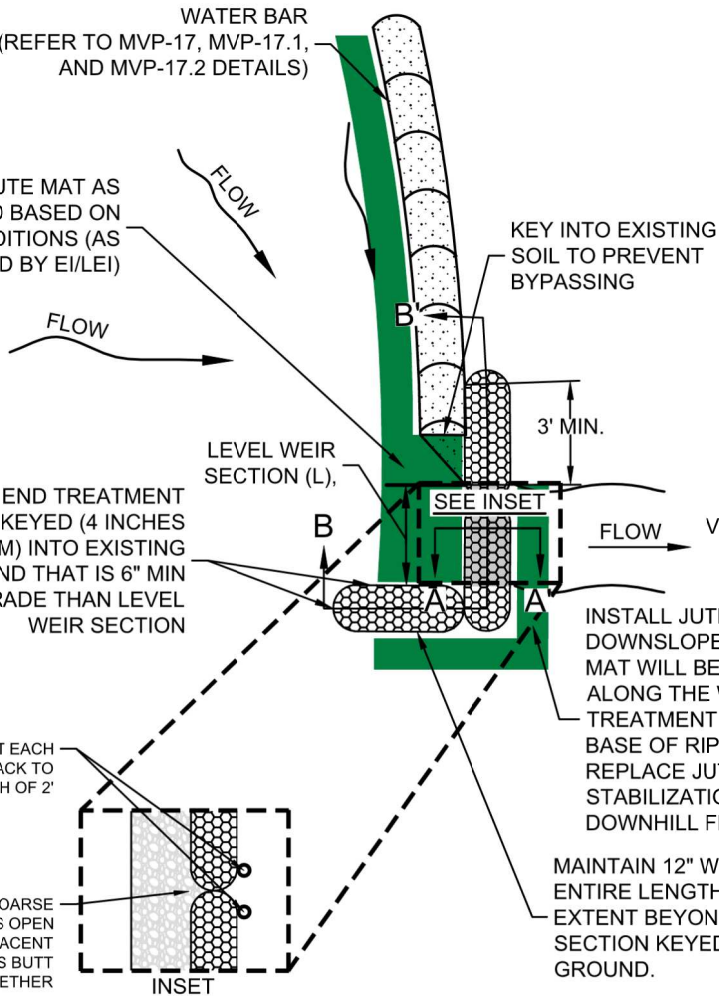
WATER BAR  
(REFER TO MVP-17, MVP-17.1,  
AND MVP-17.2 DETAILS)

INSTALL JUTE MAT AS  
NEEDED BASED ON  
SOIL CONDITIONS (AS  
DIRECTED BY E/I/LEI)

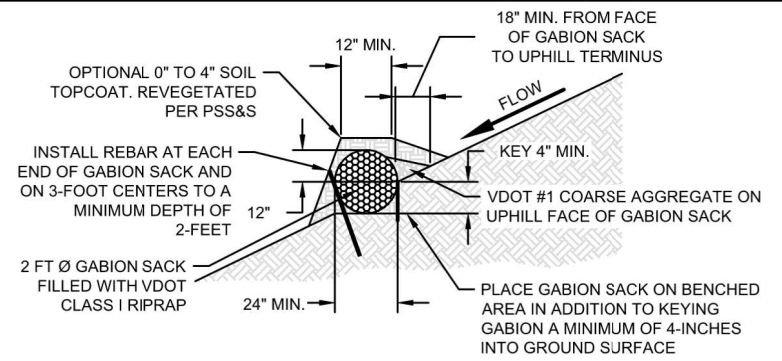
WATER BAR END TREATMENT  
TO BE KEYED (4 INCHES  
MINIMUM) INTO EXISTING  
GROUND THAT IS 6" MIN  
HIGHER GRADE THAN LEVEL  
WEIR SECTION

INSTALL REBAR AT EACH  
END OF GABION SACK TO  
A MINIMUM DEPTH OF 2'

ENSURE VDOT#1 COARSE  
AGGREGATE FILLS OPEN  
SPACE WHERE ADJACENT  
GABION SACKS BUTT  
TOGETHER



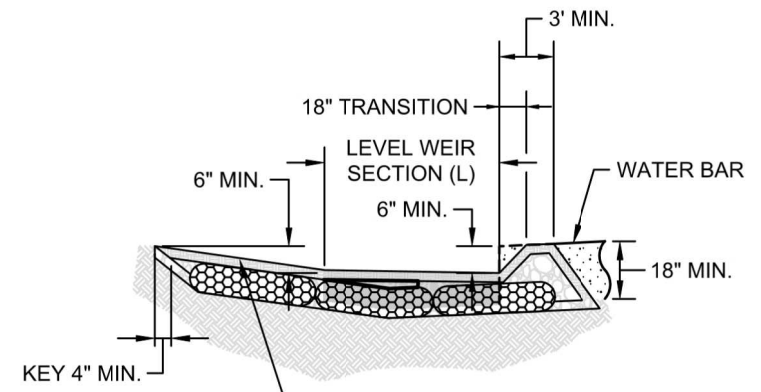
LEVEL WEIR SECTION LENGTHS	
D.A. [AC]	LENGTH ,L (FT) [SEE NOTE #1]
$\leq 0.5$	10
$0.5 \leq 1.0$	15
$1.0 \leq 1.5$	20
$> 1.5$	SITE SPECIFIC



XS: A-A'

GABION WIRE MESH MATERIAL SPECIFICATIONS

Mesh Type	Nominal Mesh Opening D in (mm)	Mesh Tensile Strength lb/ft (kN/m)	Mesh Connection to Selvege lb/ft (kN/m)	Punch Test lb (kN)
6x8	2.5 (64)	33.6 (2300)	700 (10.2)	4,000 (17.8)
8x10	3.25 (83)	35,00 (51.1)	1,400 (20.4)	6,000 (26.7)



XS: B-B'

OPTIONAL 0" TO 4" SOIL TOPCOAT. REVEGETATED PER PSS&S.

NOTE: LEVEL WEIR SECTION OF WATERBAR END TREATMENT TO BE CONSTRUCTED ON CONTOUR AS SHOWN ON DETAILS MVP-17.3, MVP-17.4, MVP-17.5, AND MVP-17.6.

Plotted by: Zaigler, Justin on: May 10, 2022 - 6:58 AM

DRAWN	JJZ	DATE	05/09/2022
CHECKED	DCW	DATE	05/09/2022
APP'D	TD	DATE	05/09/2022
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

**Mountain Valley**  
PIPELINE

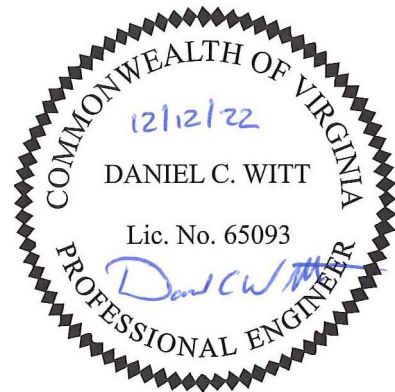
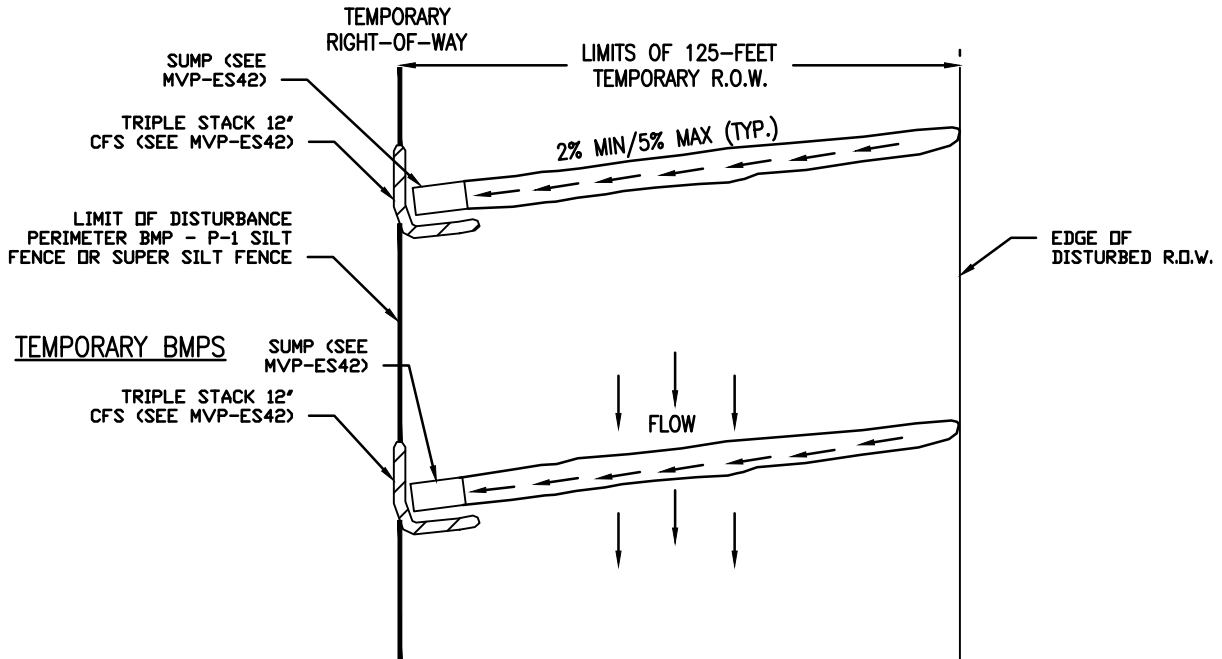
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

PERMANENT WATERBAR END TREATMENT DETAIL (GABION SACK CONSTRUCTION OPTION)

DRAWING NO.	REV.
MVP-17.7A	1

COMMONWEALTH OF VIRGINIA  
5/9/22  
TIMOTHY N. DUNAWAY  
No. 040064  
PROFESSIONAL ENGINEER



**NOTES:**

1. DETAIL TO BE IMPLEMENTED IN AREAS WHERE SLOPES ARE TYPICALLY  $\geq 30\%$  UNLESS SITE CONDITIONS REQUIRE SPECIALIZED CONSTRUCTION METHODS TO BE IMPLEMENTED.
2. DETAIL TO BE IMPLEMENTED IN AREAS WHERE WINCH HILL CONSTRUCTION EQUIPMENT IS NECESSARY TO COMPLETED INSTALLATION OF TRADITIONAL WATERBAR (MVP-17.1 THROUGH MVP-17.7).
3. DETAIL TO BE IMPLEMENTED WHERE SOIL CONDITIONS CONSIST OF VERY ROCKY OR SANDY SOILS AND ADEQUATE COMPACTION IS NOT FEASIBLE (AS DETERMINED BY MVP EI).
4. WATERBAR END TREATMENTS TO BE INSTALLED PER MVP-ES42 AND MVP-ES42.1.

Plotted by: Zeigler, Justin on: December 12, 2022 - 8:05 AM

DRAWN	JK	DATE	5/11/2022
CHECKED	DCW	DATE	5/11/2022
APP'D	TD	DATE	5/11/2022
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



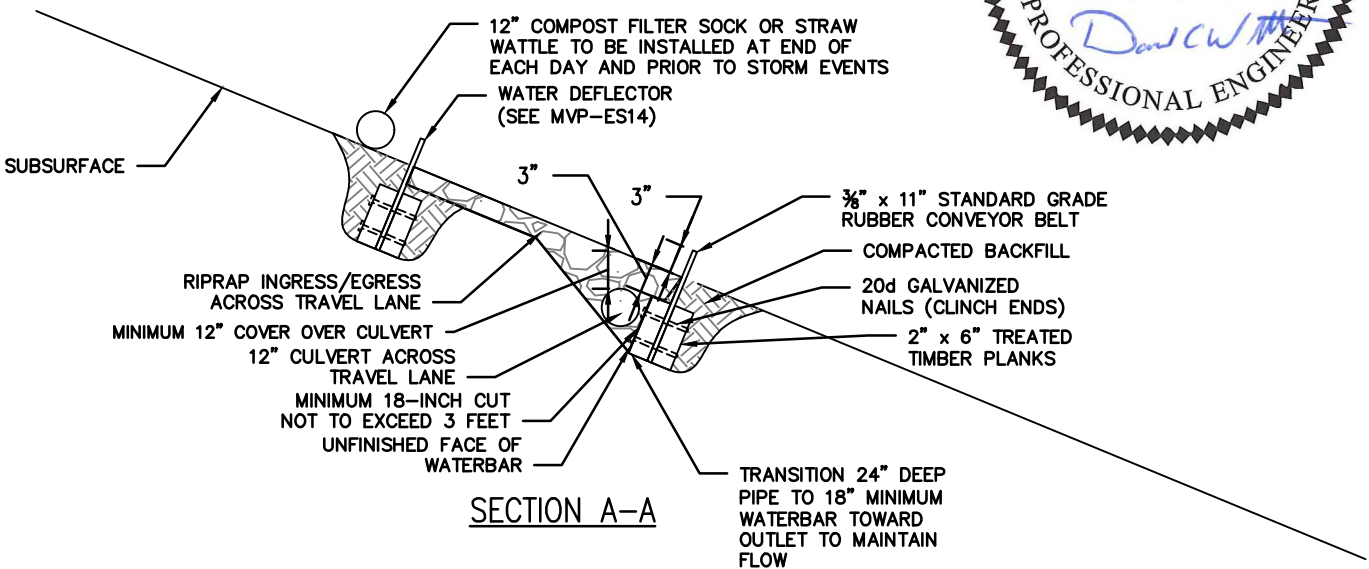
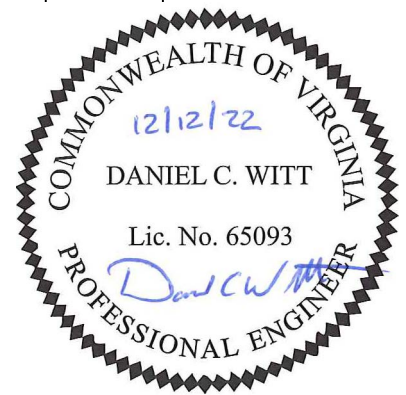
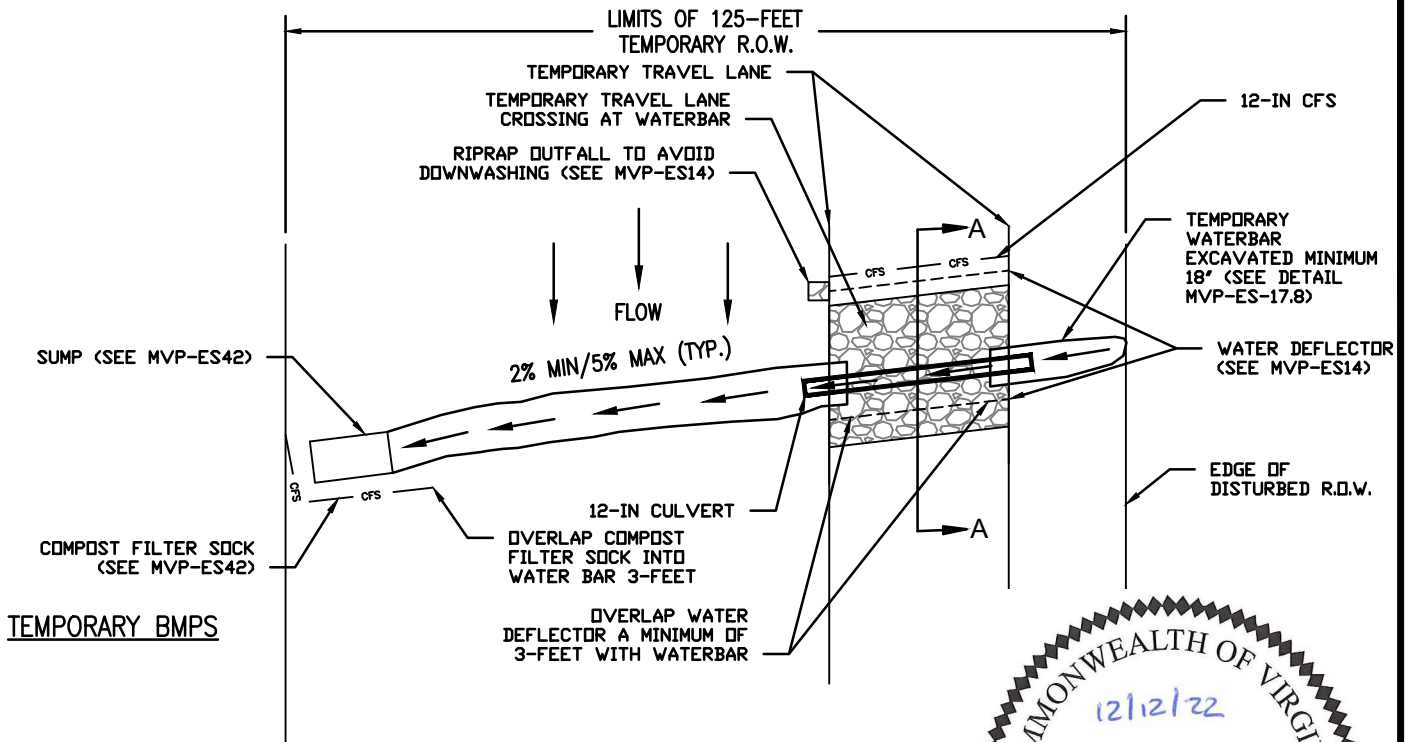
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

TEMPORARY WATER BAR INSTALLATION FOR SLOPES  $\geq 30\%$

DRAWING NO.	REV.
MVP-17.8	2





**NOTES:**

1. DETAIL TO BE IMPLEMENTED IN AREAS WHERE SLOPES ARE TYPICALLY  $\geq 30\%$  UNLESS SITE CONDITIONS REQUIRE SPECIALIZED CONSTRUCTION METHODS TO BE IMPLEMENTED.
2. DETAIL TO BE IMPLEMENTED IN AREAS WHERE WINCH HILL CONSTRUCTION EQUIPMENT IS NECESSARY TO COMPLETED INSTALLATION OF TRADITIONAL WATERBAR (MVP-17.1 THROUGH MVP-17.7).
3. DETAIL TO BE IMPLEMENTED IN SOIL CONDITIONS CONSIST OF VERY ROCKY OR SANDY SOILS AND ADEQUATE COMPACTION IS NOT FEASIBLE (AS DETERMINED BY MVP E).
4. WATERBAR END TREATMENTS TO BE INSTALLED PER MVP-ES42 AND MVP-ES42.1.
5. ACCUMULATED SEDIMENT SHALL BE REMOVED FROM COMPOST FILTER SOCK AND WATER DEFLECTORS WITHIN 24 HOURS OF INSPECTION. DAMAGED COMPOST FILTER SOCK AND WATER DEFLECTORS SHALL BE REPLACED, AND SEDIMENT-CLOGGED RIPRAP SHALL BE REPLACED

DRAWN	JWK	DATE	5/11/2022
CHECKED	DCW	DATE	5/11/2022
APP'D	TD	DATE	5/11/2022
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

TEMPORARY TRAVEL LANE CROSSING AT WATERBAR (SLOPES  $\geq 30\%$  CONDITION)

DRAWING NO.	REV.
MVP-17.8A	0

Plotted by: Zeigler, Justin on: December 12, 2022 - 1:30 PM



## STRAW MULCH

1. STRAW MULCH SHALL BE INSTALLED AT LOCATIONS IDENTIFIED ON THE CONSTRUCTION DRAWING AND/OR AS DIRECTED BY THE COMPANY'S INSPECTOR TO PROTECT SOIL FROM EROSION. AREAS TARGETED FOR STRAW MULCH INCLUDE THE FOLLOWING:
  - 10-40% SLOPES WITH LESS THAN 40% SURFACE COVER.
  - 0-10% SLOPES WITH SOILS RATED BY APPLICABLE COUNTY AS HIGH IN WIND ERODIBILITY AND LESS THAN 40% SURFACE COVER AND IF DIRECTED BY COMPANY'S INSPECTOR.
2. WHEAT, OAT, BARLEY, RYE OR FLAX STRAW WILL BE USED, WHERE APPROPRIATE, DEPENDING UPON AVAILABILITY.
3. ONLY CERTIFIED "NOXIOUS WEED-FREE" STRAW MULCH SHALL BE APPLIED AT A RATE OF:
  - 1,780 TO 2,225 LB/AC WHEAT, OAT, BARLEY OR RYE STRAW
  - 2,670 TO 3,560 LB/AC FLAX STRAW
4. AREAS WHERE RESPREAD TOPSOIL EXHIBITS AN ADEQUATE COVER FROM RESPREAD OF PLANT DEBRIS AND COARSE FRAGMENTS, MULCH RATES MAY BE REDUCED OR ELIMINATED BY THE COMPANY'S INSPECTOR.

## STRAW CRIMPING

1. STRAW CRIMPING WILL BE UTILIZED ON NONCULTIVATED, WIND EROSION PRONE SOILS, AND ON CULTIVATED, WATER EROSION PRONE SOILS AS IDENTIFIED ON THE ALIGNMENT SHEETS, UNLESS OTHERWISE DIRECTED BY THE COMPANY'S INSPECTOR. STRAW CRIMPING AT ADDITIONAL LOCATIONS IDENTIFIED BY THE COMPANY'S INSPECTOR MAY BE REQUIRED.
2. EQUIPMENT SPECIFICALLY DESIGNED TO CRIMP STRAW (SUCH AS A STRAW MULCH CRIMPER MANUFACTURED BY FINN CORPORATION OR AN APPROVED EQUIVALENT) SHALL BE USED TO CRIMP STRAW FIBERS TO A DEPTH OF TWO TO THREE INCHES. STEEP SLOPES INACCESSIBLE WITH A CRIMPER SHALL BE CRIMPED BY TRACKING WITH A CRAWLER RUNNING PERPENDICULAR TO THE SLOPE. DISCS SHALL NOT BE ALLOWED FOR CRIMPING EXCEPT AS STATED IN NOTE 3.

WHERE EXCESSIVE STONINESS IS ENCOUNTERED TO THE EXTENT THAT THE SPECIALIZED CRIMPING EQUIPMENT IS NOT

3. USEABLE, ATTEMPT TO ANCHOR THE STRAW BY INCORPORATION WITH AN AGRICULTURAL DISC OR CULTIVATOR. WHERE FROZEN GROUND CONDITIONS ARE ENCOUNTERED TO THE EXTENT THAT THE CRIMPING OPERATION IS NOT FEASIBLE, SPREAD STRAW AT DOUBLE THE NORMAL RATE.

CRIMP OR ANCHOR STRAW INTO THE SOIL TO AN APPROXIMATE DEPTH OF 2". STRAW SHOULD STAND

4. VERTICALLY 2" TO 8" OUT OF THE GROUND IN ROWS SPACED APPROXIMATELY 6" APART.

IN HIGHLY ERODIBLE SANDY LOCATIONS, WHERE DIRECTED BY THE COMPANY'S INSPECTOR, DOUBLE THE STRAW

5. APPLICATION RATE AND MAKE TWO PASSES TO ANCHOR THE STRAW, ONE PASS PERPENDICULAR TO THE OTHER OR CRISS-CROSSED.

STRAW FOR CRIMPING WILL BE APPROVED BY COMPANY AND THE LANDOWNERS AND OCCUPANTS OR APPROPRIATE

6. REGULATORY AUTHORITIES WHERE APPLICABLE. CRITERIA FOR THE SELECTION OF STRAW IS AS FOLLOWS:
  - FOR EACH LOT OF BALES, TO THE EXTENT FEASIBLE, THE FIELD WHERE THE BALES WERE OBTAINED WILL BE INSPECTED BEFORE IT IS HARVESTED, OR THE STUBBLE WILL BE INSPECTED IMMEDIATELY AFTER HARVEST AND A SAMPLE OF GRAIN WILL BE INSPECTED FOR WEED SEEDS.
  - THE STRAW MUST HAVE BEEN HARVESTED WITH A CONVENTIONAL COMBINE, NOT A ROTARY COMBINE.
  - THE STRAW MUST HAVE A MINIMUM FIBRE LENGTH OF 8", 12" IS PREFERRED.
  - THE STRAW MUST BE FREE OF NOXIOUS OR RESTRICTED WEEDS AND UNDESIRABLE SPECIES WHICH WOULD HAMPER RECLAMATION EFFORTS.
  - TO THE EXTENT FEASIBLE, BALES OBTAINED FROM LOW LYING WEEDY AREAS WILL BE IDENTIFIED AND AVOIDED.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	9/8/2015
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:  PXXXX			



DESIGN ENGINEERING

### TYPICAL CONSTRUCTION DETAIL

EROSION CONTROL  
STRAW MULCH  
(STM)

DRAWING NO.

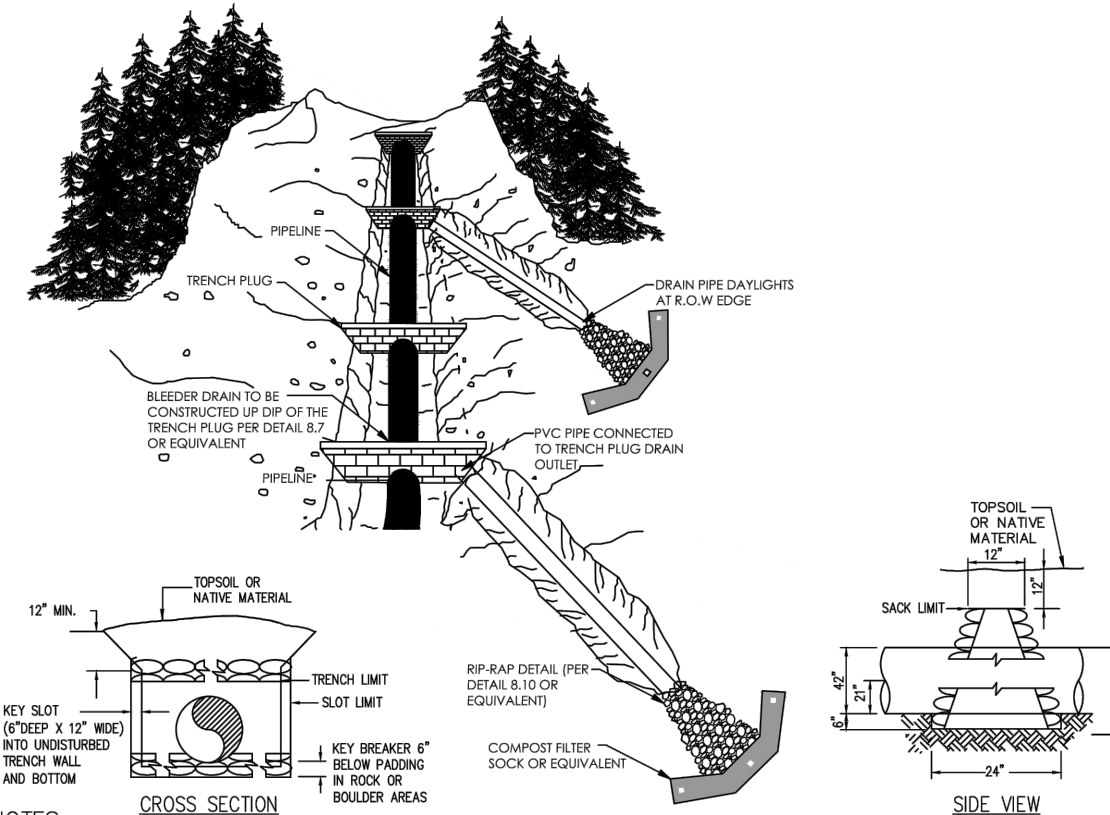
MVP-19

REV.

0

SLOPE %	DISTANCE	PLUG MATERIAL
0% - 5%	SEE NOTE 6	CONCRETE FILLED SACKS
5% - 15%	500 FT	SANDBAGS OR CONCRETE FILLED SACKS
15% - 25%	300 FT	SANDBAGS OR CONCRETE FILLED SACKS
25% - 35%	200 FT	SANDBAGS OR CONCRETE FILLED SACKS
35% - 100%	100 FT	SANDBAGS OR CONCRETE FILLED SACKS
> 100%	50 FT	CONCRETE FILLED BAGS (WETTED)

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



**NOTES:**

- TRENCH BREAKERS SHALL BE INSTALLED:
  - ON SLOPES ALONG THE TRENCH LINE WHERE THE NATURAL DRAINAGE PATTERN, PROFILE, AND TYPE OF BACKFILL MATERIAL MAY RESULT IN LOSS OF BACKFILL MATERIAL OR ALTERATION OF THE NATURAL PATTERN;
  - AT THE BASE OF SLOPES ADJACENT TO WATERBODIES AND WETLANDS;
  - WHERE NEEDED TO AVOID DRAINING A WETLAND;
  - ON UPLAND SLOPES, AT THE SAME SPACING AS SLOPE BREAKERS AND UP SLOPE OF SLOPE BREAKERS;
  - IN CULTIVATED LAND AND RESIDENTIAL AREAS WHERE PERMANENT SLOPE BREAKERS ARE NOT TYPICALLY INSTALLED, AT THE SAME SPACING AS IF PERMANENT SLOPE BREAKERS WERE REQUIRED.
- MATERIALS APPROPRIATE FOR USE AS PERMANENT TRENCH BREAKERS INCLUDE SANDBAGS OR CONCRETE FILLED SACKS. TOPSOIL SHALL NOT BE USED FOR TRENCH BREAKERS.
- TRENCH BREAKERS INSTALLED AT WATERBODY AND WETLAND CROSSINGS SHALL BE CONSTRUCTED OF IMPERVIOUS MATERIALS (CONCRETE FILLED SACKS).
- BREAKER SPACING AND CONFIGURATION MAY BE CHANGED AS DIRECTED BY MVP. DEPTH OF DITCH MAY VARY WITH SITE CONDITIONS.
- ALL MATERIALS SHALL BE SUPPLIED BY CONTRACTOR.
- TRENCH BREAKERS ARE REQUIRED AT ALL WATERBODY CROSSINGS REGARDLESS OF TRENCH SLOPE. OTHERWISE NOTE REQUIRED AT SLOPES < 5%.
- SINGLE TRENCH BREAKERS WILL BE A MINIMUM WIDTH OF 24" AND DOUBLE TRENCH BREAKERS WILL BE A MINIMUM WIDTH OF 36".
- FOR SUBSURFACE AND TRENCH BREAKER DRAINAGE DETAILS INCLUDING THOSE FOR STEEP SLOPES, SEE LANDSLIDE MITIGATION TYPICAL DETAILS.
- FOR SLOPES EXCEEDING 50%, CONCRETE FILLED SACKS ARE REQUIRED UNLESS OTHERWISE APPROVED BY MVP.

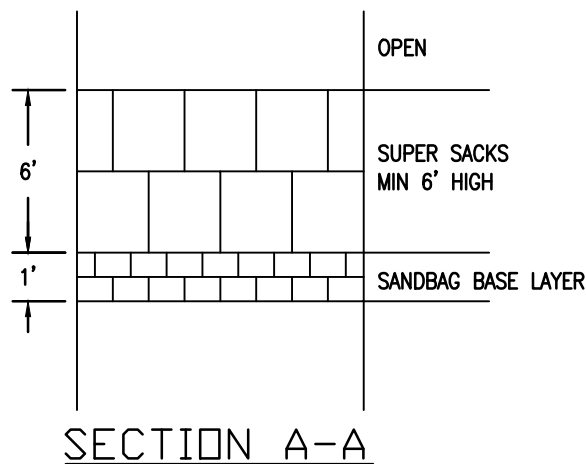
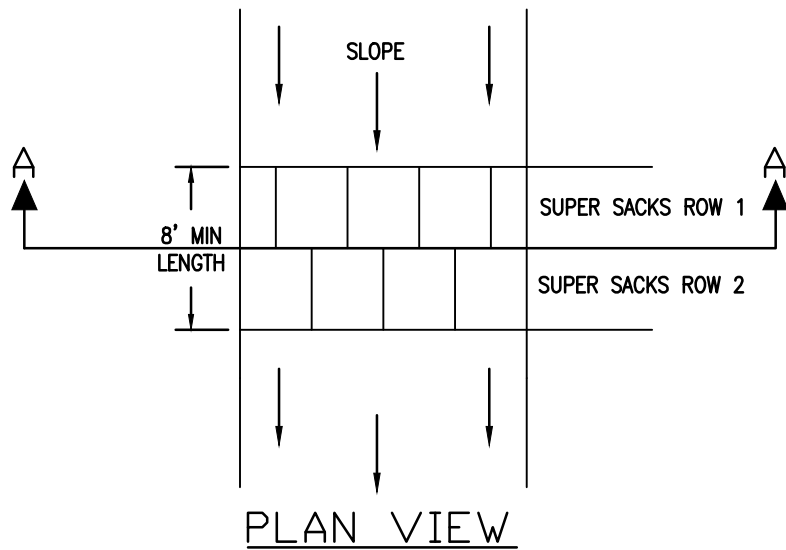
THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

<b>DRAWN</b>	JL	<b>DATE</b>	10/6/2016
<b>CHECKED</b>	MMF	<b>DATE</b>	10/6/2016
<b>APP'D</b>	XXX	<b>DATE</b>	08/11/17
<b>SCALE</b>	N.T.S.	<b>SHEET</b>	1 OF 1
<b>JOB NO.</b>			
<b>PROJECT ID:</b>			
MVP - VA PORTION			



**DESIGN ENGINEERING**

<b>TYPICAL CONSTRUCTION DETAIL</b>	
TYPICAL TRENCH BREAKER REQUIREMENTS	
<b>DRAWING NO.</b>	MVP-20
<b>REV.</b>	0



**NOTES:**

1. SPACING OF THIS ENHANCED DETAIL WILL BE IMPLEMENTED ON SLOPES EQUAL TO OR EXCEEDING 3H:1V (33%) SLOPE CONDITIONS.
2. MAXIMUM SPACING BETWEEN THIS ENHANCED DETAIL WILL BE 100 FEET ACROSS THE 500-FOOT TRENCH LENGTH.
3. SUPER SACK BAGS USED FOR THIS INSTALLATION WILL BE INSTALLED TO A MINIMUM OF TWO LAYERS IN HEIGHT (MINIMUM 6 FEET).
4. SUPER SACK BAGS WILL BE INSTALLED A MINIMUM OF TWO ROWS DEEP (HORIZONTAL) AND TWO ROWS HIGH (VERTICAL).
5. BEAKERS WILL BE SECURED TIGHTLY TO THE TRENCH WALLS.
6. A BASE LAYER OF TRADITIONAL SANDBAGS WILL BE PLACED BENEATH THE SUPER SACK BAGS TO MINIMIZE SEEPAGE.
7. FOR EXISTING TRENCH EXCAVATIONS THAT MEET THE ABOVE CONDITIONS AND TRENCH WILL NOT BE BACKFILLED WITHIN 5 DAYS OR PRIOR TO THE NEXT RAIN EVENT:
  - TEMPORARY SUPER SACK BREAKERS WILL BE INSTALLED AS NOTED ABOVE
  - SUPER SACKS WILL BE STAGED AND READY FOR INSTALLATION SHOULD A STORM EVENT POP UP

DRAWN	GR	DATE	08/25/2021
CHECKED	DW	DATE	08/25/2021
APP'D	RE	DATE	08/25/2021
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			



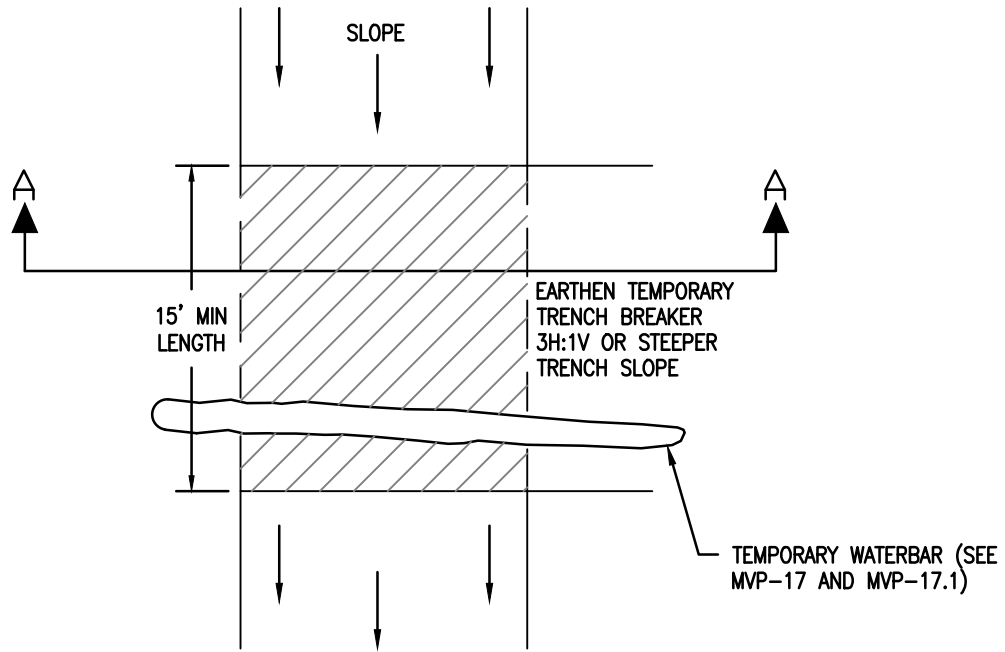
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

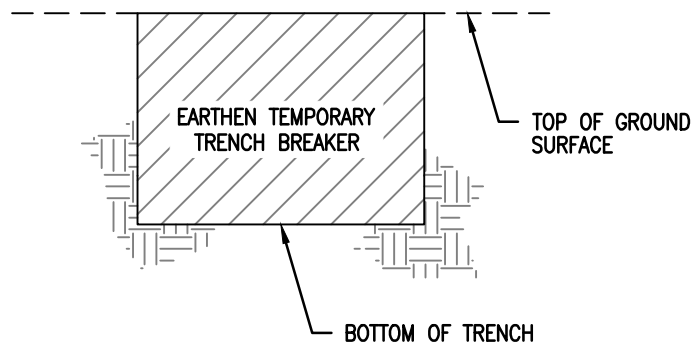
VA ENHANCED TEMPORARY  
TRENCH BREAKER DETAIL

DRAWING NO.	REV.
MVP-20A	0

PROJECT ID:  
MVP – VA PORTION



PLAN VIEW



SECTION A-A

**NOTES:**

1. EARTHEN TEMPORARY TRENCH BREAKER DETAIL WILL BE IMPLEMENTED IN AREAS WHERE TRENCH CONDITIONS MEET OR EXCEED 3H:1V (33%) SLOPE.
2. WILL BE USED TO SEPARATE CONTIGUOUS LENGTH OF TRENCH NOT TO EXCEED 500 LINEAR FEET.
3. MINIMUM BREAKER LENGTH IS 15 FEET AT THE GROUND SURFACE.
4. AN EARTHEN WATERBAR WILL BE CONSTRUCTED ACROSS THE BREAKER TO DIRECT TRENCH WATER OFF THE LOD VIA AN APPROVED END TREATMENT.
5. EARTHEN TRENCH BREAKER WILL BE INSTALLED FOLLOWING EXCAVATION AND WILL REMAIN IN PLACE UNTIL IMMEDIATELY PRIOR TO LOWERING OF THE PIPELINE INTO THE TRENCH.

DRAWN	GR	DATE	08/25/2021
CHECKED	DW	DATE	08/25/2021
APP'D	RE	DATE	08/25/2021
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

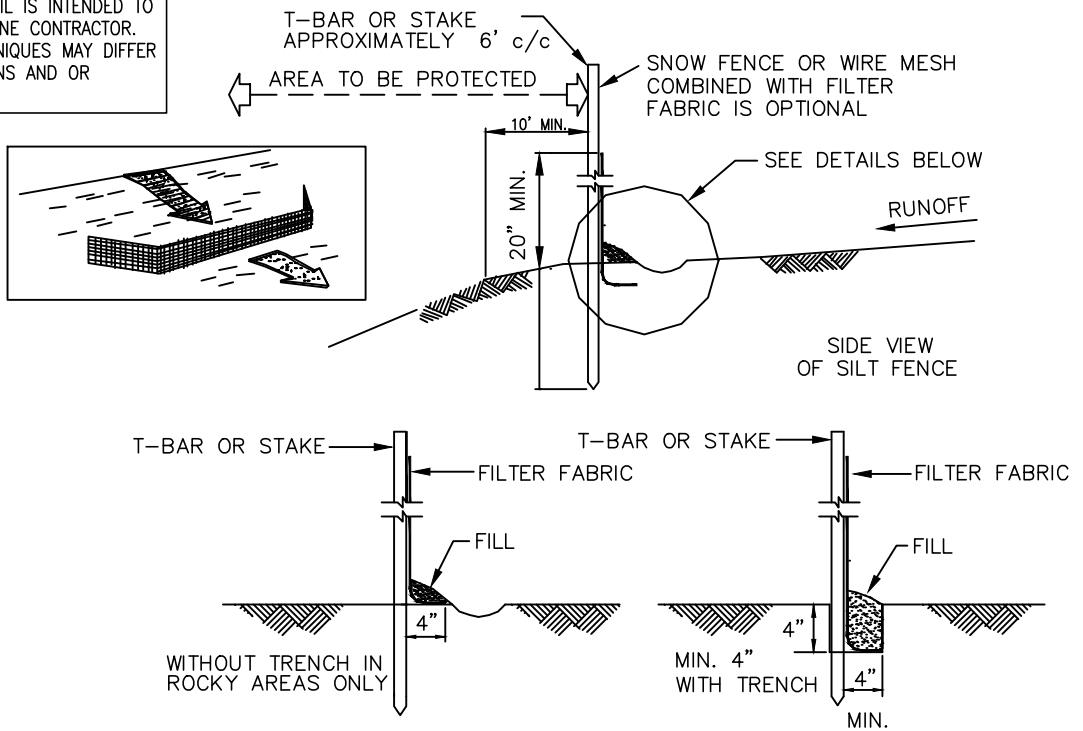
**TYPICAL CONSTRUCTION DETAIL**

VA ENHANCED TEMPORARY TRENCH BREAKER DETAIL (EARTHEN)

DRAWING NO.	MVP-20B
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REV.	0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



**NOTE:**

1. GENERALLY WHEN A LONG SEDIMENT BARRIER IS REQUIRED, SILT FENCE WILL BE UTILIZED RATHER THAN STRAW BALES AT:
  - THE BASE OF ALL SLOPES ABOVE ROADS, SPRINGS, WETLANDS, IMPOUNDMENTS AND PERENNIAL AND INTERMITTENT STREAMS.
  - THE DOWN SLOPE RIGHT-OF-WAY EDGE WHERE ANY OF THE ABOVE MENTIONED LOCATIONS ARE ADJACENT TO THE RIGHT-OF-WAY.
  - BETWEEN TOPSOIL/SPOIL STOCKPILES AND PERENNIAL OR INTERMITTENT STREAMS OR WETLANDS WHERE BUFFER ZONE REQUIREMENTS CANNOT BE MET.
  - ALONG R.O.W. BOUNDARIES OF WETLAND CONSTRUCTION.
  - AS SPECIFIED IN THE SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN.
  - AS DIRECTED BY THE COMPANY'S INSPECTOR.
  
2. THE SILT FENCE SHALL BE CONSTRUCTED AS FOLLOWS:
  - FABRIC USED FOR THE SILT FENCE SHALL BE A "STANDARD STRENGTH" GEOTEXTILE, SUCH AS MIRAFI 100X OR AN APPROVED EQUIVALENT.
  - THE FABRIC SHALL BE CUT FROM A CONTINUOUS FABRIC ROLL.
  - THE HEIGHT OF THE FENCE SHALL NOT EXCEED 24".
  - SPLICES SHALL ONLY BE DONE AT POSTS AND SHALL CONSIST OF A MINIMUM OF 6" OF OVERLAP WITH BOTH ENDS SECURED TO THE POST.
  - POSTS SHALL BE POSITIONED A MAXIMUM OF 6' APART.
  - POSTS SHALL CONSIST OF 2"X2" WOODEN STAKES OF SUFFICIENT LENGTH TO EXTEND A MINIMUM OF 12" INTO THE GROUND.
  - FABRIC SHALL BE STAPLED OR WIRED TO POSTS A MAXIMUM OF EVERY 9".
  
3. THE SILT FENCE SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER OR AS FOLLOWS:
  - A TRENCH, 4" WIDE AND 4" DEEP, SHALL BE EXCAVATED ALONG THE CONTOUR. THE POST SHALL BE DRIVEN INTO THE BOTTOM OF THE TRENCH ON THE DOWNSTREAM SIDE OF THE FILTER FABRIC. THE TRENCH SHALL BE BACK FILLED AND COMPACTED, ENSURING 4" OF FENCE IS BURIED WITHIN THE TRENCH.
  - IN AREAS WHERE THE TERRAIN IS TOO ROCKY FOR TRENCHING, A 4" GROUND FLAP WITH ROCK FILL TO HOLD IT IN PLACE SHALL BE USED.

DRAWN	JDM	DATE	9/8/2015
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

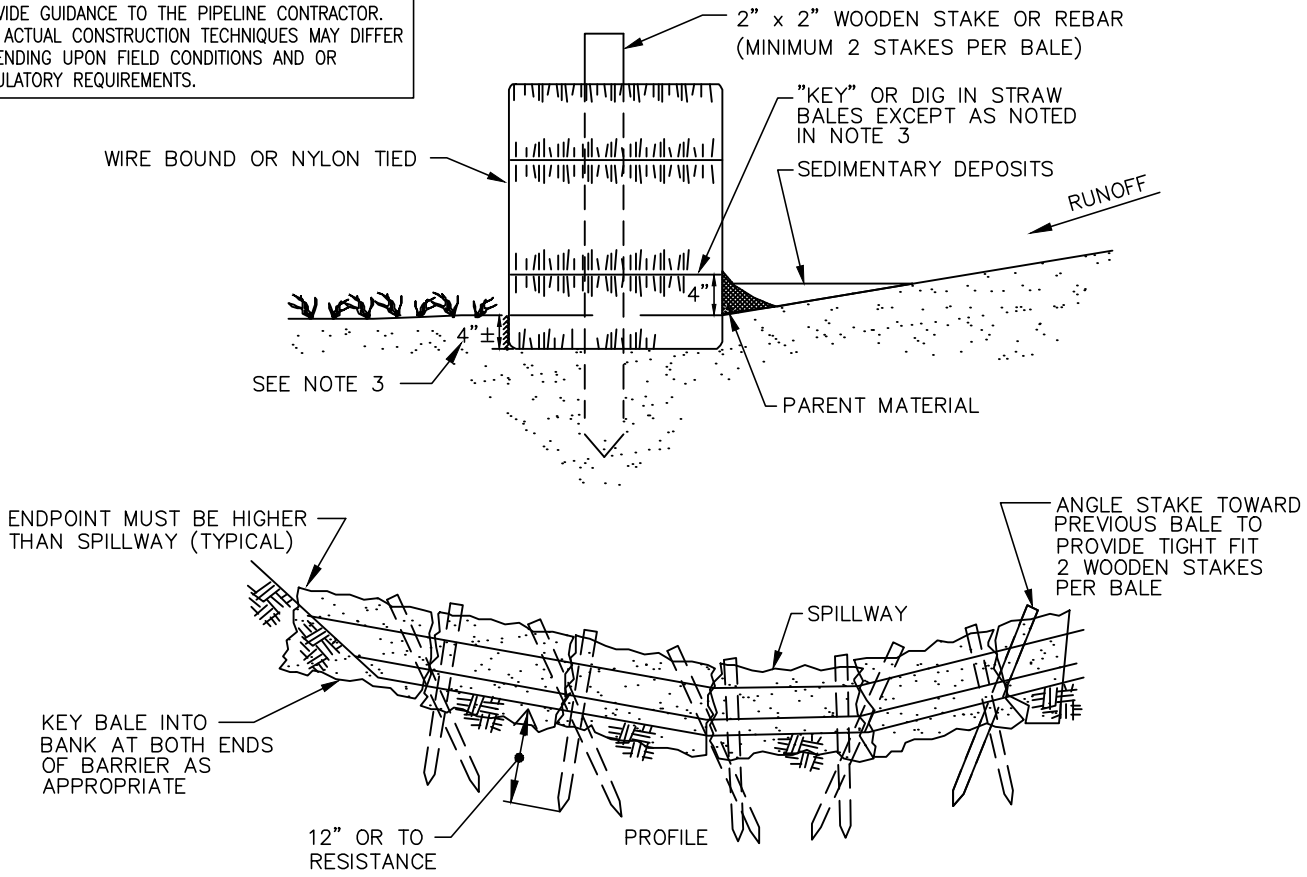


DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
EROSION CONTROL SILT FENCE SEDIMENT BARRIER (SFB)	
DRAWING NO.	REV.
MVP-21	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



**NOTES:**

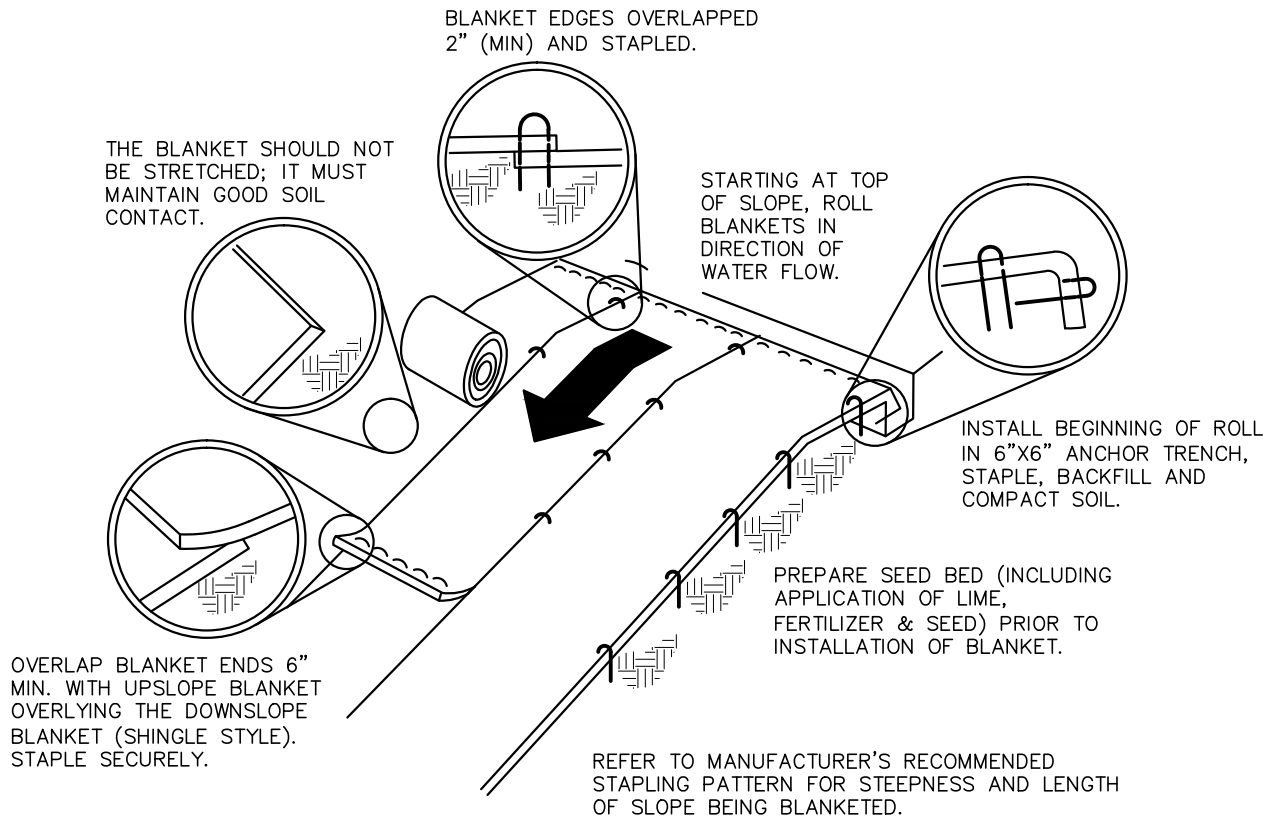
1. STRAW BALE SEDIMENT BARRIERS SHALL BE INSTALLED AT THE FOLLOWING LOCATIONS:
  - THE BASE OF ALL SLOPES ABOVE ROADS, SPRINGS, WETLANDS, IMPOUNDMENTS AND FLOWING STREAMS.
  - THE DOWNSLOPE RIGHT-OF-WAY EDGE WHERE ANY OF THE ABOVE-MENTIONED LOCATIONS ARE ADJACENT TO THE RIGHT-OF-WAY.
  - BETWEEN TOPSOIL/SPOIL STOCKPILES AND STREAMS OR WETLANDS AS NEEDED.
  - ALONG R.O.W. BOUNDARIES IN WETLAND CONSTRUCTION.
  - AS SPECIFIED IN THE SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN.
  - AS DIRECTED BY THE COMPANY'S INSPECTOR.
2. STRAW BALE SEDIMENT BARRIERS SHALL CONSIST OF A ROW OF STRAW BALES, PLACED ON THE FIBER-CUT EDGE (TIES NOT IN CONTACT WITH THE GROUND). BALES SHALL BE TIGHTLY ABUTTED TO ONE ANOTHER. THE BARRIER SHALL BE ONE BALE HIGH. ONLY CERTIFIED "NOXIOUS WEED-FREE" STRAW SHALL BE USED WHENEVER POSSIBLE.
3. ENTRENCH ("KEY") STRAW BALES INTO THE GROUND TO A DEPTH OF 4" EXCEPT IN FROZEN, SATURATED, OR EXTREMELY ROCKY SOILS. PLACE PARENT MATERIAL ON UPSTREAM SIDE OF STRAW BALES TO PREVENT UNDERMINING.
4. WALK ON STRAW BALES TO INSURE ADEQUATE BALE-TO-SOIL CONTACT.
5. ANCHOR STRAW BALES SECURELY IN PLACE WITH TWO WOODEN OR STEEL REBAR STAKES DRIVEN THROUGH THE TOPS OF THE BALES. THE STAKES SHALL PENETRATE THE GROUND A DISTANCE OF 12" UNLESS ROCK OR AN IMPERMEABLE LAYER IS ENCOUNTERED:
  - THE FIRST, CENTER AND END BALES OF THE BARRIER SHALL HAVE STAKES DRIVEN VERTICALLY THROUGH THE BALE.
  - BALES, OTHER THAN THOSE LOCATED AT THE ENDS OR CENTER OF THE BARRIER, SHALL HAVE THE FIRST STAKE DRIVEN THROUGH THE TOP OF THE BALE AT AN ANGLE SO THAT THE STAKE PASSES THROUGH THE PREVIOUSLY PLACED BALE, IN ORDER TO PROVIDE TIGHT CONTACT BETWEEN BALES. THE SECOND STAKE SHALL BE DRIVEN VERTICALLY THROUGH THE TOP OF THE BALE.

DRAWN	JDM	DATE	9/8/2015
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:  PXXXX			



DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
EROSION CONTROL STRAW BALE SEDIMENT BARRIER (SBB)	
DRAWING NO.  MVP-22	REV.  0



SEED AND SOIL AMENDMENTS SHALL BE APPLIED ACCORDING TO RATES IN THE PLAN DRAWINGS PRIOR TO INSTALLING THE BLANKET.

PROVIDE ANCHOR TRENCH AT TOE OF SLOPE IN SIMILAR FASHION AT THE TOP OF SLOPE.

SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS.

BLANKET SHALL HAVE GOOD CONTINUOUS CONTACT AND UNDERLYING SOIL THROUGHOUT ENTIRE LENGTH. LAY BLANKET LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH BLANKET.

BLANKET SHALL BE STAPLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

BLANKET AREAS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL PERENNIAL VEGETATION IS ESTABLISHED TO A MINIMUM UNIFORM 70% COVERAGE THROUGHOUT THE BLANKETED AREA. DAMAGED OR DISPLACED BLANKETS SHALL BE RESTORED OR REPLACED WITHIN 4 CALENDAR DAYS.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JDM	DATE	9/8/2015
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

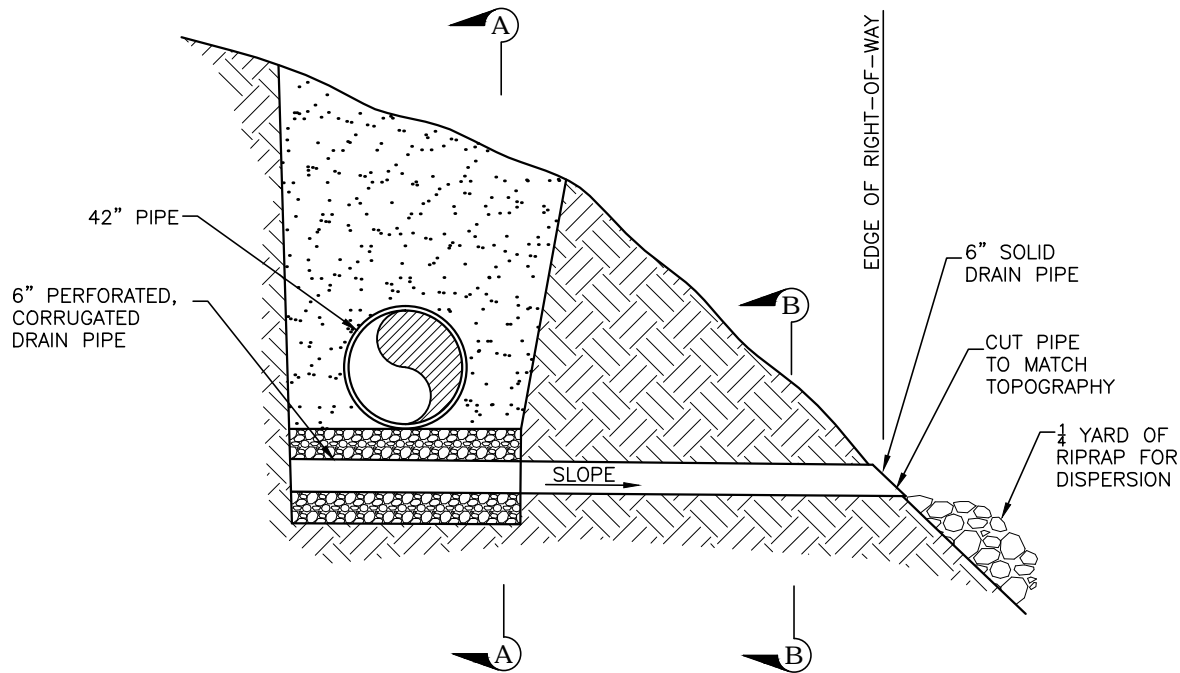


DESIGN ENGINEERING

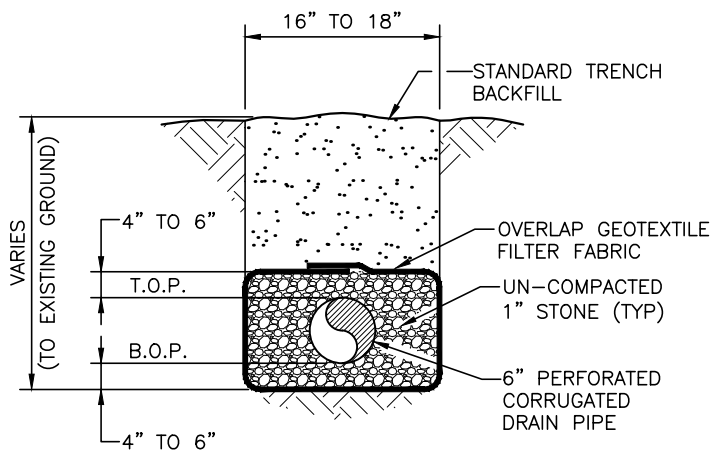
**TYPICAL CONSTRUCTION DETAIL**

SLOPE INSTALLATION

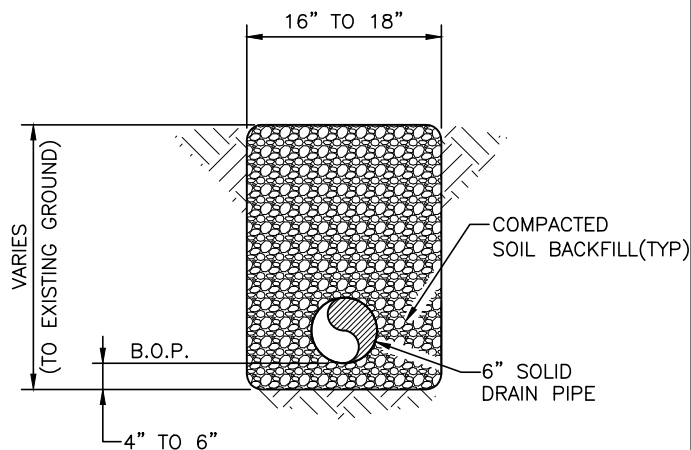
DRAWING NO. MVP-23	REV. 0
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MAINLINE CROSS SECTION



SECTION A-A



SECTION B-B

**NOTES**

1. LOW POINT DITCH DRAINS SHALL BE INSTALLED AT LOCATIONS SPECIFIED IN THE APPROVED EROSION & SEDIMENTATION CONTROL PLAN, AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. FILL STONE SHOULD BE 1" AGGREGATE WITHOUT FINES, CRUSHER RUN WITHOUT FINES, OR EQUIVALENT.
3. DRAIN PIPE TO BE CONNECTED USING STANDARD PIPE COLLARS.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JIL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	xxx	DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			

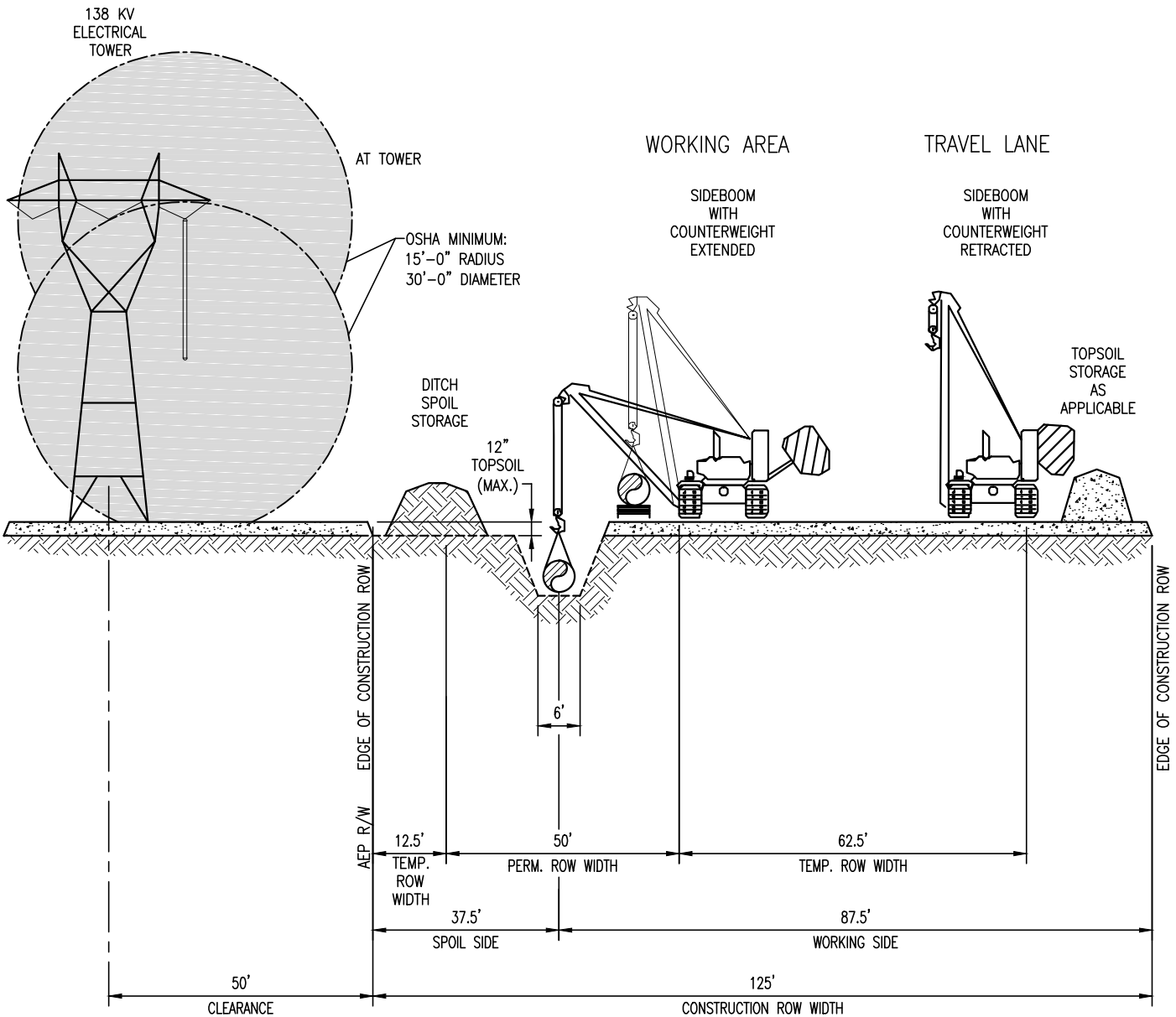


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

SIDEHILL LOW-POINT DRAIN TYPICAL

DRAWING NO.	REV.
MVP-24	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

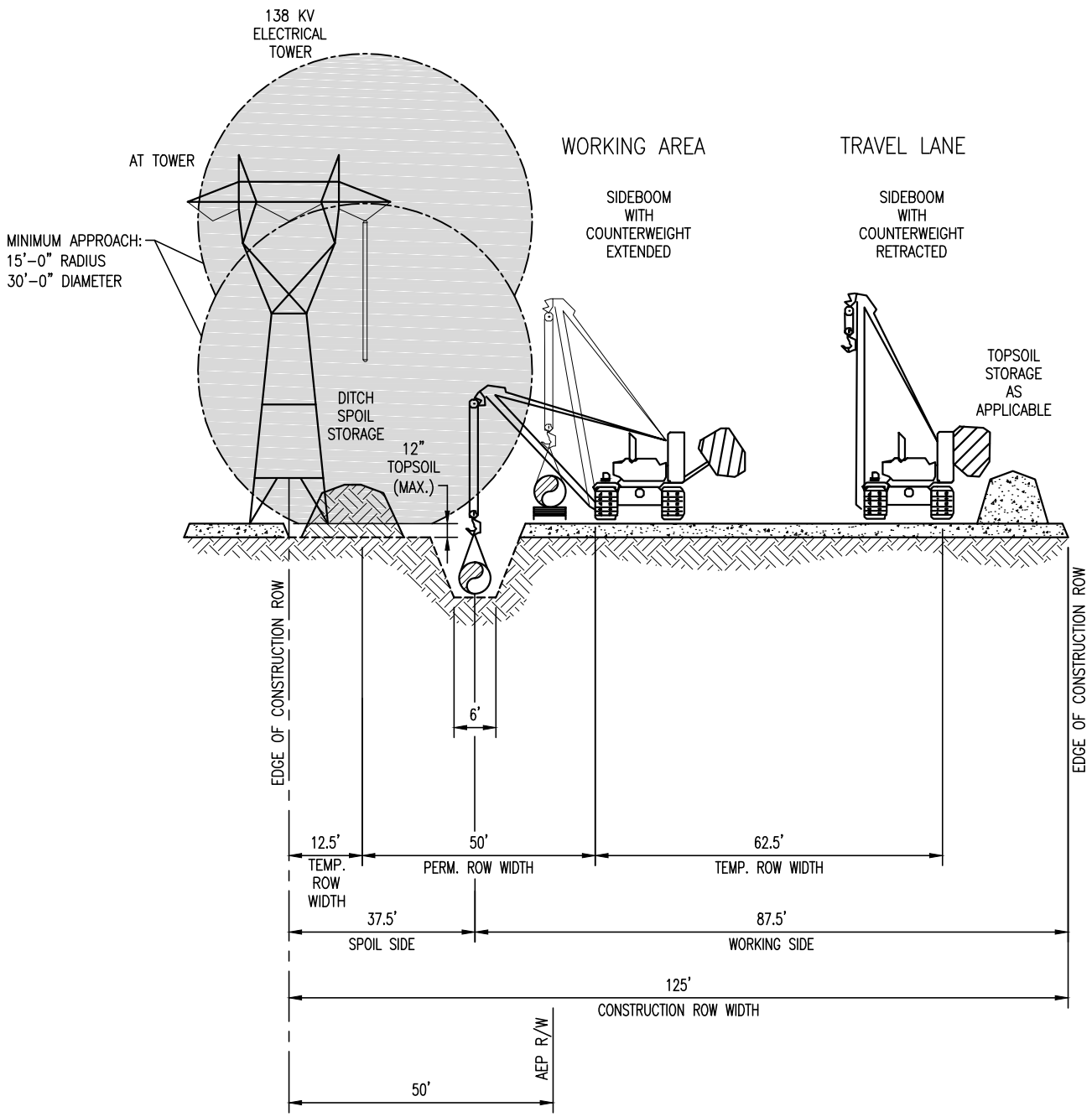


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO. MVP-25	REV. 0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



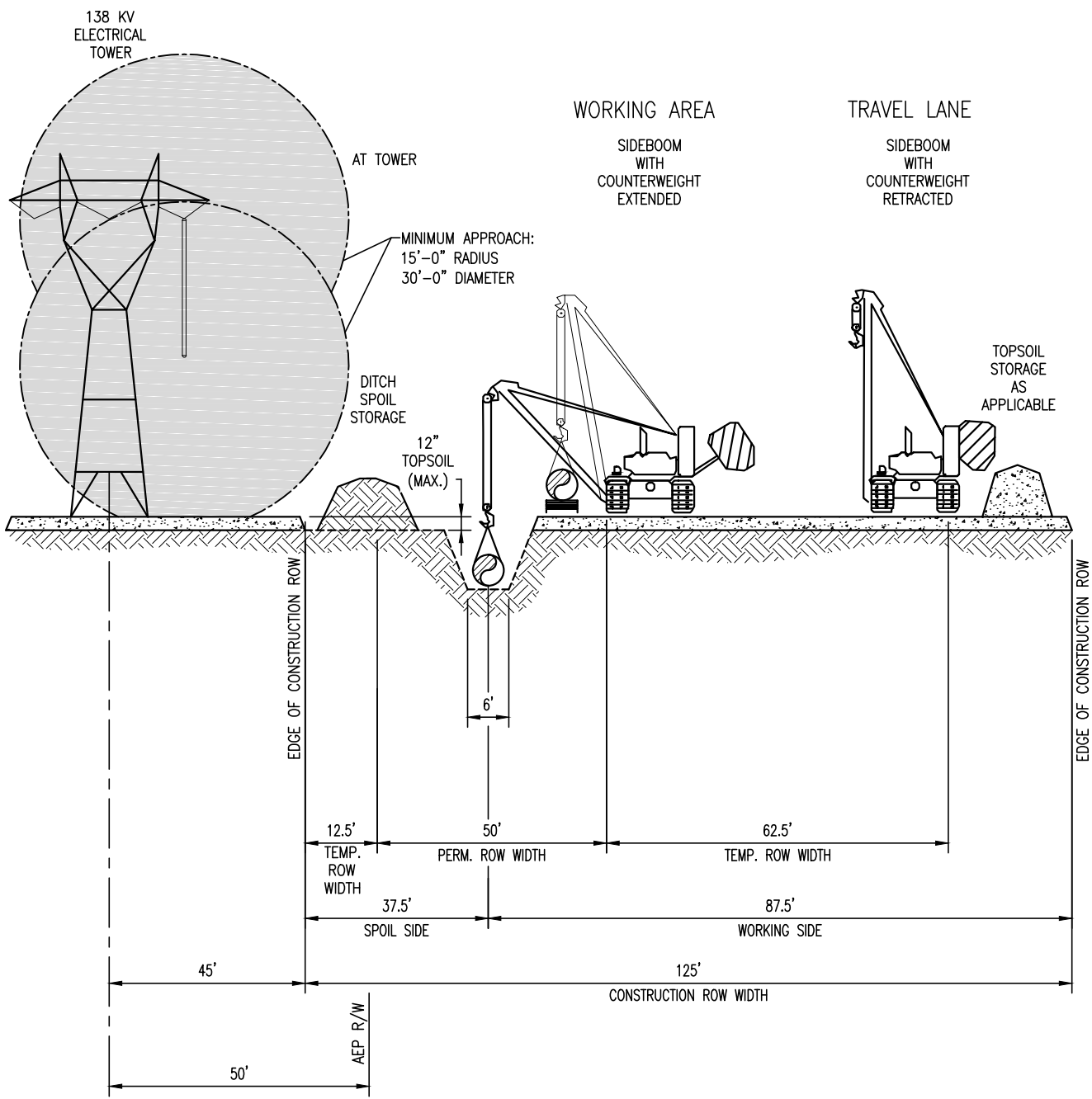
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-26	0





THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



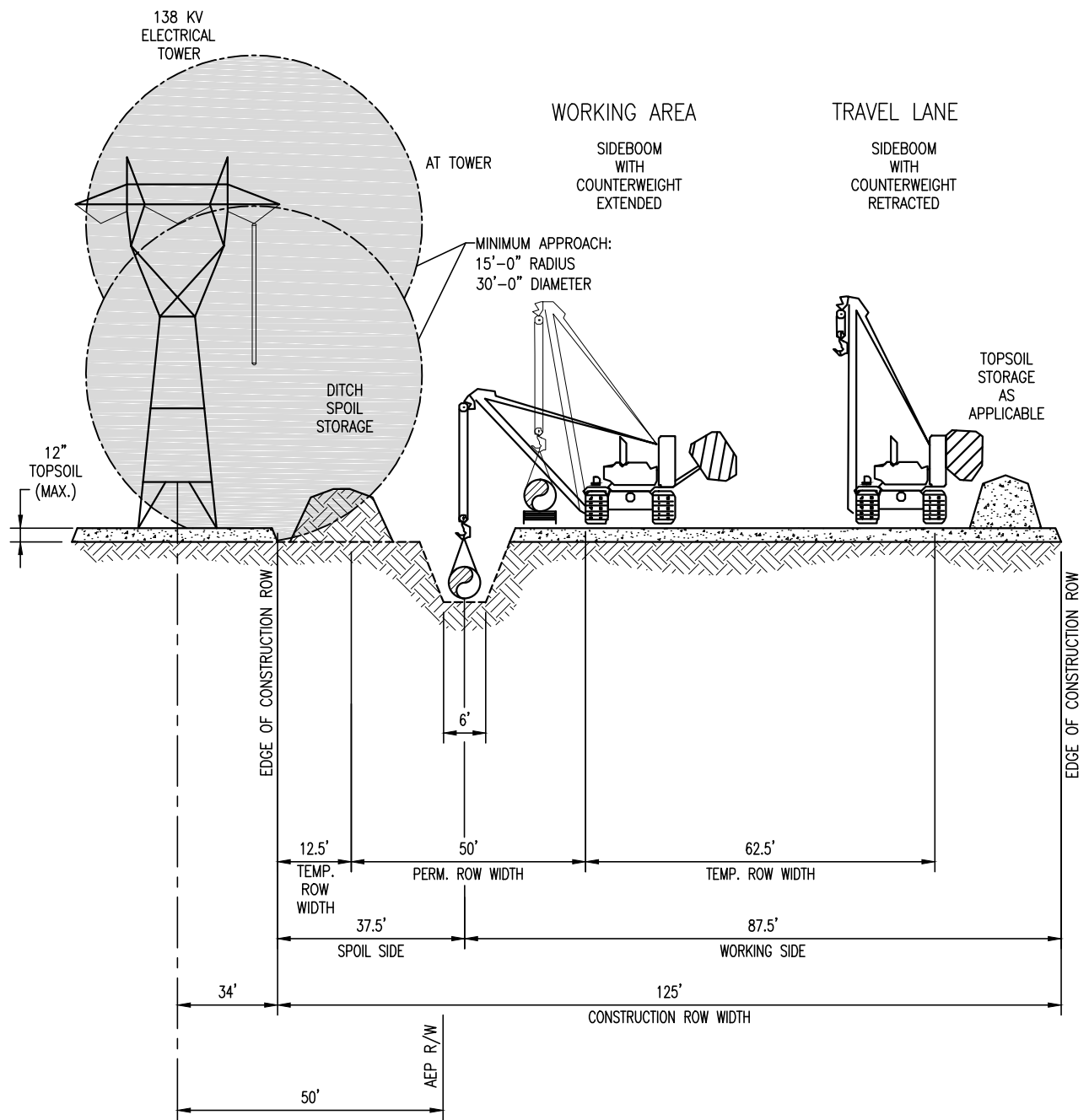
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO.	MVP-27
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REV.	0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

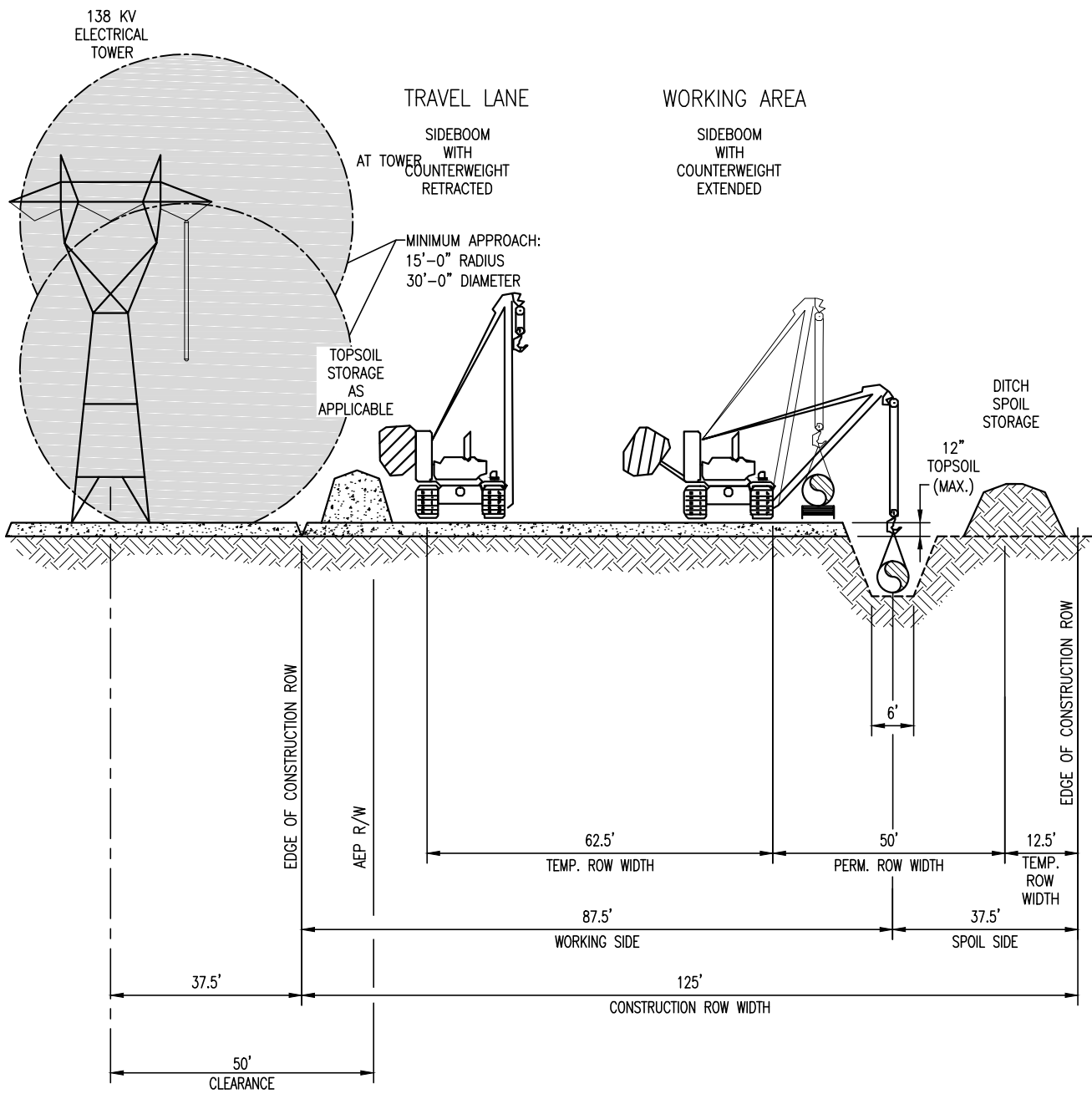
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CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
MAINLINE CONSTRUCTION PARALLEL TO POWER LINES RIGHT-OF-WAY	
DRAWING NO.	REV.
MVP-28	0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

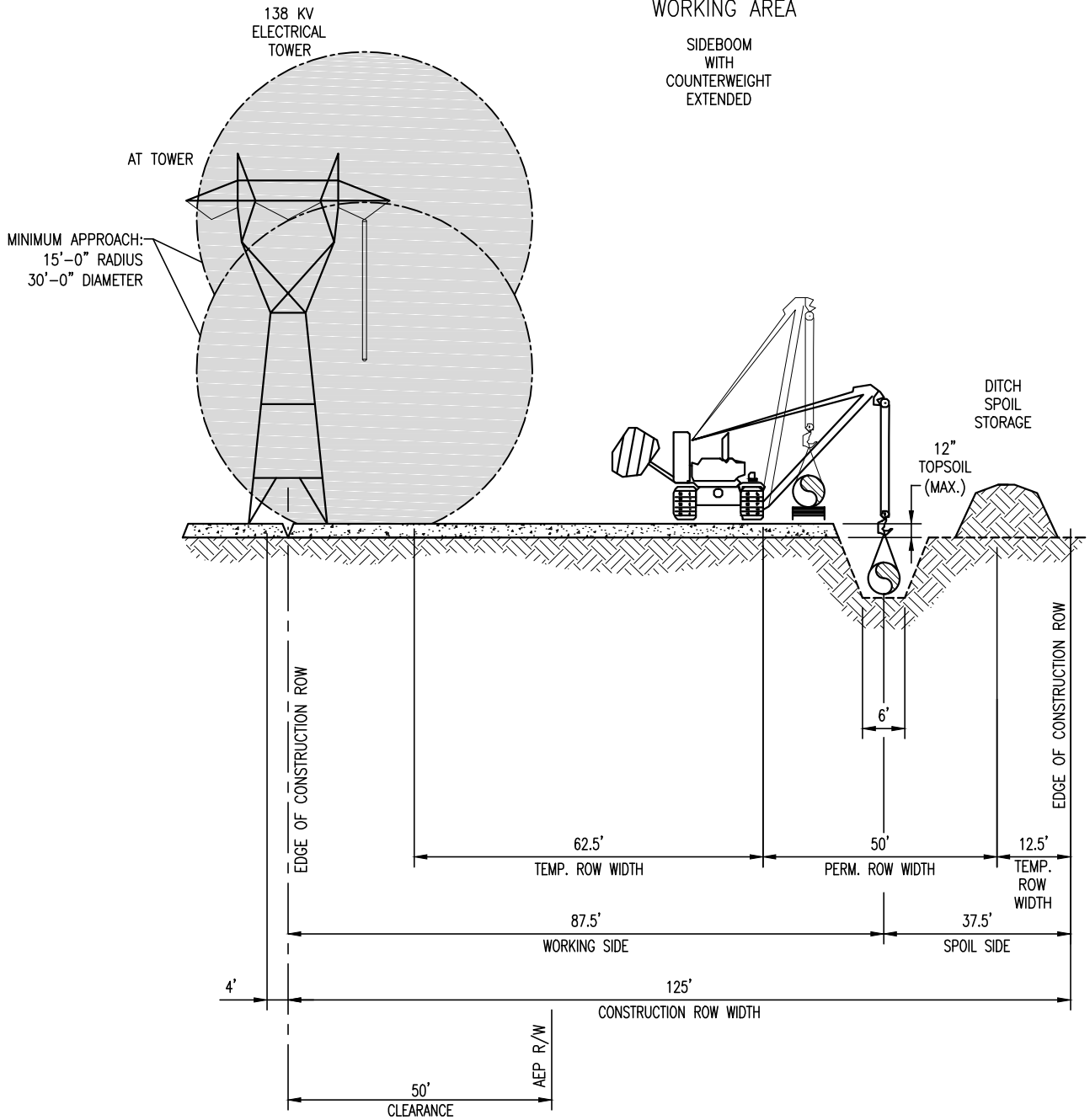


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO. MVP-29	REV. 0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JDM	DATE	3/17/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

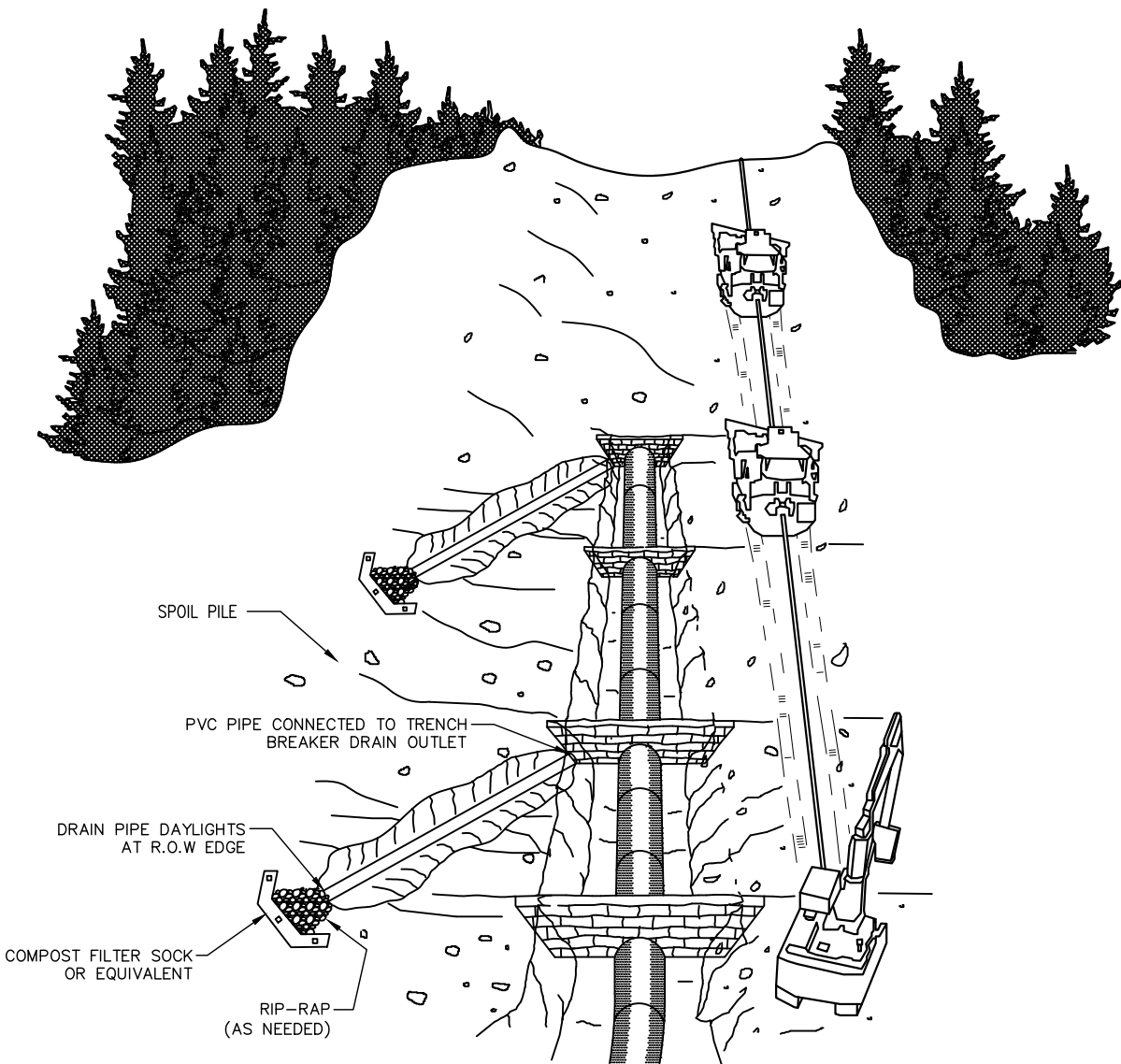


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
PARALLEL TO POWER LINES  
RIGHT-OF-WAY

DRAWING NO. MVP-30	REV. 0
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SPOIL PILE

PVC PIPE CONNECTED TO TRENCH BREAKER DRAIN OUTLET

DRAIN PIPE DAYLIGHTS AT R.O.W EDGE

COMPOST FILTER SOCK OR EQUIVALENT

RIP-RAP (AS NEEDED)

**NOTES:**

1. WINCHES MAY BE REQUIRED FOR MOVING EQUIPMENT AND MATERIAL, AND DURING CONSTRUCTION ON STEEP LONGITUDINAL SLOPES.
2. WINCHES WILL EITHER BE FIXED WINCHES OR TRACKED EQUIPMENT WITH WINCHES.
3. WINCHES WILL TYPICALLY BE REQUIRED FOR SLOPES OF 30% (17") AND UP.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

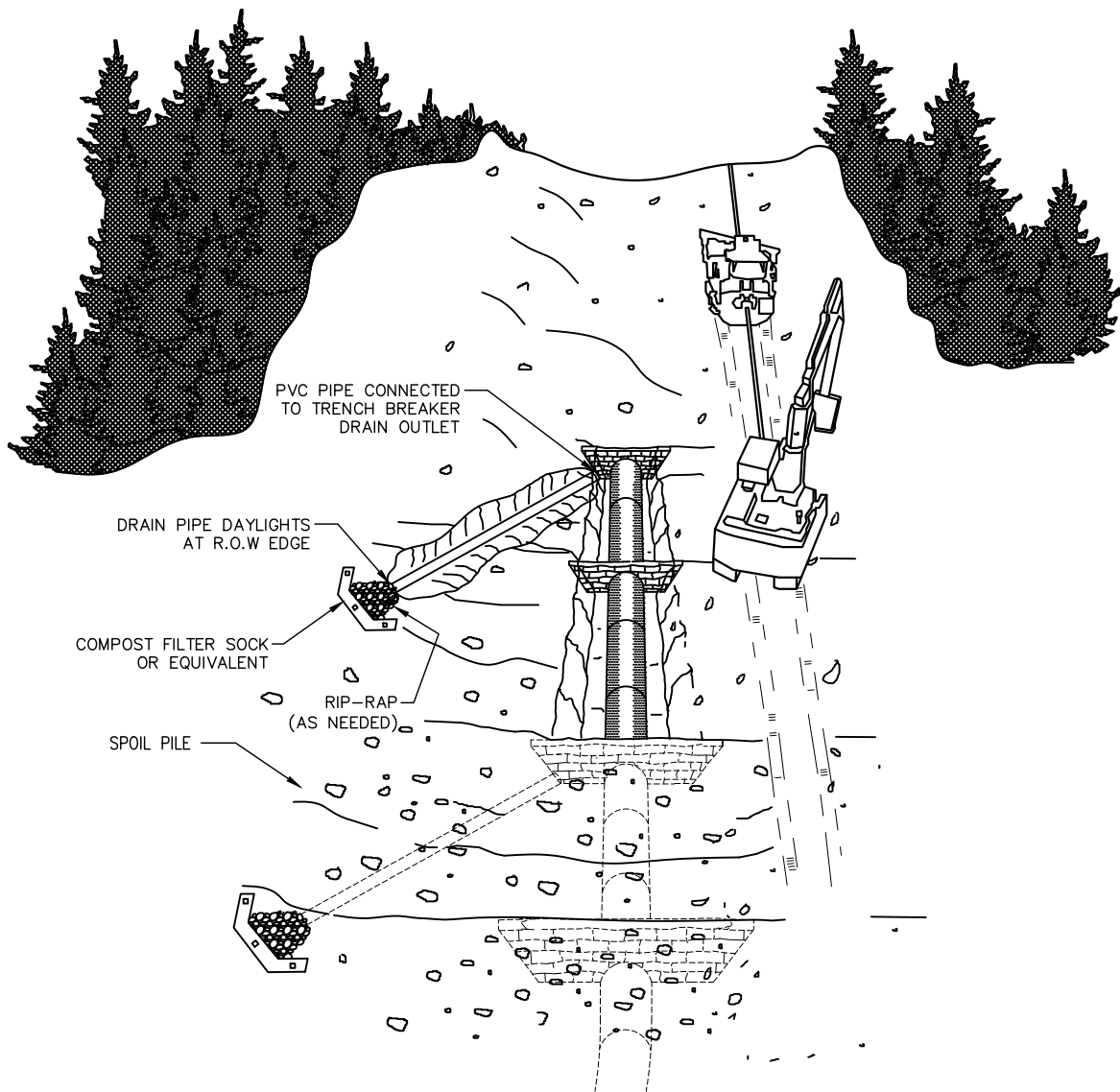
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APP'D	RLM	DATE	04/06/16
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			



DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
MAINLINE CONSTRUCTION STEEP HILL PARALLEL CONSTRUCTION NO TOP SOIL SEGREGATION	
DRAWING NO.	REV.
MVP-31	0





**NOTES:**

1. WINCHES MAY BE REQUIRED FOR MOVING EQUIPMENT AND MATERIAL, AND DURING CONSTRUCTION ON STEEP LONGITUDINAL SLOPES.
2. WINCHES WILL EITHER BE FIXED WINCHES OR TRACKED EQUIPMENT WITH WINCHES.
3. WINCHES WILL TYPICALLY BE REQUIRED FOR SLOPES OF 30% (17°) AND UP.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWING ASSUMES TYPE "B" SOIL

DRAWN	JIL	DATE	06/23/16
CHECKED	RRR	DATE	06/23/16
APP'D	RLM	DATE	06/23/16
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
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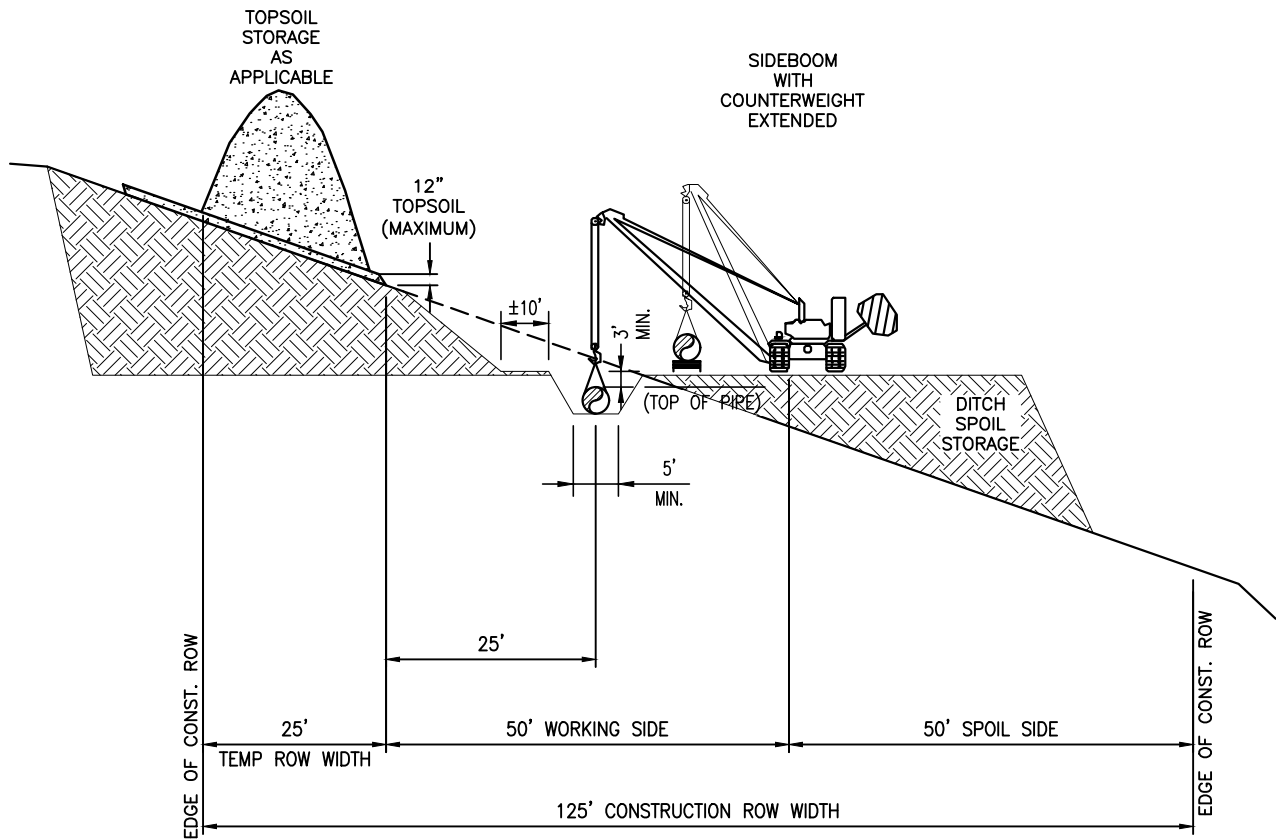


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
 STEEP HILL STOVE PIPE CONSTRUCTION  
 JEFFERSON NATIONAL FOREST  
 NO TOP SOIL SEGREGATION

DRAWING NO.	REV.
MVP-32	0



NOTES:

1. SEEPS OR SPRINGS ENCOUNTERED IN THE EXCAVATION SHALL BE INTERCEPTED BY TRANSVERSE TRENCH DRAINS, CUTOFF DRAINS, OR SIMILAR, AND DIRECTED OUT OF THE PIPELINE DITCH TO AN ENERGY DISSIPATING STRUCTURE (SUCH AS A RIPRAP APRON).
2. BACKFILL MATERIAL SHALL EXCLUDE ORGANIC MATERIAL, VEGETATION, STUMPS, ROOT SYSTEMS, FROZEN MATERIAL, AND ROCKS LARGER THAN THREE INCHES IN DIAMETER.
3. BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL MOISTURE CONTENT IS SUITABLE FOR COMPACTION, AT OR NEAR OPTIMUM MOISTURE CONTENT (I.E., NOT IMMEDIATELY FOLLOWING A LARGE PRECIPITATION EVENT OR WHEN SOIL IS EXCESSIVELY DRY).
4. BACKFILL MATERIAL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES THICK.
5. BACKFILL COMPACTION SHALL BE ACCOMPLISHED USING THE BACK OF AN EXCAVATOR BUCKET, SHEEP'S FOOT ROLLER, OR SIMILAR.
6. WHERE A TEMPORARY CUT AND FILL SURFACE IS REQUIRED, ANY GROUND FRACTURES FORMING NEAR THE CUT/FILL LINE OR THE PIPELINE DITCH SHALL BE REPAIRED TO PREVENT WATER INFILTRATION.
7. ALL STREAMS, GULLIES, NATURAL DRAINS, FIELD ROADS OR TRAILS, AND OTHER WATER CONVEYING FEATURES SHALL BE PROPERLY RECONTOURED SUCH THAT THE PERMANENT RIGHT-OF-WAY IS PROTECTED FROM PREFERENTIAL WATER ACCUMULATION AND INFILTRATION.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	EPG	DATE	10/06/16
CHECKED	MMF	DATE	10/06/16
APP'D	RLM	DATE	10/06/16
SCALE	N.T.S.	SHEET	1 OF 1

JOB NO.  
PROJECT ID:  
**PXXXX**

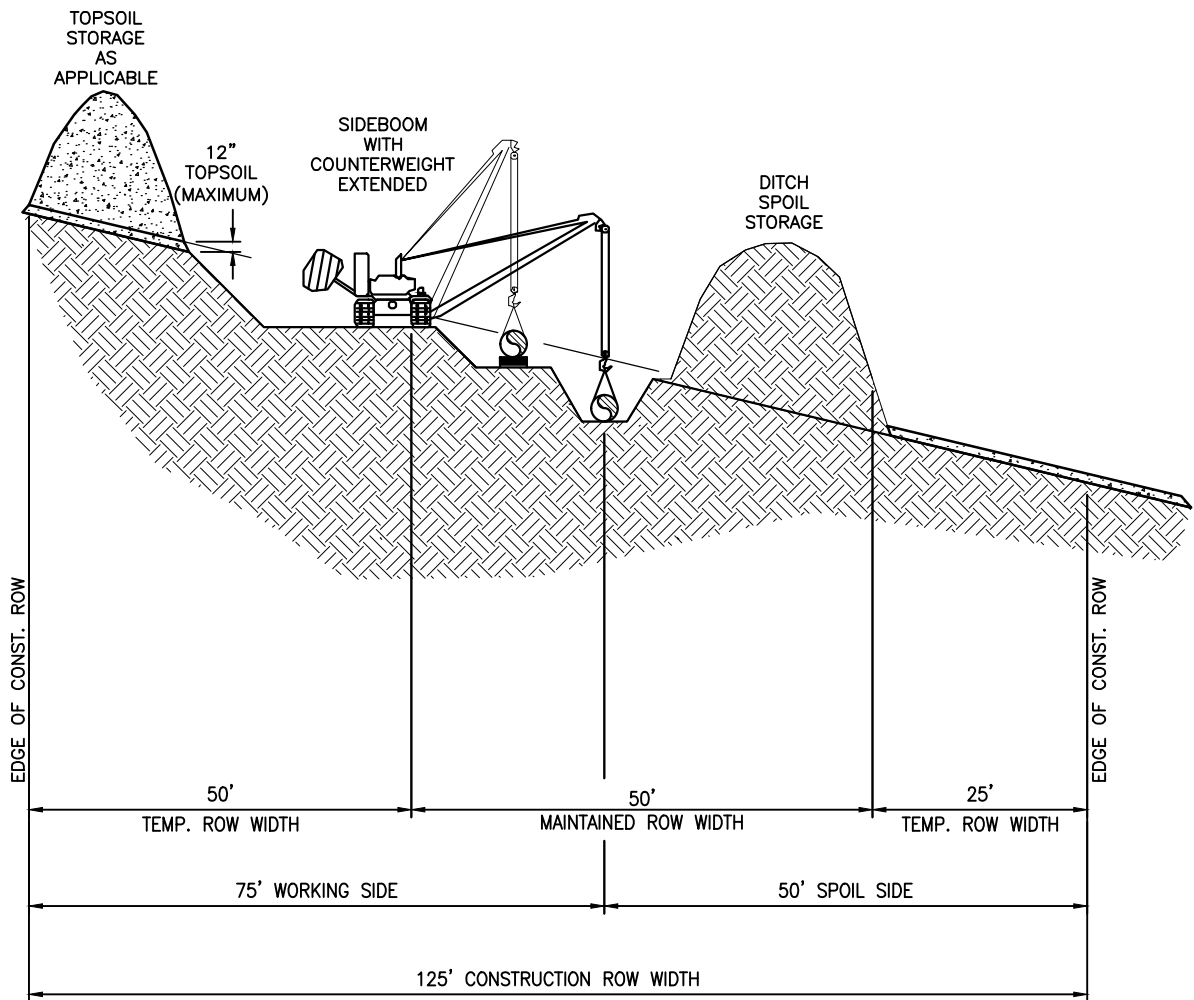


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MAINLINE CONSTRUCTION  
SIDE HILL CONSTRUCTION  
RIGHT OF WAY

DRAWING NO. <b>MVP-33</b>	REV. <b>0</b>
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**NOTES:**

1. SEEPS OR SPRINGS ENCOUNTERED IN THE EXCAVATION SHALL BE INTERCEPTED BY TRANSVERSE TRENCH DRAINS, CUTOFF DRAINS, OR SIMILAR, AND DIRECTED OUT OF THE PIPELINE DITCH TO AN ENERGY DISSIPATING STRUCTURE (SUCH AS A RIPRAP APRON).
2. BACKFILL MATERIAL SHALL EXCLUDE ORGANIC MATERIAL, VEGETATION, STUMPS, ROOT SYSTEMS, FROZEN MATERIAL, AND ROCKS LARGER THAN THREE INCHES IN DIAMETER.
3. BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL MOISTURE CONTENT IS SUITABLE FOR COMPACTION, AT OR NEAR OPTIMUM MOISTURE CONTENT (I.E., NOT IMMEDIATELY FOLLOWING A LARGE PRECIPITATION EVENT OR WHEN SOIL IS EXCESSIVELY DRY).
4. BACKFILL MATERIAL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES THICK.
5. BACKFILL COMPACTION SHALL BE ACCOMPLISHED USING THE BACK OF AN EXCAVATOR BUCKET, SHEEP'S FOOT ROLLER, OR SIMILAR.
6. WHERE A TEMPORARY CUT AND FILL SURFACE IS REQUIRED, ANY GROUND FRACTURES FORMING NEAR THE CUT/FILL LINE OR THE PIPELINE DITCH SHALL BE REPAIRED TO PREVENT WATER INFILTRATION.
7. ALL STREAMS, GULLIES, NATURAL DRAINS, FIELD ROADS OR TRAILS, AND OTHER WATER CONVEYING FEATURES SHALL BE PROPERLY RECONTOURED SUCH THAT THE PERMANENT RIGHT-OF-WAY IS PROTECTED FROM PREFERENTIAL WATER ACCUMULATION AND INFILTRATION.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	EPG	DATE	10/06/16
CHECKED	MMF	DATE	10/06/16
APP'D	RLM	DATE	10/06/16
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			

PROJECT ID:  
**PXXXX**



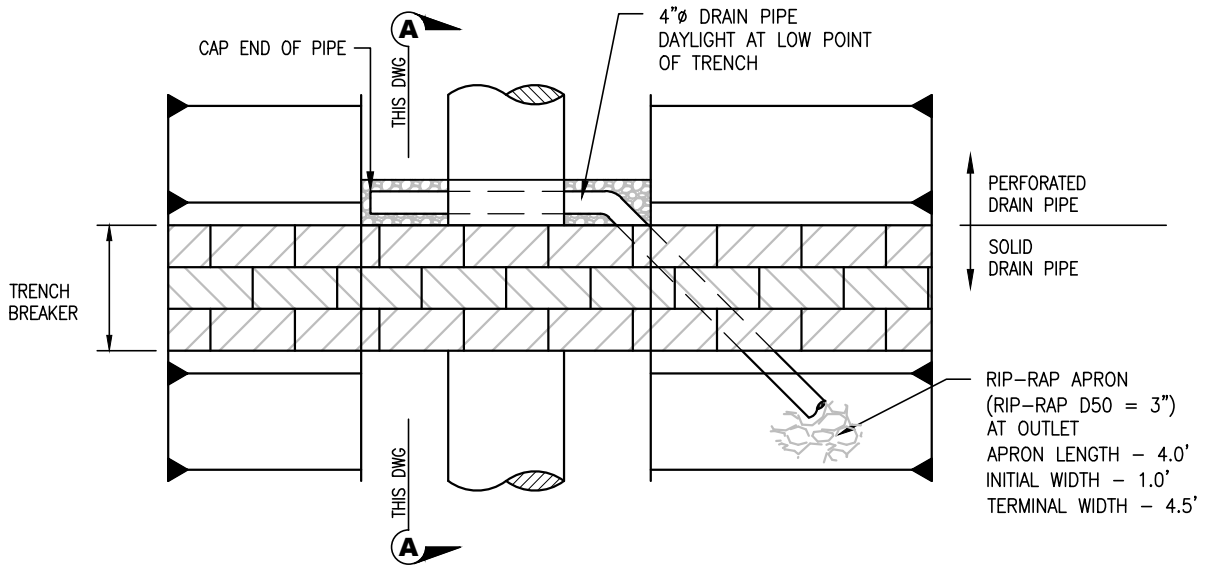
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**TYPICAL CONSTRUCTION DETAIL**

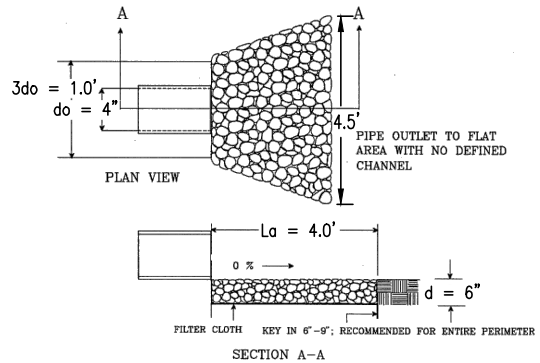
MAINLINE CONSTRUCTION  
TWO TONE METHOD  
RIGHT OF WAY

DRAWING NO.  
**MVP-34**

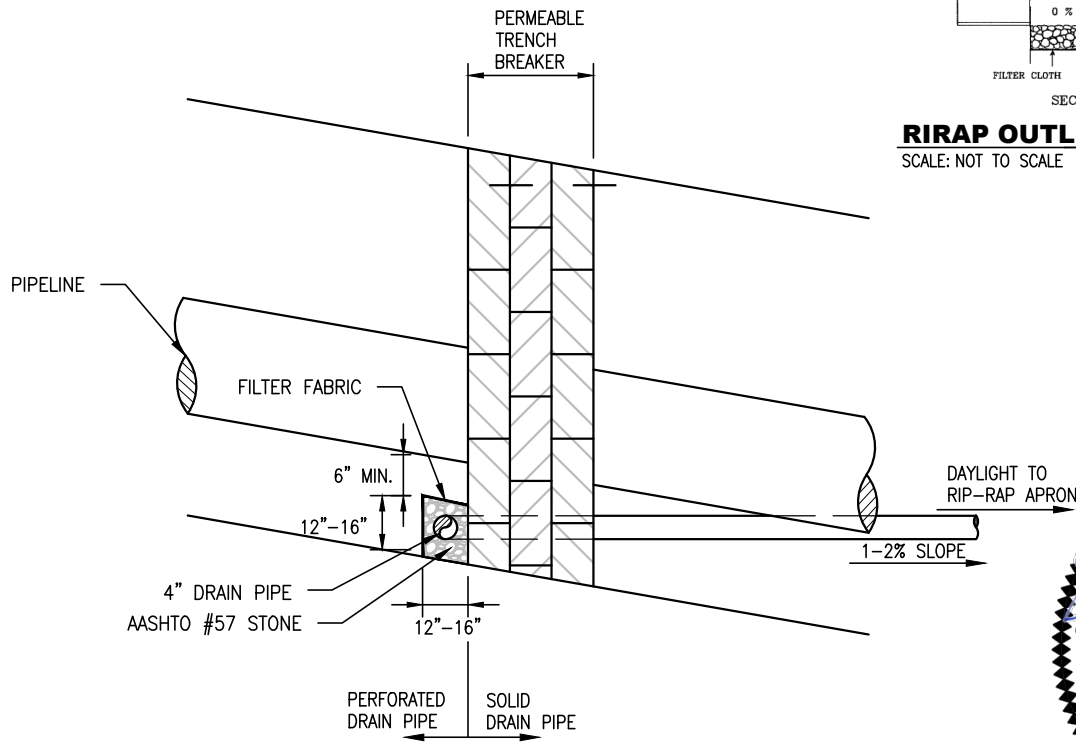
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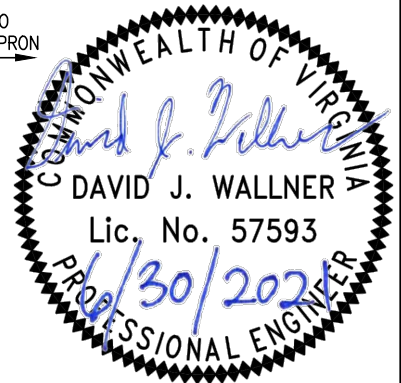
**PLAN**  
SCALE: NOT TO SCALE



**RIRAP OUTLET PROTECTION**  
SCALE: NOT TO SCALE



**SECTION A-A**  
SCALE: NOT TO SCALE

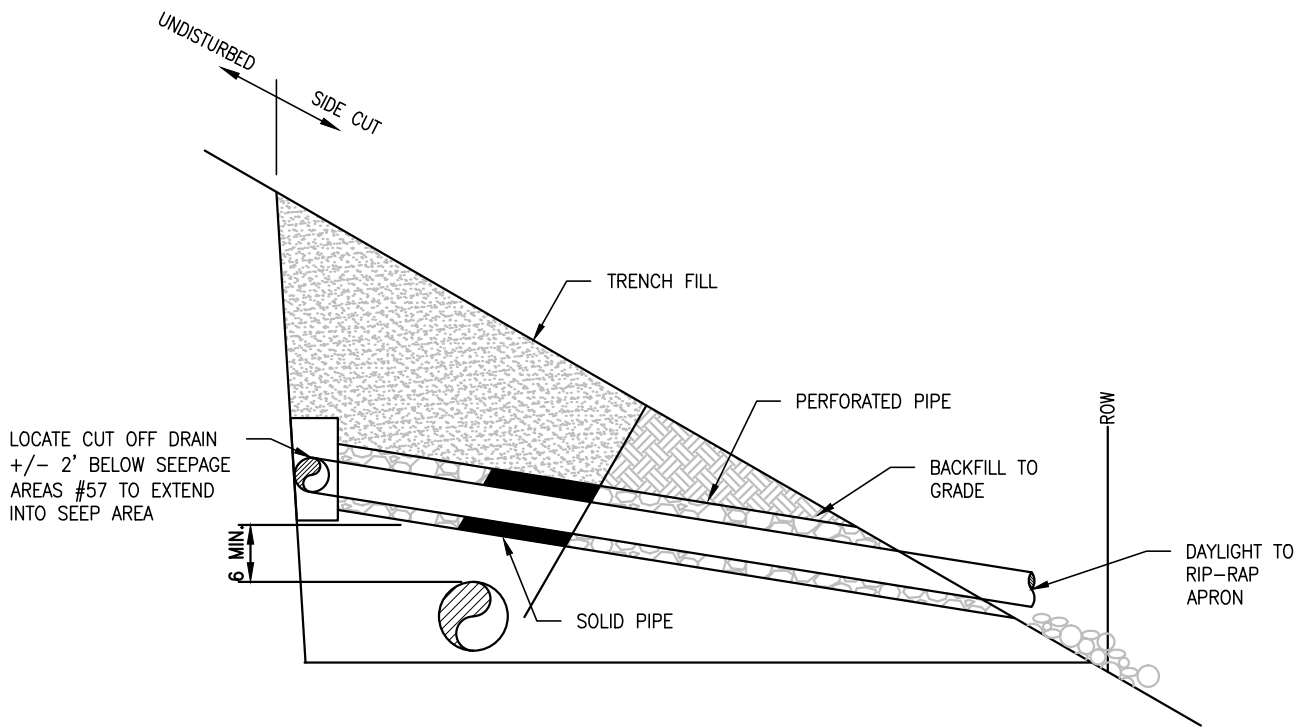
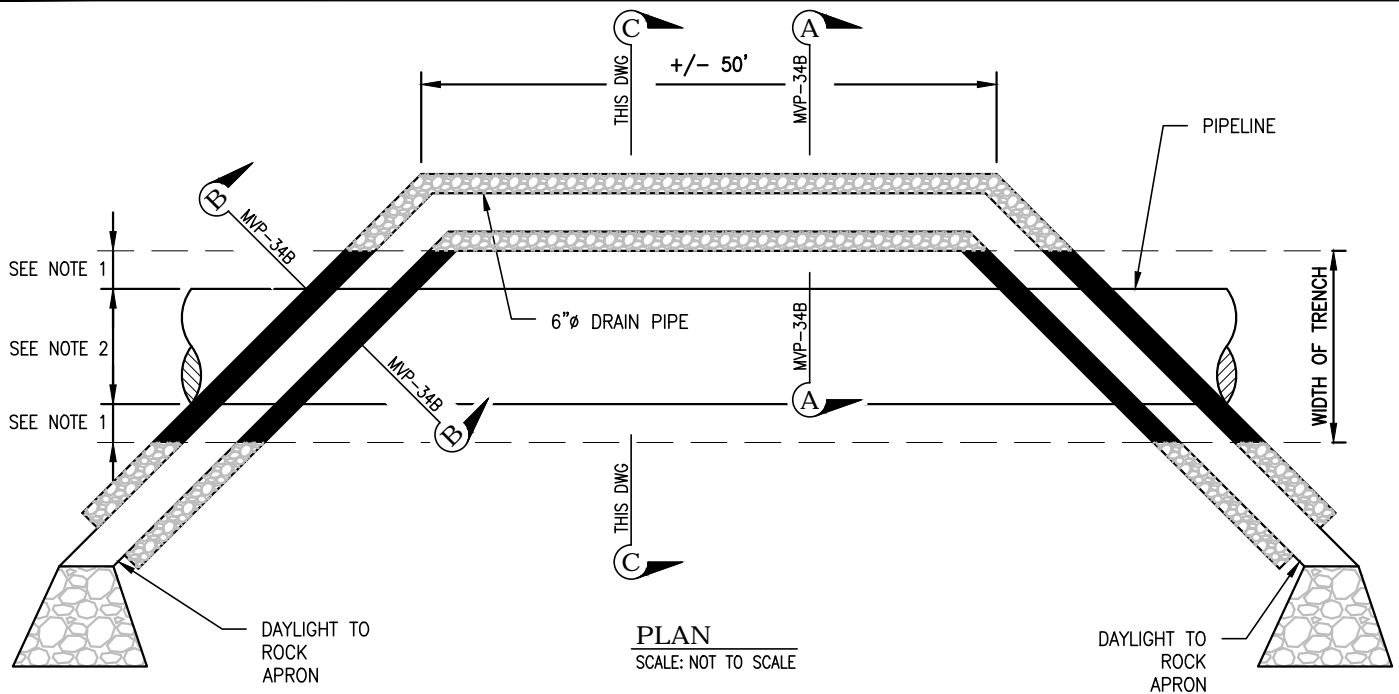


Plotted by: Rickabough, Greg on: June 30, 2021 - 4:24 PM

DRAWN	JK	DATE	06/30/2021
CHECKED	RE	DATE	06/30/2021
APP'D	DW	DATE	06/30/2021
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

**Mountain Valley**  
PIPELINE  
DESIGN ENGINEERING

<b>TYPICAL CONSTRUCTION DETAIL</b>	
TRENCH BREAKER DAYLIGHT DRAIN	
DRAWING NO.	REV.
MVP-35	2



**NOTES:**

1. PERFORATED PIPE SURROUNDED BY #57 STONE.
2. SOLID PIPE (IN TRENCH) SURROUNDED BY TRENCH BACKFILL.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:10 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

CUTOFF DRAIN-SIDEHILL

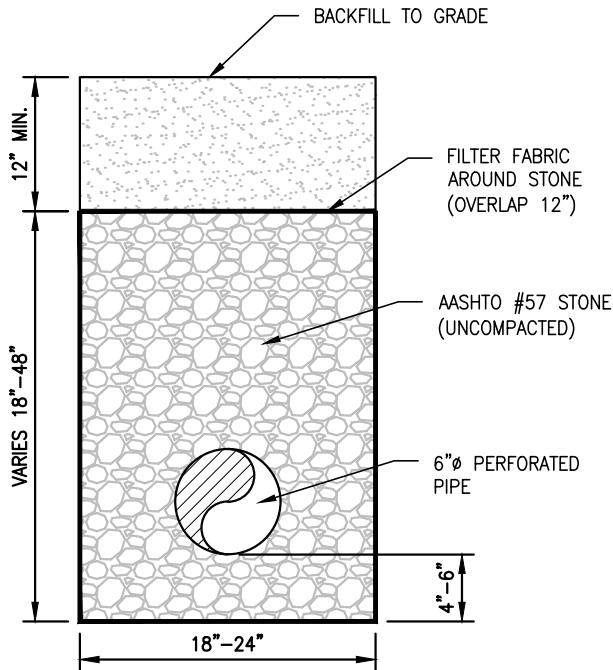
DRAWING NO.

MVP-36A

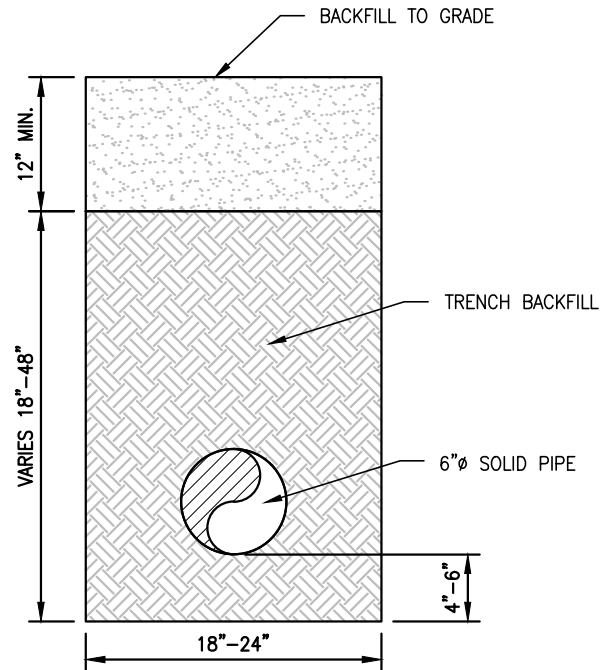
REV.

0





**SECTION A-A**  
SCALE: NOT TO SCALE  
FROM MVP-34A



**SECTION B-B**  
SCALE: NOT TO SCALE  
FROM MVP-34A

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:11 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:			

MVP - VA PORTION



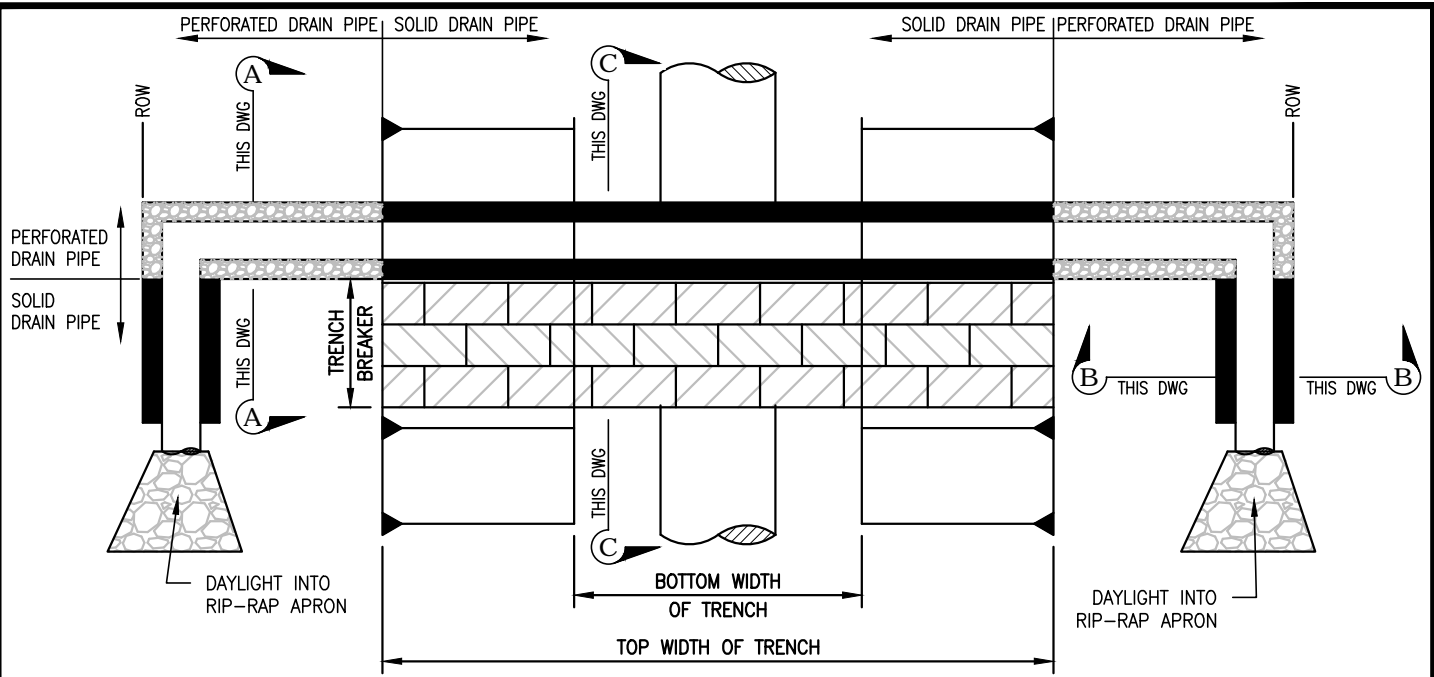
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

CUTOFF DRAIN-SIDEHILL

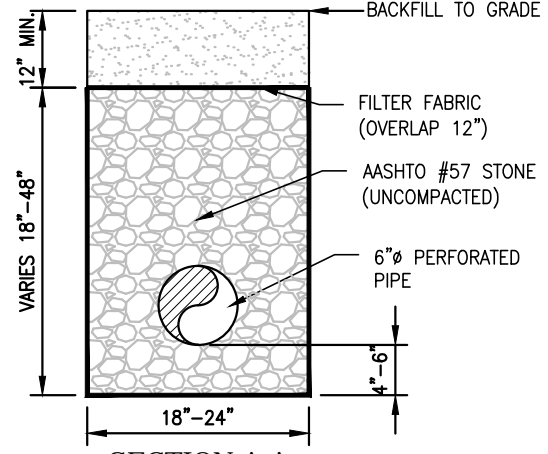
DRAWING NO. MVP-36B

REV. 0

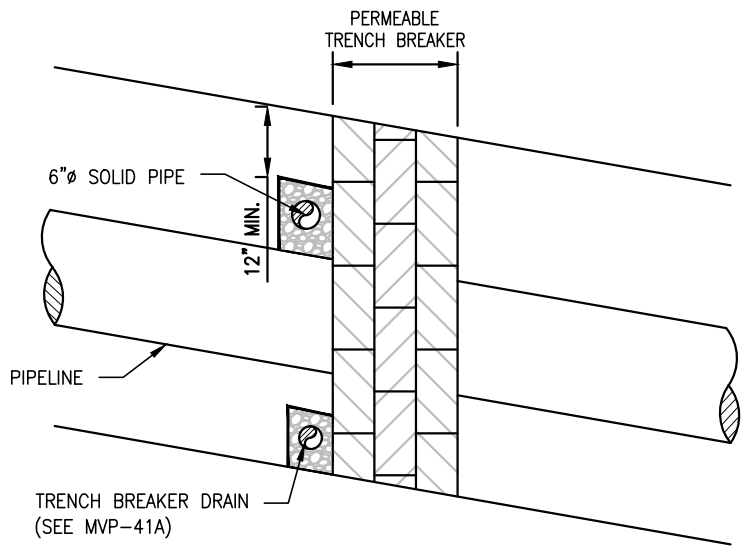


**PLAN**  
SCALE: NOT TO SCALE

**NOTES:**  
1. EACH CUTOFF DRAIN SHALL UTILIZE A TRENCH BREAKER DRAIN (SEE DETAIL 1) TO DRAIN THE TRENCH.

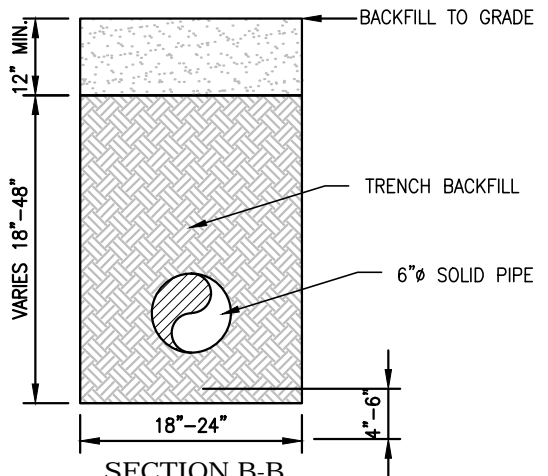


**SECTION A-A**  
SCALE: NOT TO SCALE



**SECTION C-C**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.



**SECTION B-B**  
SCALE: NOT TO SCALE

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:17 PM

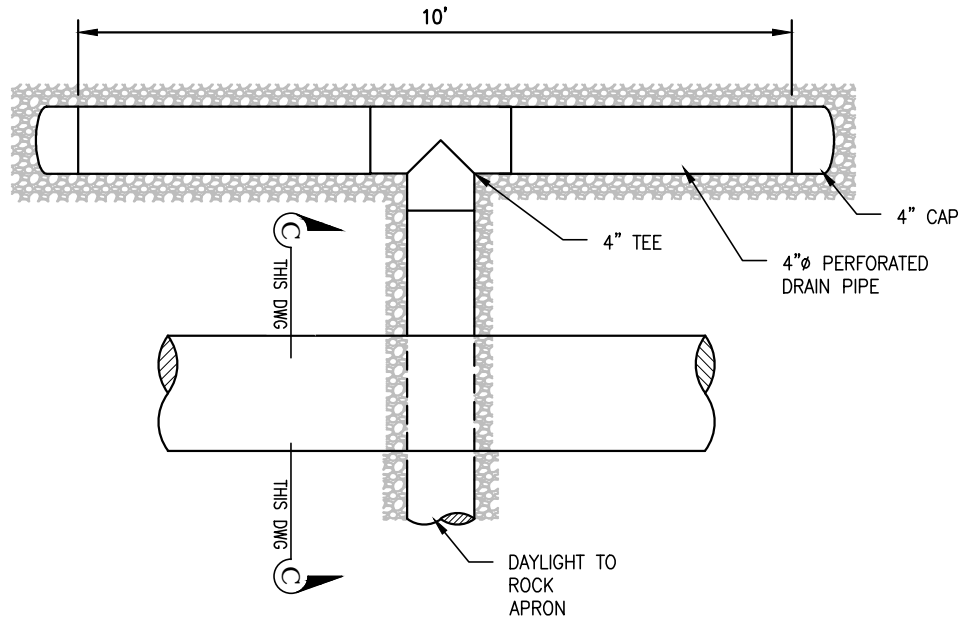
DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



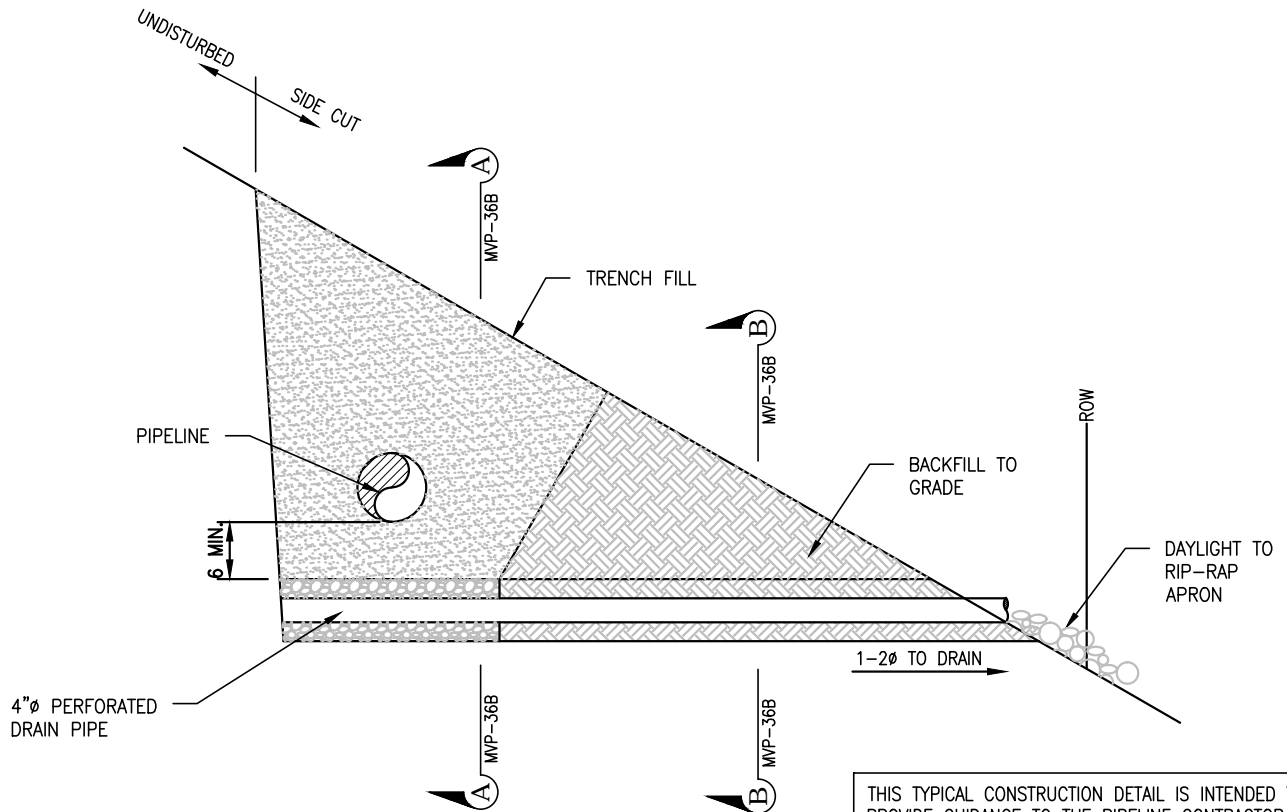
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

CUTOFF DRAIN-PLANAR	
DRAWING NO.	REV.
MVP-37	0



**PLAN**  
SCALE: NOT TO SCALE



**C-C**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:18 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

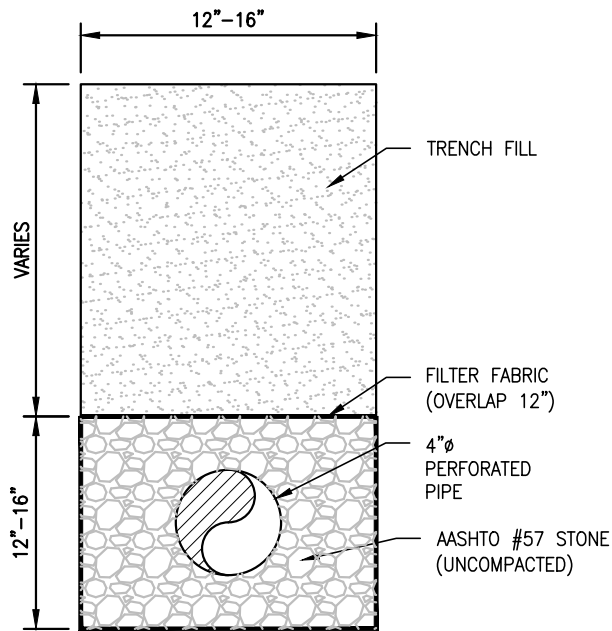
TRANSVERSE TRENCH DRAIN

DRAWING NO.

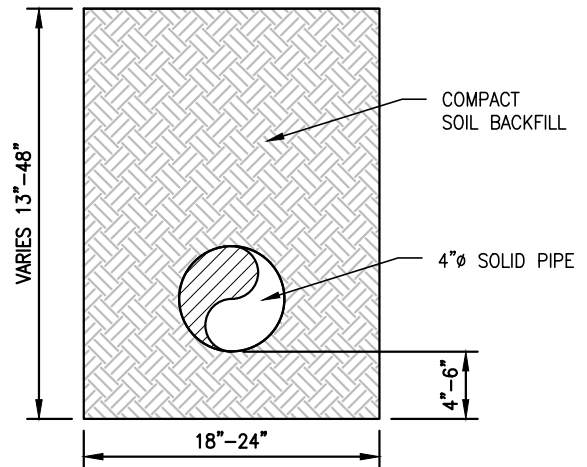
MVP-38A

REV.

0



**SECTION A-A**  
SCALE: NOT TO SCALE  
FROM MVP-36A



**SECTION B-B**  
SCALE: NOT TO SCALE  
FROM MVP-36A

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:25 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



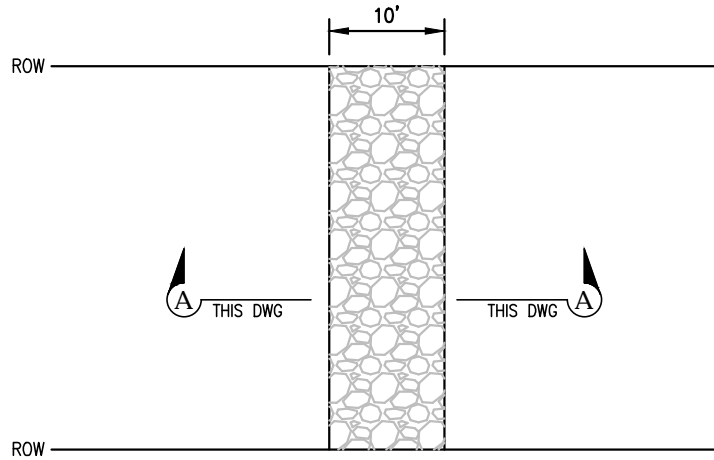
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

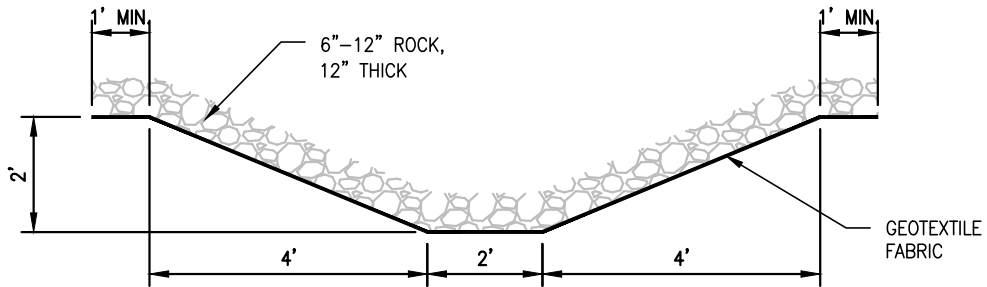
TRANSVERSE TRENCH DRAIN

DRAWING NO.	MVP-38B
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REV.	0
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**PLAN**  
SCALE: NOT TO SCALE



**SECTION A-A**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:27 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

ROCK LINED SWALE

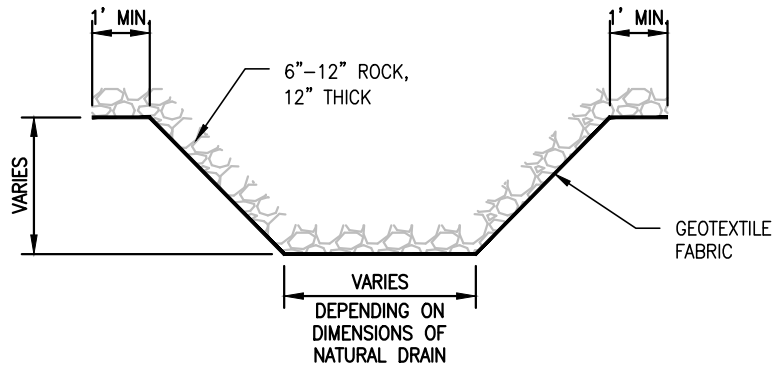
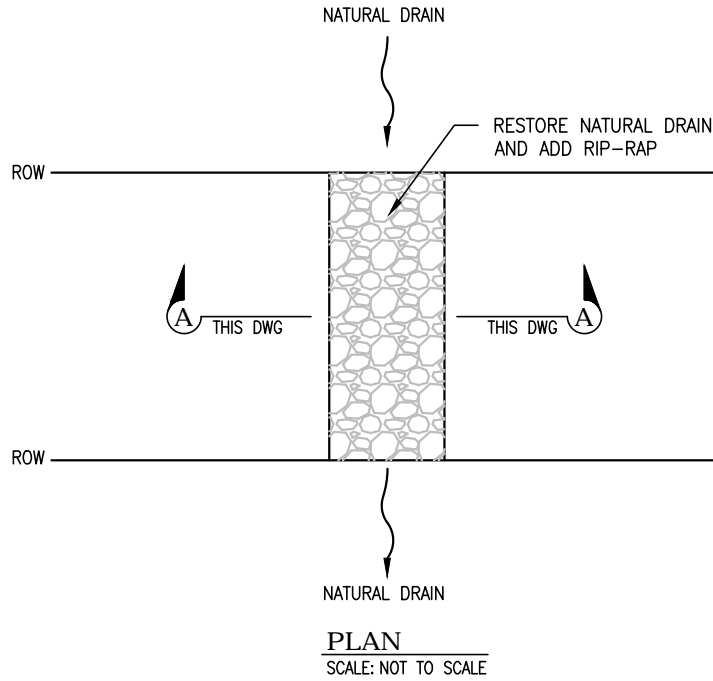
DRAWING NO.

MVP-39

REV.

0





THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:28 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



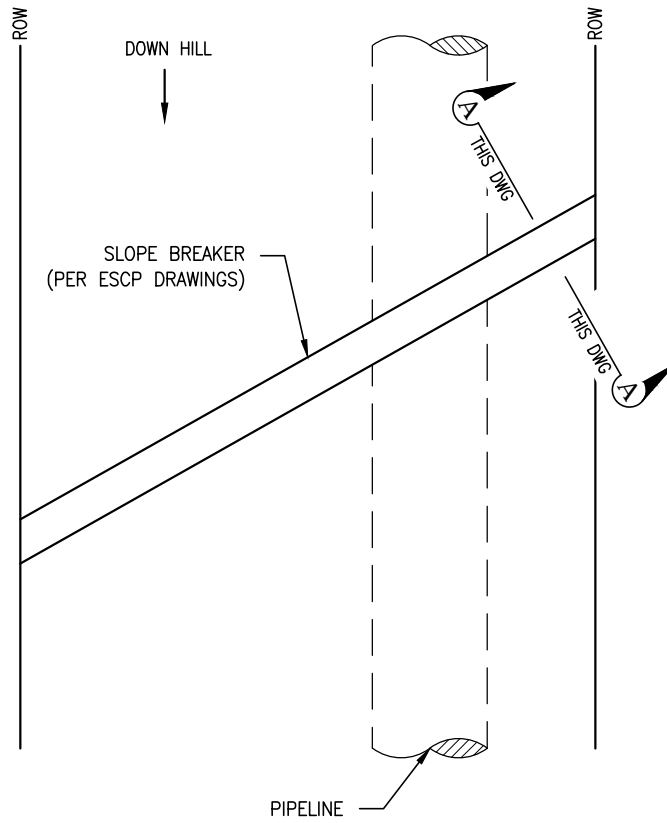
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

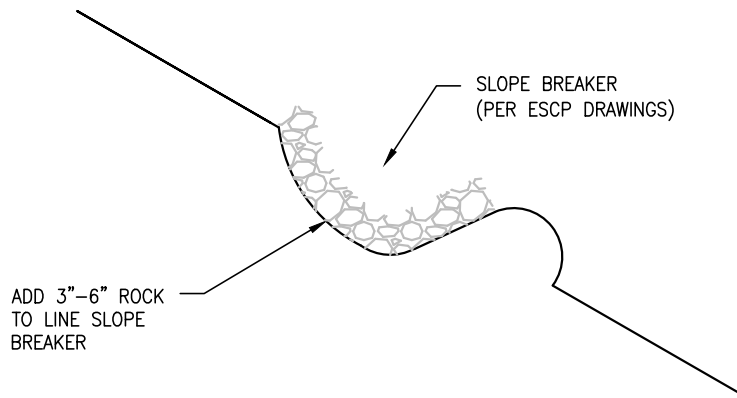
RIP-RAP NATURAL DRAIN

DRAWING NO.	MVP-40
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REV.	0
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**PLAN**  
SCALE: NOT TO SCALE



**SECTION A-A**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:33 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



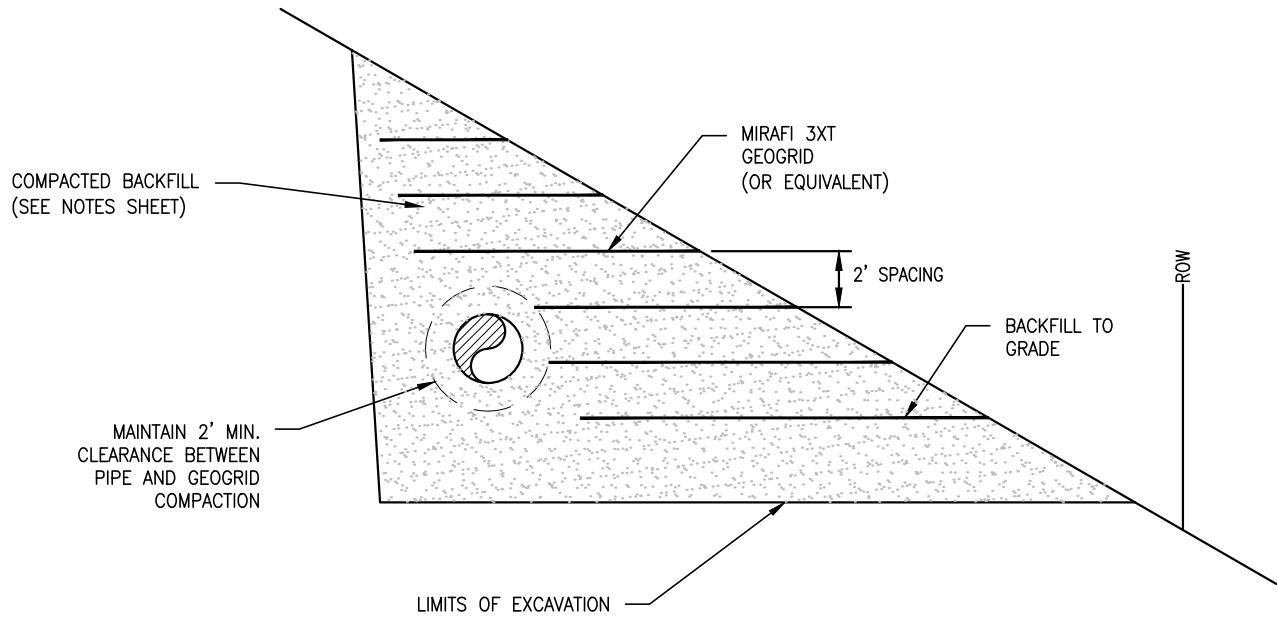
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

RIP-RAP SLOPE BREAKERS

DRAWING NO.  
MVP-41

REV.  
0



THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:34 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 3
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

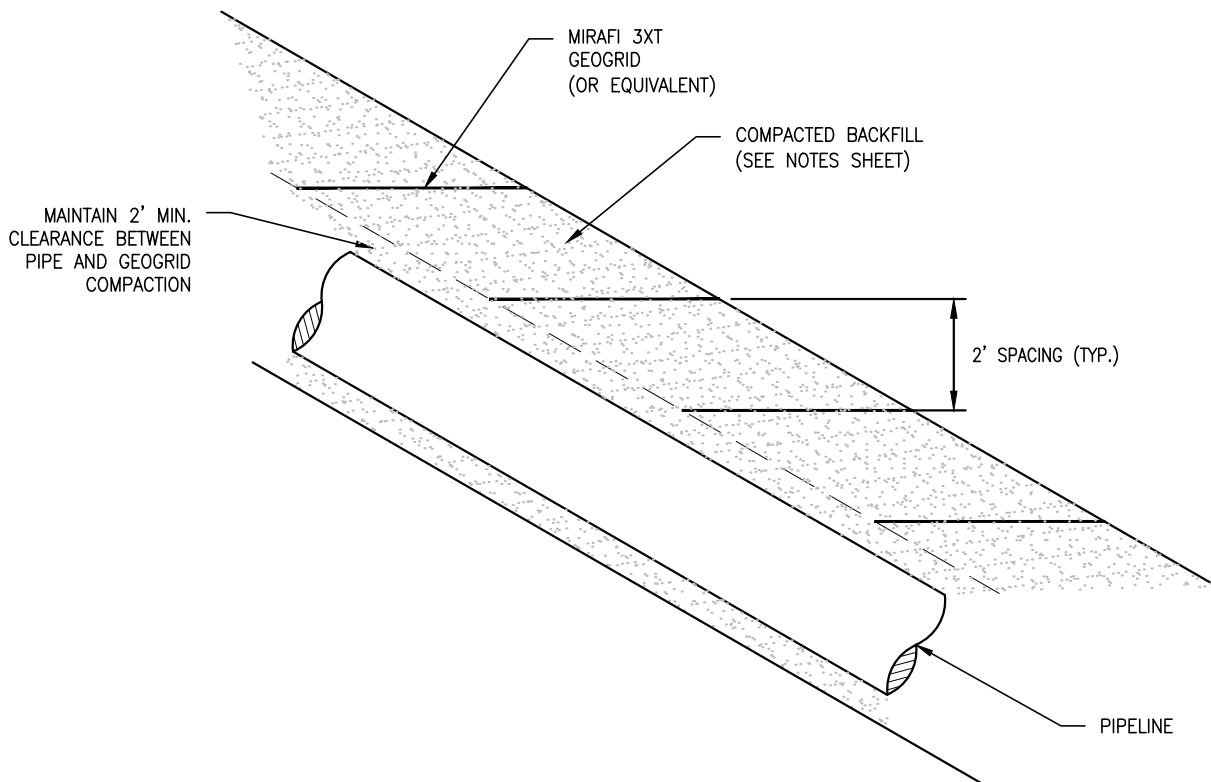


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

GEOGRID-SIDEHILL

DRAWING NO.	REV.
MVP-42A	0



**SECTION VIEW**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:41 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	2 OF 3
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

<b>SLIDE MITIGATION DETAIL</b>	
GEOGRID-PLANAR	
DRAWING NO.	REV.
MVP-42B	0

COMPACTION NOTES

- 1) ALL ROCKS LARGER THAN 6 INCHES IN SIZE, AND MORE THAN 10 PERCENT BY VOLUME SHOULD BE REMOVED AND PROPERLY DISPOSED FROM THE BACKFILL MATERIAL.
- 2) THE SUBGRADE AT THE BASE OF THE EXCAVATION SHOULD BE PROOFROLLED WITH A PNEUMATIC TIRED ROLLER OR VEHICLE.
- 3) THE EXCAVATED AREA SHALL BE BACKFILLED WITH THE CLEANED EXCAVATED SOIL MATERIAL AND COMPACTED IN PLACE.
- 4) BACKFILL OPERATIONS SHALL BE PERFORMED WHEN SOIL IS SUITABLE FOR COMPACTION (I.E., NOT IMMEDIATELY FOLLOWING A LARGE RAIN, SNOW, OR ICE EVENT). FROZEN FILL SHALL NOT BE USED.
- 5) THE BACKFILL SHALL BE PLACED IN COMPACTED LIFTS NO GREATER THAN 12 INCHES.
- 6) MAINTAIN A MINIMUM 2FT CLEARANCE BETWEEN COMPACTION ACTIVITY AND THE GAS PIPELINE.

GRAVEL DRAIN NOTES

- 1) GEOTEXTILE FABRIC SHALL BE TENCATE MIRAFI 140N OR APPROVED EQUIVALENT.
- 2) THE GEOTEXTILE FABRIC SHALL BE STORED UNDAMAGED PURSUANT TO MANUFACTURERS RECOMMENDATIONS.
- 3) DO NOT OPERATE CONSTRUCTION EQUIPMENT DIRECTLY ON THE GEOTEXTILE FABRIC.
- 4) DRAINAGE AGGREGATE SHALL MEET THE REQUIREMENTS OF AASHTO NO. 57 STONE.
- 5) DRAINAGE AGGREGATE SHALL NOT BE COMPACTED.

GEOGRID NOTES

- 1) GEOGRID REINFORCEMENT SHALL BE TENCATE MIRAFI 3XT OR APPROVED EQUIVALENT.
- 2) THE GEOGRID MATERIAL SHALL BE STORED UNDAMAGED PURSUANT TO MANUFACTURERS RECOMMENDATIONS.
- 3) GEOGRID SHALL BE PLACED HORIZONTALLY ON THE BACKFILL WITH THE PRINCIPAL STRENGTH DIRECTION PERPENDICULAR TO THE FACE OF THE SLOPE. ADJACENT PIECES OF PRIMARY GEOGRID SHALL NOT OVERLAP BUT ARE TO BE BUTTED SIDE TO SIDE.
- 4) REMOVE ALL SLACK IN THE GEOGRID MATERIAL AND ANCHOR AS NECESSARY WITH PINS, OR BAGS TO PREVENT SLACK FROM DEVELOPMENT DURING FILL PLACEMENT AND COMPACTION.
- 5) FILL IS TO BE PLACED AND SPREAD DIRECTLY ON THE GEOGRID MATERIAL WITH RUBBER TIRED EQUIPMENT ONLY. SPEEDS ARE TO BE KEPT SLOW WITH AS FEW STOPS AND TURNS AS PRACTICAL.
- 6) DO NOT OPERATE TRACKED EQUIPMENT DIRECTLY ON THE GEOGRID MATERIAL.
- 7) MAINTAIN A MINIMUM 2FT CLEARANCE BETWEEN GEOGRID MATERIAL AND THE GAS PIPELINE.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 2:55 PM

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	3 OF 3
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



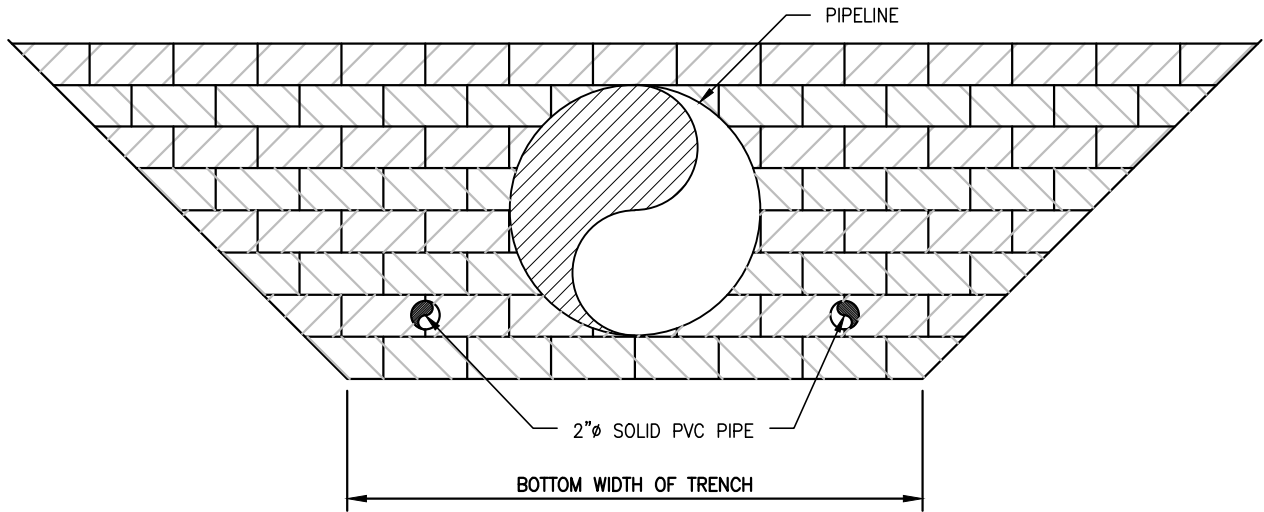
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

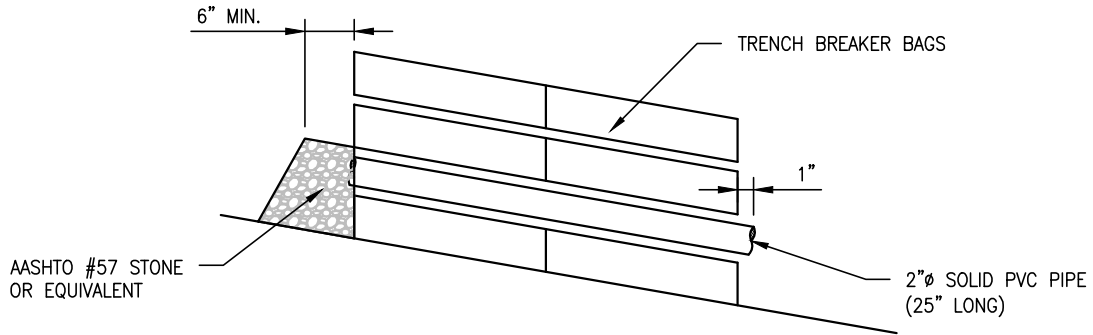
GEOGRID NOTES

DRAWING NO.	REV.
MVP-42C	0





**FRONT VIEW**  
SCALE: NOT TO SCALE



**SECTION VIEW**  
SCALE: NOT TO SCALE

**NOTES:**

1. PLACE PVC DRAIN PIPE ON FIRST LAYER OF TRENCH BREAKER BAGS.
2. PLACE PVC DRAIN PIPE EQUADISTANT FROM THE OUTSIDE EDGE OF THE 30" GAS PIPE AND THE BOTTOM LIMITS OF THE TRENCH.
3. EXTEND PVC PIPE THROUGH ENTIRE TRENCH BREAKER AND EXTEND APPROX. 1" PAST END OF BREAKER.
4. AASHTO#57 STONE SHALL BE PLACED TO A MINIMUM 6" THICKNESS UPSLOPE OF THE DRAIN PIPE.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 12:55 PM

DRAWN	TDD	DATE	4/14/2016
CHECKED	MMF	DATE	4/14/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



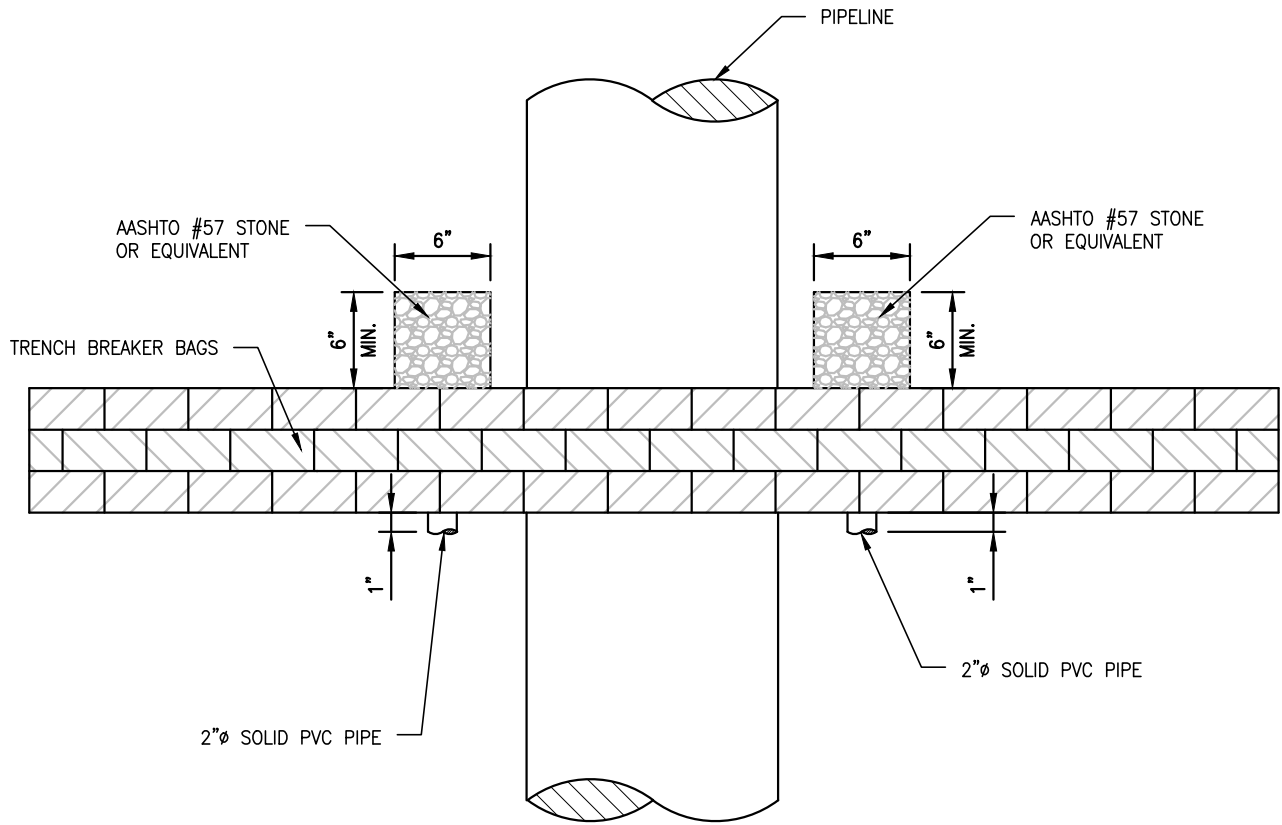
**DESIGN ENGINEERING**

**TYPICAL CONSTRUCTION DETAIL**

TRENCH BREAKER  
PASS-THROUGH DRAIN

DRAWING NO.  
MVP-43A

REV.  
0



PLAN VIEW  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	4/14/2016
CHECKED	MMF	DATE	4/14/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

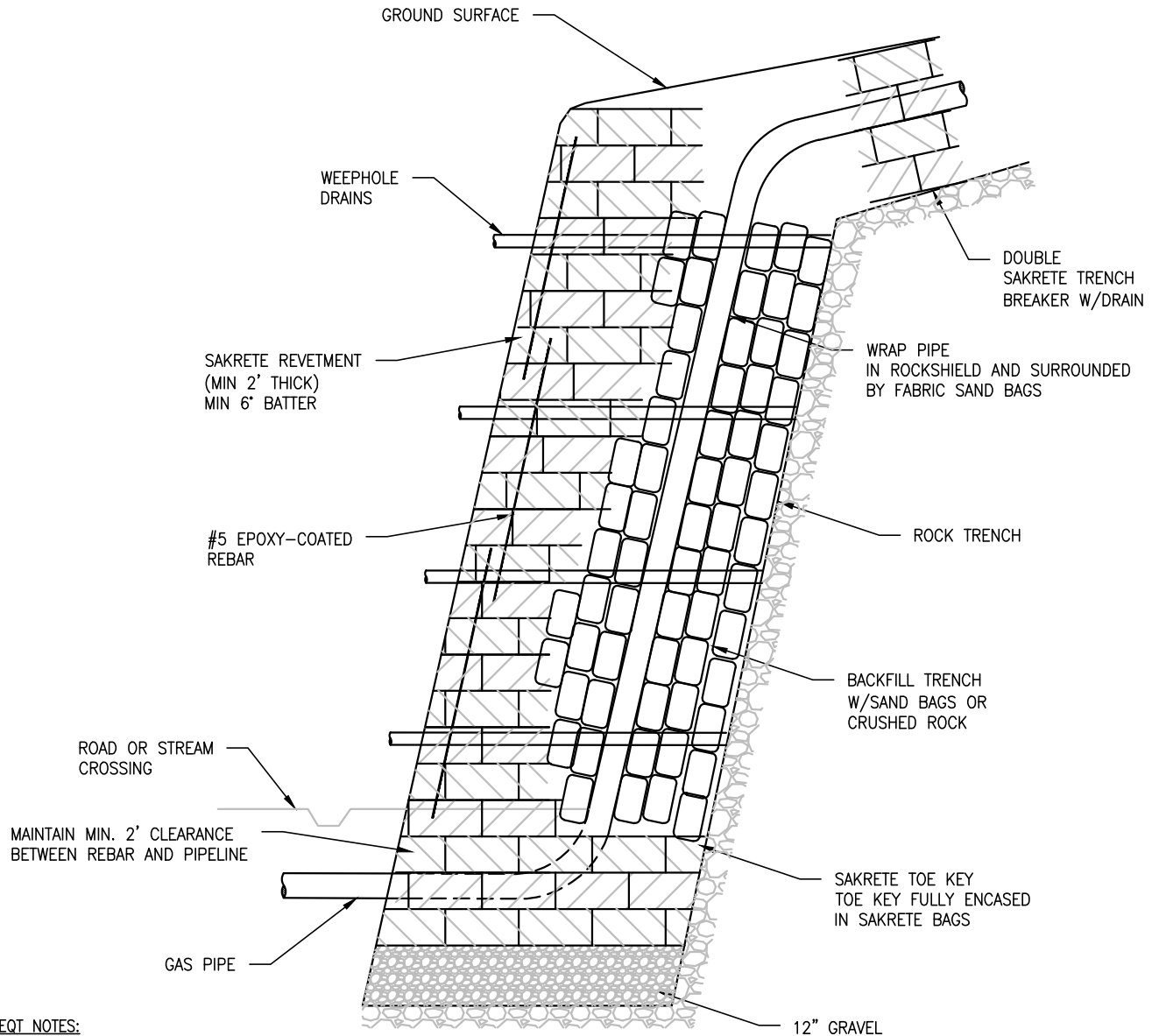
TRENCH BREAKER  
PASS-TROUGH DRAIN

DRAWING NO.

MVP-43B

REV.

0



**EQT NOTES:**

1. SAKRETE BAGS SHOULD EXTEND 4 BAGS DEEP PIPE SHOULD BE COMPLETELY SURROUNDED BY SAND BAGS, OR CRUSHED ROCK (MAX 6").
2. SAKRETE BAGS SHOULD BE STAGGERED IN A MASONRY FASHION. THE FACE OF THE WELL SHALL BE INCLINED 6"-10" FROM VERTICAL.
3. #5 REBAR SHOULD BE DRIVEN THROUGH THE SAKRETE BAGS (SEE DETAIL 1).
4. 2"Ø PVC WEEPHOLE DRAINS SHALL BE INSTALLED EVERY 15 FT.

12" GRAVEL LEVELING BASE  
 USE STONE FOR LEVELING ROCK BASE.  
 IF BASE IS NOT IN ROCK, USE 12" STONE LAYER FOR BASE.

**SIDE VIEW**  
 SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 1:23 PM

DRAWN	OL	DATE	6/29/2016
CHECKED	MMF	DATE	-
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

SLIDE MITIGATION  
 HIGHWALL REVETMENT  
 SIDE VIEW

DRAWING NO.	REV.
MVP-44A	0

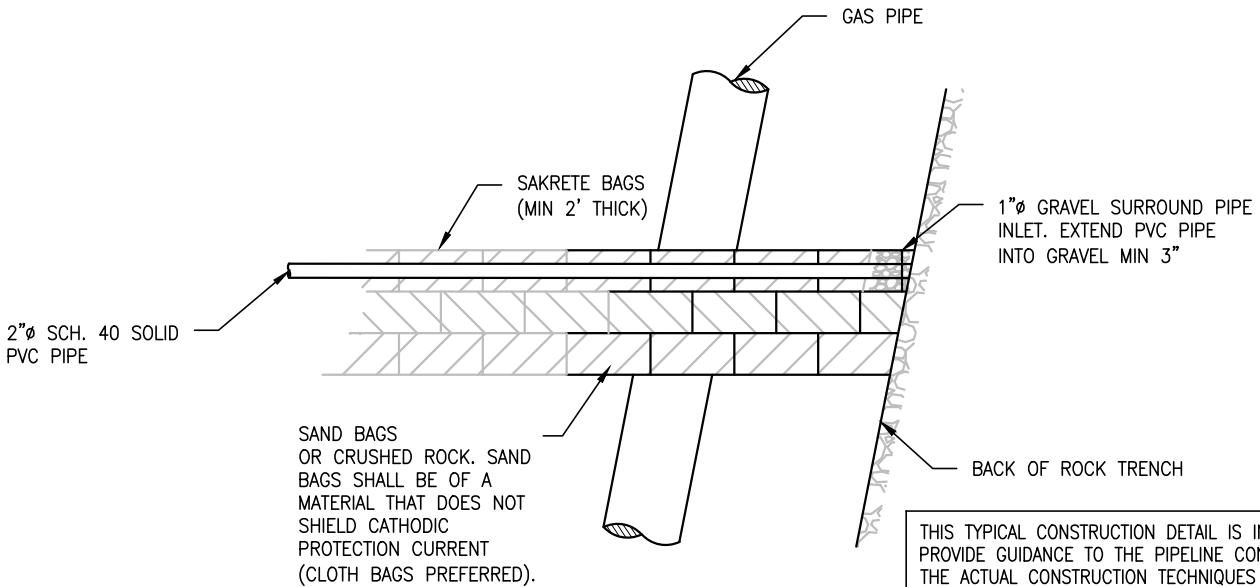
#5 EPOXY-COATED REBAR DRIVEN INTO PLACE. OVERLAP REBAR MIN. 3 BAGS. SPACE REBAR 12" HORIZONTALLY.

2"Ø PVC WEEPHOLE DRAINS (SEE DETAIL #2)

GAS PIPE (SPACE REBAR TO MAINTAIN MIN. 2' CLEARANCE FROM PIPELINE)

12" STONE LEVELING BASE

**FRONT VIEW**  
SCALE: NOT TO SCALE



**DRAIN DETAIL**  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 1:24 PM

DRAWN	OL	DATE	6/29/2016
CHECKED	MMF	DATE	-
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	2 OF 2
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			



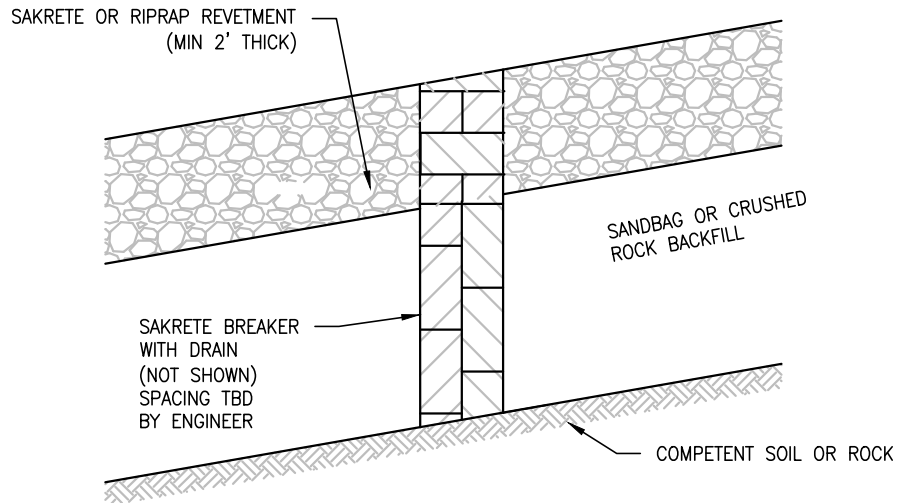
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

SLIDE MITIGATION  
HIGHWALL REVETMENT  
FRONT VIEW AND DRAIN DETAIL

DRAWING NO.  
MVP-44B

REV.  
0



SIDE VIEW  
SCALE: NOT TO SCALE

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	TDD	DATE	2/03/2016
CHECKED	MMF	DATE	2/03/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP – VA PORTION			



DESIGN ENGINEERING

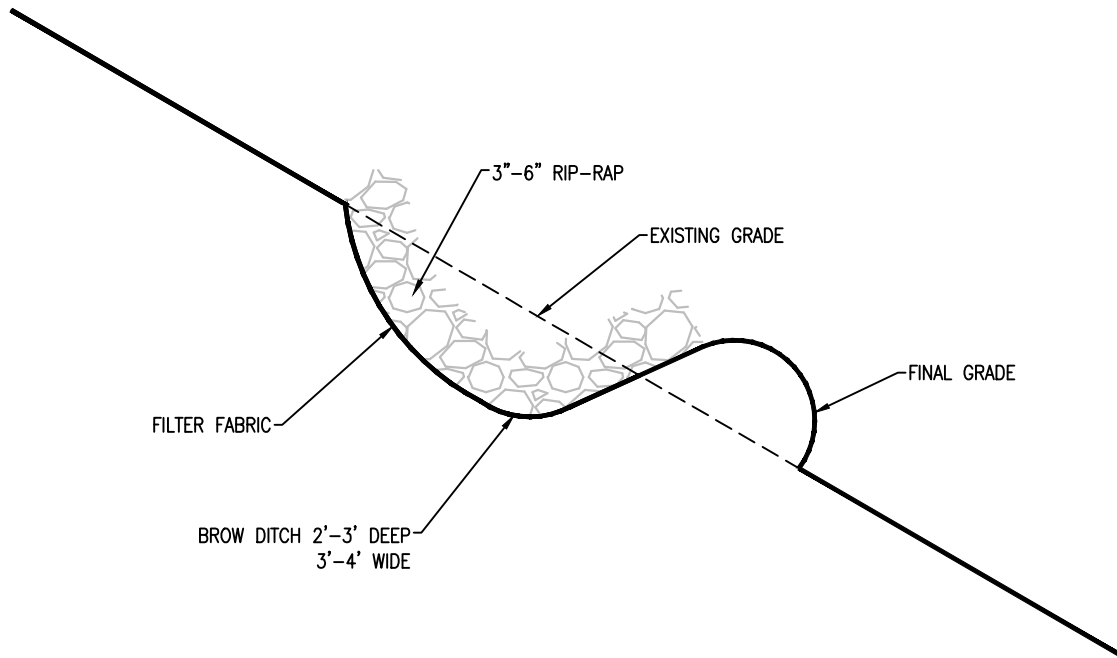
**TYPICAL CONSTRUCTION DETAIL**

STEEP SLOPE REVETMENT

DRAWING NO.	MVP-45
REV.	0

Plotted by: Kusowski, Jim on: August 16, 2017 - 1:27 PM





THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

Plotted by: Kusowski, Jim on: August 16, 2017 - 1:28 PM

DRAWN	TDD	DATE	7/12/2016
CHECKED	MMF	DATE	7/12/2016
APP'D		DATE	08/11/17
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
MVP - VA PORTION			

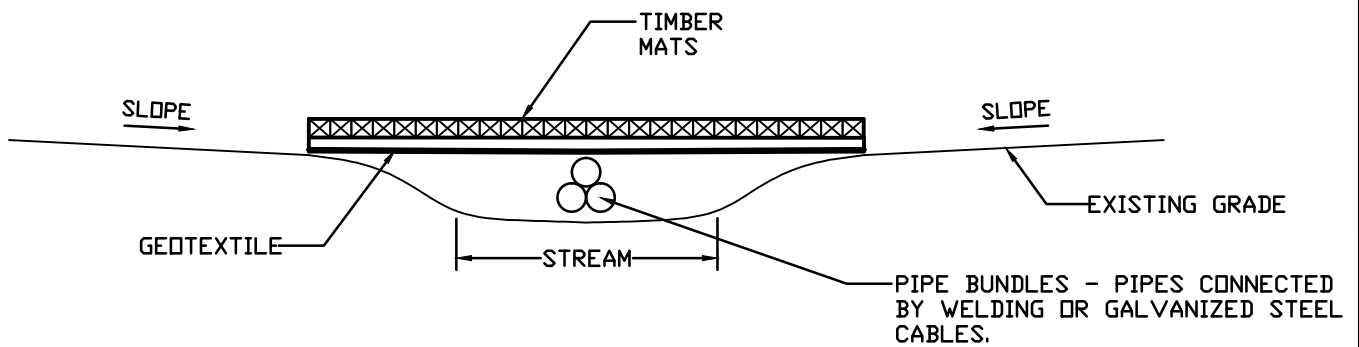


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

BROW DITCH DETAIL

DRAWING NO.	REV.
MVP-46	0



**NOTE:**

CFS TO BE INSTALLED AT THE END OF EACH WORKING DAY.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

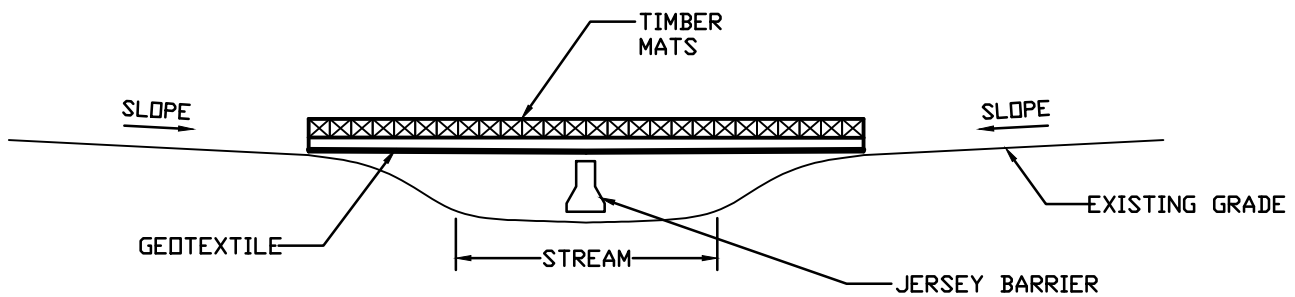


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

TIMBER MAT AND PIPE BUNDLE  
TEMPORARY STREAM CROSSING

DRAWING NO.	REV.
MVP-47	0



**NOTE:**

CFS TO BE INSTALLED AT THE END OF EACH WORKING DAY.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
APP'D	XXX	DATE	10/6/2016
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
PXXXX			

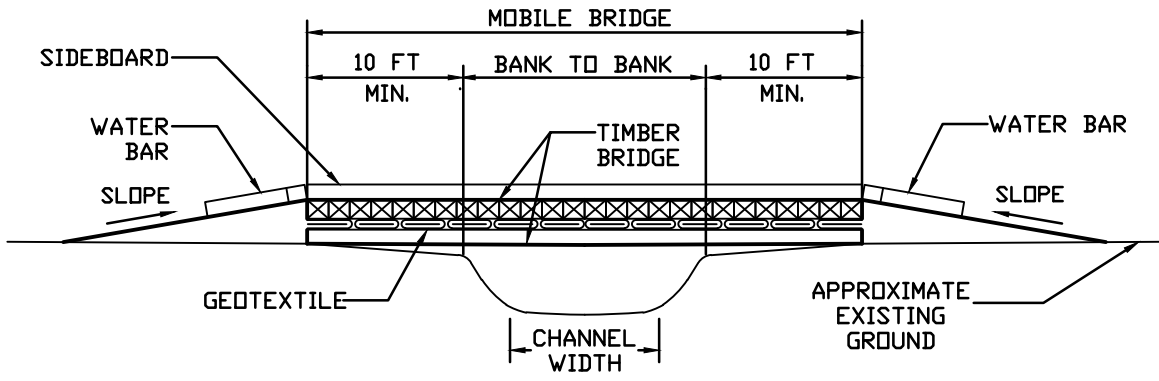
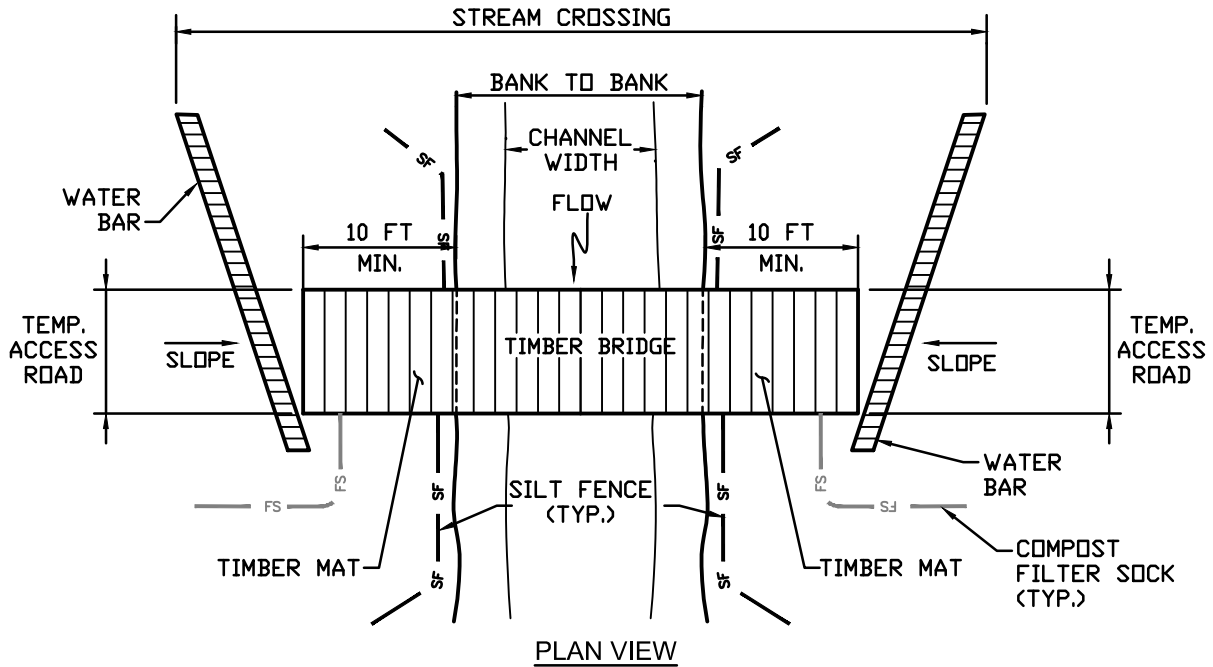


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

TIMBER MAT AND JERSEY BARRIER  
TEMPORARY STREAM CROSSING

DRAWING NO.	MVP-48	REV.	0
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CROSS SECTION - MOBILE BRIDGE

**NOTES:**

1. INSTALL WATER BARS OR SILT FENCE AT APPROACHES TO STREAM CROSSING AND COMPOST FILTER SOCKS ALONG STREAM BANKS. INSTALL COMPOST FILTER SOCK AT OUTLET OF WATER BARS.
2. MAINTAIN SURFACE OF TEMPORARY EQUIPMENT CROSSING TO PREVENT SOIL DISCHARGES TO STREAM.
3. APPROACHES TO CROSSINGS ARE NOT TO EXCEED A DEPTH OF 6 INCHES ABOVE ORIGINAL GRADE.
4. GEOTEXTILE LINER TO COME UP ON THE SIDES OF THE BRIDGE A MINIMUM OF 18".
5. SIDEBOARDS TO BE ATTACHED TO THE UPPER DECK. GEOTEXTILE TO BE WRAPPED AROUND SIDEBOARDS PRIOR TO FASTENING.

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DRAWN	JL	DATE	10/6/2016
CHECKED	MMF	DATE	10/6/2016
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SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
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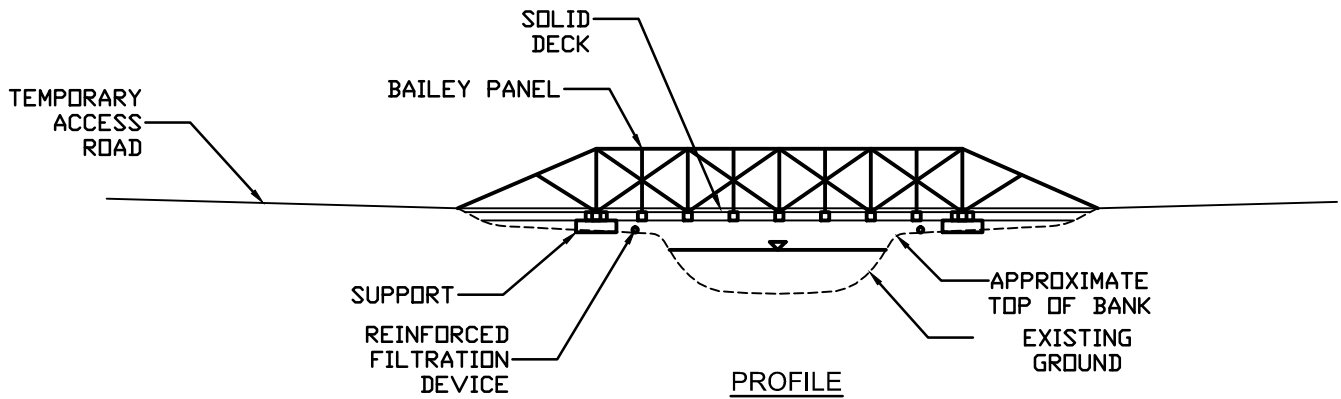
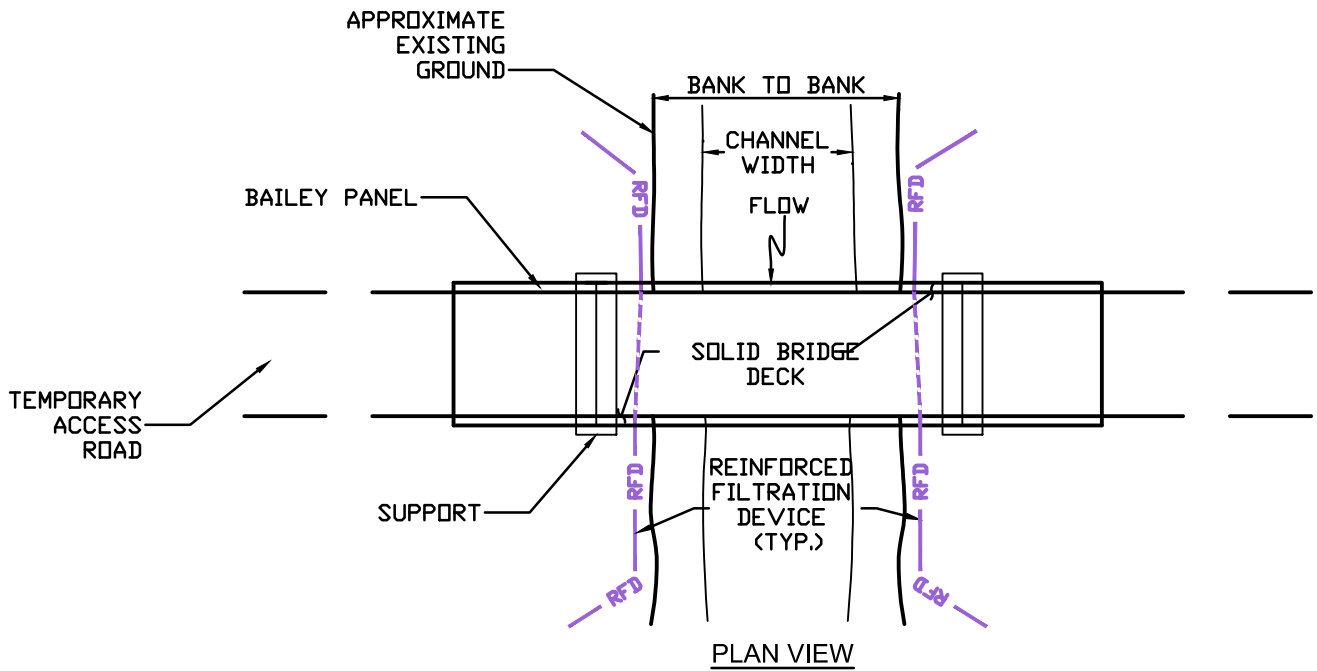


DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

MOBILE BRIDGE

DRAWING NO.	MVP-49	REV.	0
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THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE	10/6/2016
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SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:			
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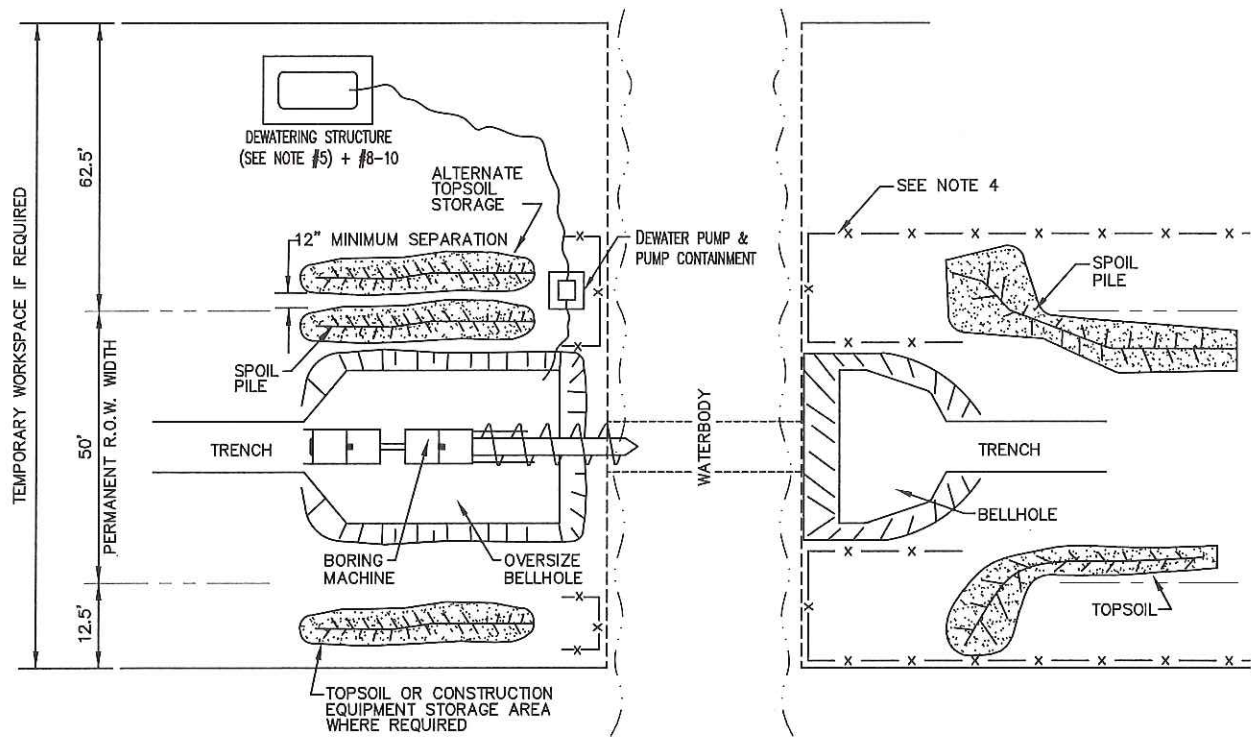
DESIGN ENGINEERING

**TYPICAL CONSTRUCTION DETAIL**

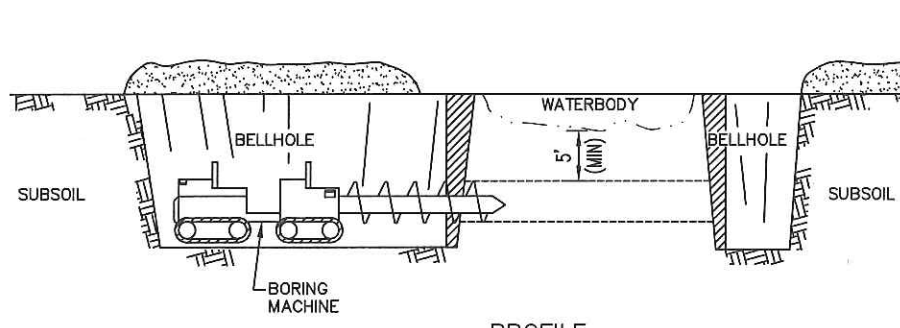
MODULAR TEMPORARY  
BAILEY BRIDGE

DRAWING NO.	REV.
MVP-50	0

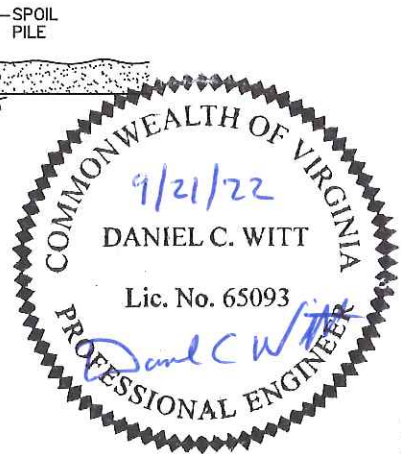




PLAN VIEW  
(NOT TO SCALE)



PROFILE



**NOTES:**

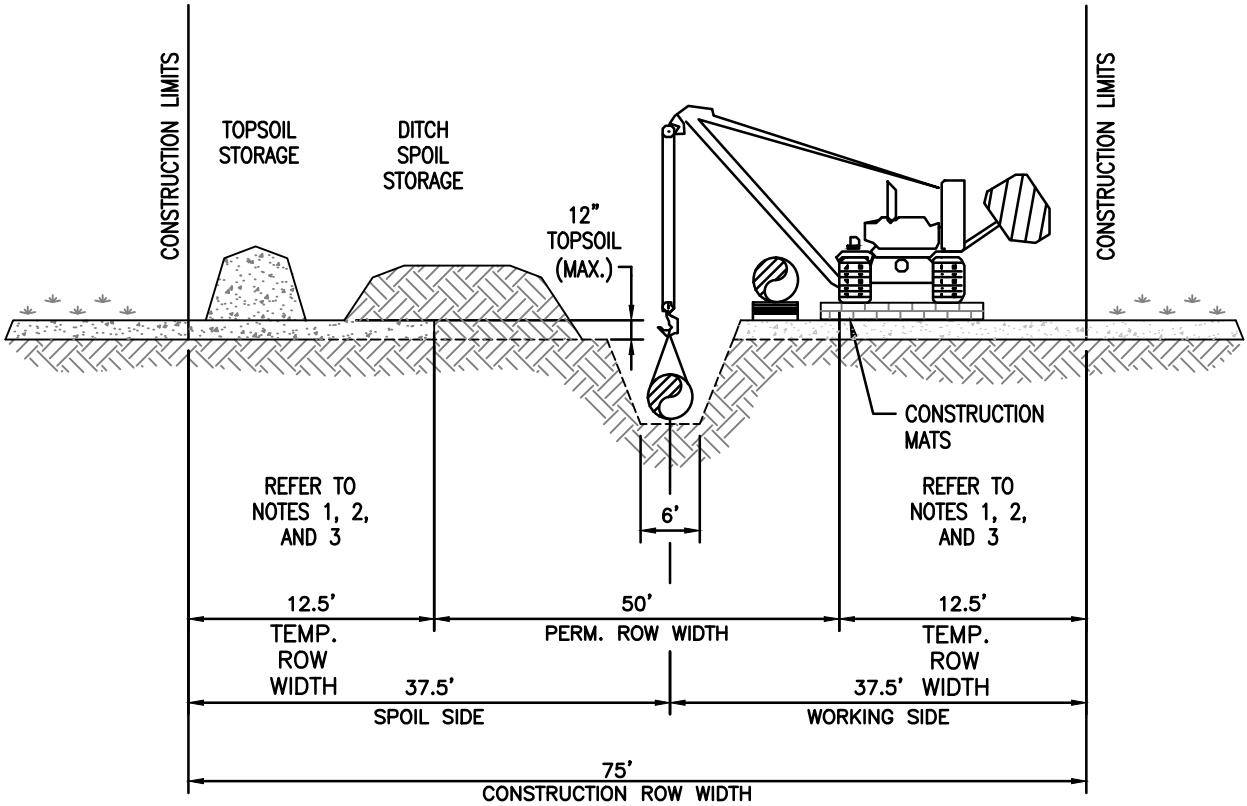
1. STRIP TOPSOIL FROM THE BELLHOLE AREA IN UNMANAGED WOODLAND. STRIP TOPSOIL FROM THE BELLHOLE AND SPOIL STORAGE AREA.
2. EXCAVATE BELLHOLE, STORING SPOIL ON OPPOSITE SIDE OF R.O.W. FROM TOPSOIL OR ADJACENT TO TOPSOIL MAINTAINING A MINIMUM 12 INCHES OF SEPARATION TO AVOID MIXING TOPSOIL AND SPOIL. SPOIL PILES MUST BE KEPT A MINIMUM OF 10 FEET FROM WATER'S EDGE AND WILL BE CONTAINED BY SEDIMENT BARRIERS.
3. THE SIDES OF THE BORE PITS SHALL BE SLOPED BACK TO STABLE CONFIGURATION UNLESS SUPPORTED BY SHEET PILING OR OTHER SHORING MEANS. INSTALL SAFETY FENCE AROUND BORE PITS AS NECESSARY.
4. INSTALL TEMPORARY EROSION CONTROL PROCEDURES AS SPECIFIED IN THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. DEWATER BORE PIT TO CONTROL SEEPAGE WATER FLOW PER THE ANNUAL STANDARDS & SPECIFICATIONS, DEWATER INTO AN APPROPRIATE DEWATERING STRUCTURE. REFER TO TYPICAL MVP-ES2 PUMPED WATER FILTER BAG AND STD & SPEC 3.26 DEWATERING STRUCTURE.
6. UPON COMPLETION OF PIPE INSTALLATION AND TIE-INS, BACKFILL PIT SPOIL. NO EXCESS SPOIL WILL BE SPREAD WITHIN FLOOD PLAINS OR DELINEATED WETLANDS AREAS.
7. BORE DEPTH WILL BE DETERMINED BASED ON SCOUR ANALYSIS HOWEVER A MINIMUM OF 5 FEET OF SEPARATION BETWEEN TOP OF BORE PROFILE & BOTTOM OF WATERBODY CHANNEL WILL BE MAINTAINED.
8. DEWATERING STRUCTURE WILL BE PLACED IN A STABILIZED AREA AWAY FROM WATERBODY AND WETLANDS.
9. PUMPING RATE WILL NOT EXCEED MFG'S RECOMMENDATIONS AND WILL NOT RESULT IN INCREASED EROSION. ENSURE FILTER BAG IS APPROPRIATELY SIZED BASED ON PUMPING RATE.
10. DEWATERING ACTIVITY SHALL BE MONITORED DURING OPERATION.

DRAWN	JJZ	DATE	9/21/2022
CHECKED	-	DATE	-
APP'D	-	DATE	-
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL	
TYPICAL WATERBODY CONVENTIONAL BORE	
DRAWING NO.	MVP-51
REV.	0



NOTES:

1. TOPSOIL SEGREGATION/REMOVAL WILL ONLY BE CONDUCTED WITHIN THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA.
2. GRUBBING ACTIVITIES SHALL BE LIMITED TO THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA. OUTSIDE OF THE PERMANENT EASEMENT, WETLAND VEGETATION SHALL ONLY BE REMOVED AT OR ABOVE THE GROUND SURFACE. WOODY VEGETATION WITHIN THE TEMPORARY EASEMENT SHALL BE CUT AT GROUND SURFACE WITH THE STUMPS TO REMAIN IN-PLACE.
3. WETLAND CROSSINGS IN VIRGINIA SHALL BE CONDUCTED IN ACCORDANCE WITH NWP12 GENERAL AND NORFOLK DISTRICT REGIONAL CONDITIONS.

THIS TYPICAL CONSTRUCTION DETAIL IS INTENDED TO PROVIDE GUIDANCE TO THE PIPELINE CONTRACTOR. THE ACTUAL CONSTRUCTION TECHNIQUES MAY DIFFER DEPENDING UPON FIELD CONDITIONS AND OR REGULATORY REQUIREMENTS.

DRAWN	JL	DATE		
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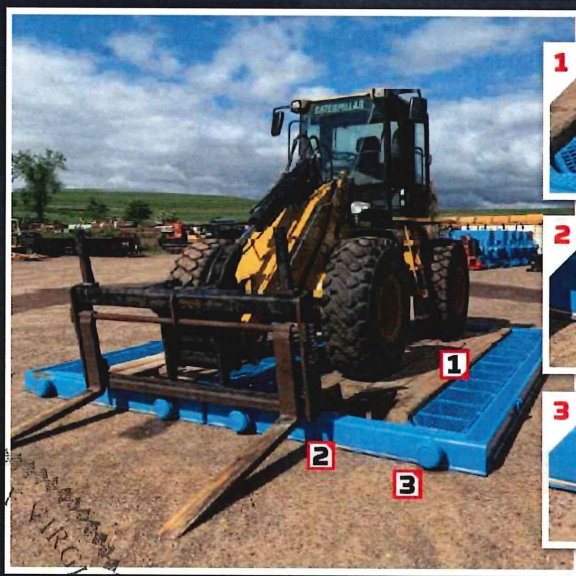
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

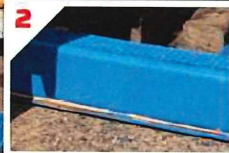
WETLAND CROSSING TYPICAL FOR  
USACE NORFOLK (VA) DISTRICT

DRAWING NO.	MVP-53	REV.	0
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1  
Removable grate to clean out sediment



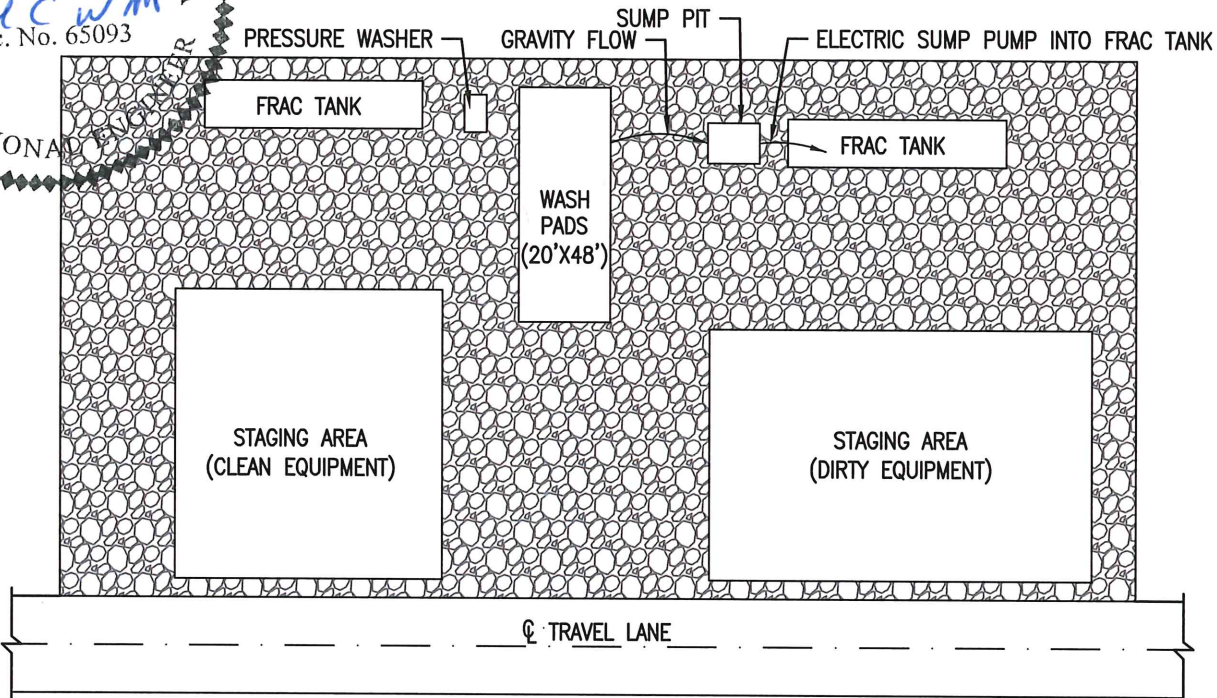
2  
Solid steel base, sealed to collect sediment & water



3  
Drain hose/piping connection - use valves on sloped side of wash pad

TYPICAL EQUIPMENT WASH PAD

COMMONWEALTH OF VIRGINIA  
 9/11/23  
 DANIEL C. WITT  
*Daniel C. Witt*  
 Lic. No. 65093  
 PROFESSIONAL ENGINEER



NOTES:

- EQUIPMENT WASH STATIONS WILL BE SET UP WHEN IT IS NECESSARY TO WASH EQUIPMENT TO MANAGE INVASIVES OR MEASURES MUST BE TAKEN TO MINIMIZE THE DISCHARGE OF WASH WATER AND POTENTIAL POLLUTANTS.
- EQUIPMENT AND VEHICLE WASH OUT AREAS WILL BE CONSTRUCTED AS SHOWN ON THIS TYPICAL DETAIL.
- SPECIFIED STATIONS FOR CLEAN OR DIRTY EQUIPMENT WILL BE INDICATED CLEARLY IN THE FIELD.
- A WORKFLOW PATH THAT PROGRESSES FROM PARKING DIRTY EQUIPMENT ON THE WASH PAD TO CLEAN EQUIPMENT PARKING WILL BE DELINEATED TO ENSURE CROSS CONTAMINATION BETWEEN STATIONS DOES NOT OCCUR.
- THE WASH OUT AREA WILL BE CONSTRUCTED TO CONTAIN ALL WASH WATER AND DIRECT IT TO ADEQUATELY SIZED SUMP PIT LINED WITH AN IMPERMEABLE LINER TO PREVENT INFILTRATION.
- WASH WATER WILL BE DIRECTED TO FRAC TANKS FOR HOLDING. TANKER TRUCKS WILL THEN MOVE THE FRAC TANK CONTENTS OFFSITE TO A DESIGNATED APPROVED DISPOSAL FACILITY.
- STRAW WATTLES WILL BE PLACED AROUND THE WASH OUT AREA TO ENSURE WASH WATER IS LOCALIZED AND INHIBITED FROM LEAVING THE SITE. WASH WATER THAT LEAVES THE WASHOUT AREA WILL FIRST BE FILTERED THROUGH THE STRAW WATTLE BEFORE REACHING THE PERIMETER SILT FENCING.
- NO SOAPS OR SOLVENTS WILL BE ALLOWED FOR USE IN EQUIPMENT WASH WATER UNLESS SPECIFICALLY REQUIRED, THE SWPPP WILL REQUIRE AMENDMENT TO SHOW THE EXTRA PRECAUTIONS IMPLEMENTED.

DRAWN	JJZ	DATE	08/22/23
CHECKED	IHH	DATE	08/22/23
APP'D	DCW	DATE	08/22/23
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:  PXXXX			



DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

EQUIPMENT WASH STATION

DRAWING NO.  MVP-54	REV.  0
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