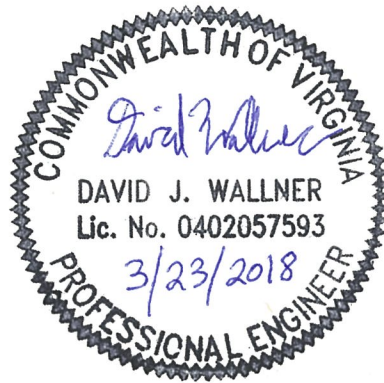


By virtue of this seal and signature, all supporting documents included in this package are accurate and support the design presented herein.



EROSION AND SEDIMENT CONTROL NARRATIVE

1. PROJECT DESCRIPTION:

THE MOUNTAIN VALLEY PIPELINE PROJECT (PROJECT) WILL EXTEND FROM THE EXISTING EQUITRANS, L.P TRANSMISSION SYSTEM AND OTHER NATURAL GAS FACILITIES IN WETZEL COUNTY, WEST VIRGINIA TO TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC'S ZONE 5 COMPRESSOR STATION 165 IN PITTSYLVANIA COUNTY, VIRGINIA. IN ADDITION, THE PROJECT WILL INCLUDE APPROXIMATELY 171,600 HORSEPOWER OF COMPRESSION AT THREE COMPRESSOR STATIONS CURRENTLY PLANNED ALONG THE ROUTE, AS WELL AS MEASUREMENT, REGULATION, AND OTHER ANCILLARY FACILITIES REQUIRED FOR THE SAFE AND RELIABLE OPERATION OF THE PIPELINE. THE PIPELINE IS DESIGNED TO TRANSPORT UP TO 2.0 MILLION DEKATHERMS PER DAY OF NATURAL GAS.

SPREAD 9 CONSISTS OF APPROXIMATELY 31.1 MILES OF 42" NATURAL GAS PIPELINE, CONSTRUCTED WITHIN GILES, CRAIG, AND MONTGOMERY COUNTIES. THE SPREAD STARTS AT THE INTERSECTION OF THE PIPELINE AND KOW CAMP ROAD (STATE ROUTE 615) AND ENDS JUST SOUTH OF U.S. 11 (LEE HIGHWAY). ACCESS TO THE PIPELINE WILL BE PROVIDED BY EXISTING ROADS, FOR BOTH PERMANENT AND TEMPORARY ACCESS. DISTURBED LAND WILL BE RETURNED TO APPROXIMATE PRE-EXISTING CONTOURS. THE CONSTRUCTION LIMITS OF DISTURBANCE (LOD) WILL BE 125 FEET WIDE. THE TOTAL SPREAD 9 LOD AREA IS 831 ACRES. THE PERMANENT RIGHT-OF-WAY (ROW) WILL BE 50 FEET WIDE. THE ROW MAY SHIFT AS A RESULT OF FIELD CONDITIONS DISCOVERED DURING CONSTRUCTION. THE ROW WILL NOT MOVE BEYOND THE TEMPORARY LOD DEPICED ON THE PLAN SHEETS. BMPS DESIGNED FOR THE ORIGINAL ROW ALIGNMENT WILL BE IMPLEMENTED ALONG THE MODIFIED ROW ALIGNMENT.

2. EXISTING SITE CONDITIONS:

EXISTING TOPOGRAPHY IS HIGHLY VARIABLE OVER THE PIPELINE ROUTE WITH GRADES RANGING FROM 0.5% TO 65%. EXISTING GROUND COVER INCLUDES PASTURE, AGRICULTURAL ACTIVITIES, SINGLE FAMILY HOMES AND OTHER STRUCTURES, STREAMS, WETLANDS, PONDS, ROADS AND RAILROADS. THERE ARE 272 DISTINCT DRAINAGE AREAS ALONG THE PIPELINE ROUTE.

3. ADJACENT AREAS:

ADJACENT AREAS INCLUDE: OTHER FORESTED AREAS, SINGLE-FAMILY HOME SITES, AGRICULTURAL ACTIVITIES (E.G. CROPS, HAY PRODUCTION), PASTURE, STREAMS, WETLANDS, PONDS, ROADS AND RAILROADS.

4. OFF-SITE AREAS:

NO OFF-SITE LAND DISTURBING ACTIVITIES ARE PROPOSED. ANY OFF-SITE LAND-DISTURBING ACTIVITY ASSOCIATED WITH THE PROJECT MUST HAVE AN APPROVED ESC PLAN.

5. SOILS:

THE SOILS LOCATED WITHIN THE LOD INCLUDE:

ALLEGHENY LOAM (1B AND 2C), BERKS AND WEIKERT SOILS (6E), BERKS AND WEIKERT VERY STONY SOILS (7D), BERKS CHANNERY SILT LOAM (2D), BERKS-CLYMER COMPLEX (1C), BERKS-CULLEOKA COMPLEX (6E AND 6G), BERKS-LOWELL-RAYNE COMPLEX (3E), BERKS-ROCK OUTCROP COMPLEX (4E), BERKS-WEIKERT COMPLEX (5D), BRADDOCK SANDY LOAM (4B AND 4C), CALVIN-ROUGH COMPLEX (10G), CANEYVILLE-OPEQUON-ROCK OUTCROP COMPLEX (8D AND 8E), CARBO AND CHILHOWIE SOILS (9C AND 9D), CARBO SILTY CLAY LOAM VERY ROCKY (5D), CARBO-ROCK OUTCROP COMPLEX (6F AND 11E), CHAGRIN SILT LOAM (7), CRAIGSVILLE SOILS (10), DUFFIELD-ERNEST COMPLEX (11B AND 11C), FAYWOOD SILT LOAM (11D AND 11F), FREDERICK AND VERTREES GRAVELLY SILT LOAM (13C AND 13D), FREDERICK AND VERTREES SILT LOAM (12B AND 12C), FREDERICK GRAVELLY SILT LOAM (14C, 14D, AND 14E), FREDERICK SILT LOAM (13D, 13E, 19C, AND 19D), FREDERICK VERY STONY SILT LOAM (15E), FREDERICK-ROCK OUTCROP COMPLEX (16F), GILPIN SILT LOAM (17D AND 17F), GILPIN VERY STONY SILT LOAM (18D AND 18F), GROSECLOSE AND POPLIMENTO GRAVELLY SOILS (17C), GROSECLOSE AND POPLIMENTO SOILS (16D AND 16E), GROSECLOSE SILT LOAM (24D AND 24E), GROSECLOSE-LITZ COMPLEX (25D), GUERNSEY SILT LOAM (19B), HAYTER LOAM (20B), HAYTER SOILS (21C), JEFFERSON EXTREMELY STONY SOILS (24D), JEFFERSON SOILS (22C), JEFFERSON VERY STONY SOILS (23C), MCGARY AND PURDY SOILS (25), NOLICHUCKY LOAM (29B, 29C, AND 29D), NOLICHUCKY VERY STONY SANDY LOAM (30C, 30D, AND 30F), OPEQUON-ROCK OUTCROP COMPLEX (33E), ORISKANY GRAVELLY FINE SANDY LOAM (27E), POPE FINE SANDY LOAM (31A), POPIMENTO SILT LOAM (31C, 31D, AND 31E), ROSS SOILS (28), SEQUIA SILT LOAM (33D AND 33F), SOTTOWER LOAM (39C), TIMBERVILLE VARIANT LOAM (35C), TUMBLING LOAM (36C), UDORHTENTS AND URBAN LAND (29), UNISON AND BRADDOCK SOILS (30B, 30C, AND 30D), WEAVER SOILS (33), WEIKERT-ROCK OUTCROP COMPLEX (55F), WURNO-CANEYVILLE COMPLEX (34E)

6. CRITICAL AREAS:

THERE ARE WETLAND AND WATERBODY CROSSINGS ALONG THE PIPELINE ROUTE, AS WELL AS WETLANDS AND STREAMS ADJACENT TO THE LOD. PRIOR TO GRADING ACTIVITIES, SEDIMENT BARRIERS WILL BE INSTALLED ACROSS THE CONSTRUCTION AREA AT THE EDGE OF THE WATER OR THE EDGE OF THE WETLAND, AND ALONG THE SIDES OF THE CONSTRUCTION WORK AREA AS NEEDED TO PREVENT THE FLOW OF SPOIL INTO THE WATERBODY OR WETLAND. SEDIMENT BARRIERS WILL BE PROPERLY MAINTAINED THROUGHOUT CONSTRUCTION AND REINSTALLED AS NECESSARY UNTIL REPLACED BY PERMANENT EROSION CONTROLS OR RESTORATION OF DISTURBED ADJACENT UPLAND AREAS IS COMPLETE. AT WETLAND AND STREAM CROSSINGS, THE CONSTRUCTION LOD HAS BEEN REDUCED FROM 125 FEET TO 75 FEET TO MINIMIZE IMPACTS. THE PRINCIPAL CROSSING METHOD WILL BE OPEN-CUT DRY-DITCH, INCLUDING FLUME PIPE CROSSING, COFFERDAM (PORTA-DAM) CROSSING AND DAM AND PUMP. WATERBODY AND WETLAND CROSSINGS WILL BE CLEARLY MARKED IN THE FIELD PRIOR TO THE START OF TREE CLEARING ACTIVITIES. TRENCH PLUGS WILL BE USED AT ALL WATERBODY CROSSINGS TO PREVENT DIVERSION OF WATER INTO UPLAND PORTIONS OF THE PIPELINE TRENCH AND TO KEEP ANY ACCUMULATED TRENCH WATER OUT OF THE WATERBODY. FINAL GRADING WILL BEGIN PROMPTLY AFTER BACKFILLING IS COMPLETED AND THEN STABILIZED IMMEDIATELY. WHEN TIMBER MATS ARE USED FOR WETLAND AND WATERBODY CROSSINGS, THE BRIDGE ENTRANCE AND EXIT ARE PROTECTED WITH BMPS (TYPICALLY COMPOST FILTER SOCK) ALONG WITH GEOTEXTILE LAYERED BETWEEN THE TIMBER MATS. THE SIDES OF THE BRIDGE ARE PROTECTED WITH WOOD CURBS, TOE BOARDS, SIDE BOARDS OR WEDGES TO PROTECT THE WATERBODY FROM SPOIL SLOUGHING OFF THE TIMBERMATS INTO THE WATERBODY. TO FURTHER PROTECT WATERS FROM SEDIMENT TRACKED ONTO THE TIMBER MATS, ADDITIONAL CONTROLS WILL BE ADDED IN THE FIELD AS NECESSARY. TIMBER MATS WILL BE CLEARED OF SOIL/ROCK MUD ACCUMULATION AT THE END OF EACH DAY.

MANY PORTIONS OF THE PIPELINE ROUTE ARE LOCATED IN LANDSLIDE SUSCEPTIBLE AREAS. THESE LANDSLIDE SUSCEPTIBLE AREAS PRIMARILY OCCUR IN WEATHERED BEDROCK OR COLLUVIAL SOIL AND WITHIN OLD LANDSLIDE DEBRIS LOCATED ON STEEP SLOPES. REFER TO THE PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS FOR VIRGINIA FOR THE LANDSLIDE MITIGATION PLAN (APPENDIX F)

ACIDIC SOILS AREAS ARE KNOWN TO OCCUR IN PORTIONS OF THE PROJECT AREA. REFER TO THE PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS FOR VIRGINIA FOR THE ACID FORMING MATERIALS IDENTIFICATION AND TESTING WORK PLAN (APPENDIX G).

KARST FEATURES ARE LOCATED WITHIN 1/4 MILE (THE SECONDARY KARST BUFFER) AND WITHIN 150 FEET OF THE PROPOSED ROUTE. REFER TO THE PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS FOR VIRGINIA FOR THE KARST HAZARDS ASSESSMENT (APPENDIX H).

7. EROSION AND SEDIMENT CONTROL MEASURES:

UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE CONSTRUCTED AND MAINTAINED ACCORDING TO THE MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, THIRD EDITION, 1992, AS WELL AS ANY ADDITIONAL MEASURES REQUIRED BY APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

- 1. STRUCTURAL PRACTICES
3.01 - SAFETY FENCE
3.02 - CONSTRUCTION ENTRANCE
3.04 - STRAW BALE BARRIER
3.05 - SILT FENCE BARRIER
3.06 - BRUSH BARRIER
3.09 - TEMPORARY DIVERSION DIKE
3.11 - TEMPORARY SLOPE BREAKERS / TEMPORARY RIGHT-OF-WAY DIVERSION
3.18 - OUTLET PROTECTION
3.20 - ROCK CHECK DAM
3.22 - VEGETATIVE STREAMBANK STABILIZATION
3.24 - TEMPORARY STREAM CROSSING
3.25 - DIVERSION CHANNEL CROSSING / FLUME PIPE CROSSING / COFFERDAM CROSSING
3.26 - DEWATERING STRUCTURE
3.27 - TURBIDITY CURTAIN
3.29 - SURFACE ROUGHENING
MVP-ES2 - PUMPED WATER FILTER BAG
MVP-ES3 - COMPOST FILTER SOCK
MVP-ES9 - BELTED SILT RETENTION FENCE
MVP-ES37 - TIMBER MAT / WETLAND CROSSING
MVP-ES38 - DIVERSION DIKE / WATERBARS WITH COMPOST
MVP-ES50 - CLEAN WATER DIVERSION WITH CLEAN WATER PIPE
MVP-ES51 - PLUNGE POOL OUTLET ISOMETRIC VIEW
MVP-ES51.1 - PLUNGE POOL OUTLET
MVP-20 TRENCH PLUGS / BREAKERS

- 2. VEGETATIVE PRACTICES
3.30 - TOPSOIL (STOCKPILE)
3.31 - TEMPORARY SEEDING
3.32 - PERMANENT SEEDING
3.35 - MULCHING
3.36 - SOIL STABILIZATION BLANKETS AND MATTING
MVP-ES11.0 - TEMPORARY EROSION CONTROL SEEDING MIX
MVP-ES11.1 - FOREST REGENERATION WOODY SEED MIX AND APPLICATION RATES
MVP-ES11.2 - UPLAND MEADOW SEED MIX AND APPLICATION RATES
MVP-ES11.3 - UPLAND STEEP SLOPE SEED MIX AND APPLICATION RATES
MVP-ES11.4 - WETLAND SEED MIX AND APPLICATION RATES
MVP-ES11.5 - RIPARIAN SEED MIX AND APPLICATION RATES
MVP-ES11.6 - NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS
MVP-ES11.7 - NATIVE TREE AND SHRUB SPECIES FOR BARE ROOT PLANTINGS WITHIN RIPARIAN AREAS AND FORESTED WETLANDS
MVP-ES11.8 - STREAM CROSSINGS PROPOSED FOR BARE ROOT SEEDING PLANTINGS
MVP-ES11.9 - STREAM CROSSING FOR BARE ROOT SEEDING PLANTING
MVP-ES46 - 46.2 - TOPSOILING & SOIL HANDLING

8. PERMANENT STABILIZATION:

ALL DISTURBED AREAS SHALL BE STABILIZED WITH PERMANENT SEEDING WITHIN SEVEN WORKING DAYS OF FINAL GRADING, WEATHER AND SOIL CONDITIONS PERMITTING, AS SPECIFIED IN THE PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS FOR VIRGINIA.

9. STORMWATER RUNOFF CONSIDERATIONS:

CONCENTRATED STORMWATER FLOW SHALL BE RELEASED TO NATURAL STORMWATER CONVEYANCE SYSTEMS. CHANNEL PROTECTION REQUIREMENTS WILL BE MET VIA THE ENERGY BALANCE METHOD AND DETENTION ASSOCIATED WITH COMPOST AMENDED WATERBARS. IF NECESSARY TO DISSIPATE CONCENTRATED FLOW INTO SHEET FLOW, LEVEL SPREADERS WILL BE DESIGNED PER VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION NO. 2. FLOOD PROTECTION WILL BE MET BY DISCHARGING TO CONCENTRATED STORMWATER FLOW TO STORMWATER CONVEYANCE SYSTEMS THAT DO NOT EXPERIENCE LOCALIZED FLOODING DURING THE 10-YEAR 24-HOUR STORM EVENT AND THE 10-YEAR 24-HOUR POST-DEVELOPMENT PEAK FLOW RATE IS CONFINED WITHIN THE STORMWATER CONVEYANCE SYSTEM, OR DEMONSTRATING A REDUCTION IN THE 10-YEAR 24-HOUR STORM EVENT PEAK FLOW RATE.

10. 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 PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS.

EXISTING ACCESS ROADS WILL BE UTILIZED IN THEIR CURRENT CONFIGURATION WITH NO ADDITIONAL DISTURBANCE BEYOND EXISTING LIMITS. WORK WILL BE LIMITED TO ROUTINE MAINTENANCE WITHIN THE EXISTING FOOTPRINT. ALL EXISTING ROADS WILL BE RETURNED TO DOCUMENTED PRE-EXISTING CONDITIONS TO BE PROVIDED TO DEQ PRIOR TO CONSTRUCTION.

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 RE-VEGETATION WILL BE CONSIDERED SUCCESSFUL WHEN THE COVER OF HERBACEOUS 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. RE-VEGETATION EFFORTS WILL CONTINUE UNTIL WETLAND RE-VEGETATION IS SUCCESSFUL.

CONDUCTING INSPECTIONS OF TEMPORARY ESC CONTROLS AND SWM BMPS AT LEAST ONCE EVERY FOUR BUSINESS DAYS.

REPAIR OF ALL INEFFECTIVE TEMPORARY ESC MEASURES SHALL OCCUR WITHIN 24 HOURS OF IDENTIFICATION, OR AS SOON AS CONDITIONS ALLOW IF COMPLIANCE WITH THIS TIME FRAME WOULD RESULT IN GREATER ENVIRONMENTAL IMPACTS.

TEMPORARY BMPS WILL BE REMOVED UPON ACHIEVING VEGETATIVE STABILIZATION. DISTURBED AREAS NOT ATTAINING AN ACCEPTABLE VEGETATIVE COVER SHALL BE RE-SEEDED AS NEEDED UNTIL STABILIZATION IS ACHIEVED.

TEMPORARY ESC 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.

11. CALCULATIONS: BMP SIZING AND INSTALLATION HAS BEEN BASED ON THE FOLLOWING CRITERIA INCLUDED BY REFERENCE IN BOTH THE ANNUAL STANDARDS AND SPECIFICATIONS AND THE GENERAL DETAILS INCLUDED WITH THE EROSION AND SEDIMENT CONTROL PLANS:

- COMPOST FILTER SOCK - MVP-ES3.0, MVP-ES3.1, MVP-ES3.3
COMPOST AMENDED RIGHT-OF-WAY DIVERSION/WATER BAR - VIRGINIA BMP CLEARINGHOUSE SPECIFICATION NO. 4
EARTHEN LEVEL SPREADER - VIRGINIA BMP CLEARINGHOUSE SPECIFICATION NO. 2
GRASS LINED CHANNEL - VIRGINIA BMP CLEARINGHOUSE SPECIFICATION NO. 3
PERMANENT RIGHT-OF-WAY DIVERSION/WATER BAR - DETAIL MVP-17, MVP-17.1, MVP-17.2
SEDIMENT TRAP - VADEQ STD & SPEC 3.13
SILT FENCE - VADEQ STD & SPEC 3.05
TEMPORARY RIGHT-OF-WAY DIVERSION/WATER BAR - VADEQ STD & SPEC 3.11
TRENCH BREAKERS - MVP-20
CLEAN WATER PIPE - MVP-ES50
PLUNGE POOL OUTLET - MVP-ES51, MVP-ES51.1

12. GENERAL EROSION AND SEDIMENT CONTROL NOTES:

- ES-1: UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND VIRGINIA REGULATIONS 9VAC25-840 EROSION AND SEDIMENT CONTROL REGULATIONS.
ES-2: THE PLAN APPROVING AUTHORITY MUST BE NOTIFIED ONE WEEK PRIOR TO THE PRE-CONSTRUCTION CONFERENCE, ONE WEEK PRIOR TO THE COMMENCEMENT OF LAND DISTURBING ACTIVITY, AND ONE WEEK PRIOR TO THE FINAL INSPECTION.
ES-3: ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CLEARING.
ES-4: A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE AT ALL TIMES.
ES-5: PRIOR TO COMMENCING LAND-DISTURBING ACTIVITIES IN AREAS OTHER THAN INDICATED ON THESE PLANS (INCLUDING, BUT NOT LIMITED TO, OFF-SITE BORROW OR WASTE AREAS), THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTARY EROSION CONTROL PLAN TO THE OWNER FOR REVIEW AND APPROVAL BY THE PLAN APPROVING AUTHORITY.
ES-6: THE CONTRACTOR IS RESPONSIBLE FOR INSTALLATION OF ANY ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE PLAN APPROVING AUTHORITY.
ES-7: ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT UNTIL FINAL STABILIZATION IS ACHIEVED.
ES-8: DURING DEWATERING OPERATIONS, WATER WILL BE PUMPED INTO AN APPROVED FILTERING DEVICE.
ES-9: THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.

13. MINIMUM STANDARDS (MS):

ALL LAND-DISTURBING ACTIVITIES UNDERTAKEN ON PRIVATE AND PUBLIC LANDS IN THE COMMONWEALTH OF VIRGINIA MUST MEET THE 19 "MINIMUM STANDARDS" FOR ESC IN SECTION 4VAC60-30-40 OF THE VIRGINIA ESC REGULATIONS. THE APPLICANT WHO SUBMITS THE ESC PLAN TO THE PROGRAM AUTHORITY FOR APPROVAL IS RESPONSIBLE FOR ENSURING COMPLIANCE WITH THE MINIMUM STANDARDS THAT APPLY TO HIS/HER ACTIVITIES.

MS-1 SOIL STABILIZATION. PERMANENT OR TEMPORARY STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN 7 DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 14 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.

MS-2 SOIL STOCKPILE STABILIZATION. DURING CONSTRUCTION, SOIL STOCKPILES AND BORROW AREAS SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. TEMPORARY PROTECTION AND PERMANENT STABILIZATION SHALL BE APPLIED TO ALL SOIL STOCKPILES ON THE SITE AND BORROW AREAS OR SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.

MS-3 PERMANENT STABILIZATION. PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON DENUDED AREAS NOT OTHERWISE PERMANENTLY STABILIZED. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE, AND WILL INHIBIT EROSION.

MS-4 SEDIMENT BASINS & TRAPS. SEDIMENT BASINS, SEDIMENT TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS, AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND-DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.

MS-5 STABILIZATION OF EARTHEN STRUCTURES. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.

MS-6 SEDIMENT TRAPS & SEDIMENT BASINS. SEDIMENT TRAPS AND BASINS SHALL BE DESIGNED AND CONSTRUCTED BASED UPON THE TOTAL DRAINAGE AREA TO BE SERVED BY THE TRAP OR BASIN AS FOLLOWS:

- 1. SEDIMENT TRAPS:
1.1. ONLY CONTROL DRAINAGE AREAS LESS THAN THREE ACRES.
1.2. MINIMUM STORAGE CAPACITY OF 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA.
2. SEDIMENT BASINS:
2.1. CONTROL DRAINAGE AREAS GREATER THAN OR EQUAL TO THREE ACRES.
2.2. MINIMUM STORAGE CAPACITY OF 134 CUBIC YARDS PER ACRE OF DRAINAGE AREA.
2.3. THE OUTFALL SYSTEM SHALL, AT A MINIMUM, MAINTAIN THE STRUCTURAL INTEGRITY OF THE BASIN DURING A TWENTY-FIVE YEAR STORM OF 24-HOUR DURATION.

MS-7 CUT AND FILL SLOPES DESIGN & CONSTRUCTION. CUT AND FILL SLOPES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER THAT WILL MINIMIZE EROSION. SLOPES FOUND TO BE ERODING EXCESSIVELY WITHIN ONE YEAR OF PERMANENT STABILIZATION SHALL BE PROVIDED WITH ADDITIONAL SLOPE STABILIZING MEASURES UNTIL THE PROBLEM IS CORRECTED.

MS-8 CONCENTRATED RUNOFF DOWN SLOPES. CONCENTRATED RUNOFF SHALL NOT FLOW DOWN CUT OR FILL SLOPES UNLESS CONTAINED WITHIN AN ADEQUATE TEMPORARY OR PERMANENT CHANNEL, FLUME, OR SLOPE DRAIN STRUCTURE.

MS-9 SLOPE MAINTENANCE. WHENEVER WATER SEEPS FROM A SLOPE FACE, ADEQUATE DRAINAGE OR OTHER PROTECTION SHALL BE PROVIDED.

MS-10 STORM SEWER INLET PROTECTION. ALL STORM SEWER INLETS MADE OPERABLE DURING CONSTRUCTION SHALL BE PROTECTED SO THAT SEDIMENT-LADEN WATER CANNOT ENTER THE STORMWATER CONVEYANCE SYSTEM WITHOUT FIRST BEING FILTERED/ TREATED TO REMOVE SEDIMENT.

MS-11 STORMWATER CONVEYANCE PROTECTION. BEFORE NEWLY CONSTRUCTED STORMWATER CONVEYANCE CHANNELS OR PIPES ARE MADE OPERATIONAL, ADEQUATE OUTLET PROTECTION AND ANY REQUIRED TEMPORARY OR PERMANENT CHANNEL LINING SHALL BE INSTALLED IN BOTH THE CONVEYANCE CHANNEL AND RECEIVING CHANNEL.

MS-12 WORK IN LIVE WATERCOURSE. WHEN WORK IN A LIVE WATERCOURSE IS PERFORMED, PRECAUTIONS SHALL BE TAKEN TO MINIMIZE ENCROACHMENT, CONTROL SEDIMENT TRANSPORT AND STABILIZE THE WORK AREA TO THE GREATEST EXTENT POSSIBLE DURING CONSTRUCTION. NONERODIBLE MATERIAL SHALL BE USED FOR THE CONSTRUCTION OF CAUSEWAYS AND COFFERDAMS. EARTHEN FILL MAY BE USED FOR THESE STRUCTURES IF ARMORED BY NONERODIBLE COVER MATERIALS.

MS-13 CROSSING LIVE WATERCOURSE. WHEN A LIVE WATERCOURSE MUST BE CROSSED BY CONSTRUCTION VEHICLES MORE THAN TWICE IN ANY SIX-MONTH PERIOD, A TEMPORARY VEHICULAR STREAM CROSSING CONSTRUCTED OF NONERODIBLE MATERIAL SHALL BE PROVIDED.

MS-14 REGULATION OF WATERCOURSE CROSSING. ALL APPLICABLE FEDERAL STATE AND LOCAL REGULATIONS PERTAINING TO WORKING IN OR CROSSING LIVE WATERCOURSES SHALL BE MET.

MS-15 STABILIZING OF WATERCOURSE. THE BED AND BANKS OF A WATERCOURSE SHALL BE STABILIZED IMMEDIATELY AFTER WORK IN THE WATERCOURSE IS COMPLETED.

MS-16 UNDERGROUND UTILITY LINE INSTALLATION. UNDERGROUND UTILITY LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING STANDARDS IN ADDITION TO OTHER APPLICABLE CRITERIA:

- a. NO MORE THAN 500 LINEAR FEET OF TRENCH MAY BE OPENED AT ONE TIME.
b. EXCAVATED MATERIAL SHALL BE PLACED ON THE UPHILL SIDE OF TRENCHES.
c. EFFLUENT FROM DEWATERING OPERATIONS SHALL BE FILTERED OR PASSED THROUGH AN APPROVED SEDIMENT TRAPPING DEVICE, OR BOTH, AND DISCHARGED IN A MANNER THAT DOES NOT ADVERSELY AFFECT FLOWING STREAMS OR OFF-SITE PROPERTY.
d. MATERIAL USED FOR BACKFILLING TRENCHES SHALL BE PROPERLY COMPACTED IN ORDER TO MINIMIZE EROSION AND PROMOTE STABILIZATION.
e. RESTABILIZATION SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THESE REGULATIONS.
f. COMPLY WITH APPLICABLE SAFETY REGULATIONS.

MS-17 VEHICULAR SEDIMENT TRACKING. WHERE CONSTRUCTION VEHICLE ACCESS ROUTES INTERSECT PAVED OR PUBLIC ROADS:

- a. PROVISIONS SHALL BE MADE TO MINIMIZE THE TRANSPORT OF SEDIMENT BY VEHICULAR TRACKING ONTO THE PAVED SURFACE.
b. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY.
c. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER.

MS-18 REMOVAL OF TEMPORARY MEASURES. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE LOCAL PROGRAM AUTHORITY. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

Table with 7 columns: DATE, DNE, DMN, CHKD., APPD., DW, RE. Rows for ADDED DETAILS FOR ROADS AND PADS, ADDRESS VADEQ COMMENTS, ADDRESS VADEQ COMMENTS, ADDRESS VADEQ COMMENTS, ADDRESS VADEQ COMMENTS, ADDRESS VADEQ COMMENTS, ADDRESS VADEQ COMMENTS.

Mountain Valley Pipeline logo and project title: EROSION AND SEDIMENT CONTROL PLANS MOUNTAIN VALLEY PIPELINE PROJECT - H600 LINE. Includes company name MOUNTAIN VALLEY PIPELINE, LLC and address 555 SOUTHPOINTE BOULEVARD, SUITE 200 CANONSBURG, PA 15317.

TETRA TECH logo and address: 661 ANDERSEN DRIVE FOSTER PLAZA 7 PITTSBURGH, PA 15220. Tagline: complex world | CLEAR SOLUTIONS™

GENERAL DETAILS SET label in a pink box.

Professional Engineer seal for David J. Wallner, License No. 0402057593, State of Virginia.

Table with 2 columns: FIELD, VALUE. Fields include DRAWN BY (KAL), CHECKED BY (HT), APPROVED BY (RE), DATE (11/28/2017), SCALE (AS SHOWN), and NARRATIVE (1 OF 4).

**MS-19 STORMWATER MANAGEMENT.** PROPERTIES AND WATERWAYS DOWNSTREAM FROM DEVELOPMENT SITES SHALL BE PROTECTED FROM SEDIMENT DEPOSITION, EROSION AND DAMAGE DUE TO INCREASES IN VOLUME, VELOCITY AND PEAK FLOW RATE OF STORMWATER RUNOFF FOR THE STATED FREQUENCY STORM OF 24-HOUR DURATION IN ACCORDANCE WITH THE FOLLOWING STANDARDS AND CRITERIA. STREAM RESTORATION AND RELOCATION PROJECTS THAT INCORPORATE NATURAL CHANNEL DESIGN CONCEPTS ARE NOT MAN-MADE CHANNELS AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS:

- a. CONCENTRATED STORMWATER RUNOFF LEAVING A DEVELOPMENT SITE SHALL BE DISCHARGED DIRECTLY INTO AN ADEQUATE NATURAL OR MAN-MADE RECEIVING CHANNEL, PIPE OR STORM SEWER SYSTEM. FOR THOSE SITES WHERE RUNOFF IS DISCHARGED INTO A PIPE OR PIPE SYSTEM, DOWNSTREAM STABILITY ANALYSES AT THE OUTFALL OF THE PIPE OR PIPE SYSTEM SHALL BE PERFORMED.
- b. ADEQUACY OF ALL CHANNELS AND PIPES SHALL BE VERIFIED IN THE FOLLOWING MANNER:
  1. THE APPLICANT SHALL DEMONSTRATE THAT THE TOTAL DRAINAGE AREA TO THE POINT OF ANALYSIS WITHIN THE CHANNEL IS ONE HUNDRED TIMES GREATER THAN THE CONTRIBUTING DRAINAGE AREA OF THE PROJECT IN QUESTION; OR
  2. (A) NATURAL CHANNELS SHALL BE ANALYZED BY THE USE OF A TWO-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP CHANNEL BANKS NOR CAUSE EROSION OF CHANNEL BED OR BANKS.
    - (b) ALL PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS SHALL BE ANALYZED BY THE USE OF A 10-YEAR STORM TO VERIFY THAT STORMWATER WILL NOT OVERTOP ITS BANKS AND BY THE USE OF A TWO-YEAR STORM TO DEMONSTRATE THAT STORMWATER WILL NOT CAUSE EROSION OF CHANNEL BED OR BANKS; AND
    - (c) PIPES AND STORM SEWER SYSTEMS SHALL BE ANALYZED BY THE USE OF A 10-YEAR STORM TO VERIFY THAT STORMWATER WILL BE CONTAINED WITHIN THE PIPE OR SYSTEM.
- c. IF EXISTING NATURAL RECEIVING CHANNELS OR PREVIOUSLY CONSTRUCTED MAN-MADE CHANNELS OR PIPES ARE NOT ADEQUATE, THE APPLICANT SHALL:
  1. IMPROVE THE CHANNELS TO A CONDITION WHERE A 10-YEAR STORM WILL NOT OVERTOP THE BANKS AND A TWO-YEAR STORM WILL NOT CAUSE EROSION TO THE CHANNEL, THE BED, OR THE BANKS; OR
  2. IMPROVE THE PIPE OR PIPE SYSTEM TO A CONDITION WHERE THE 10-YEAR STORM IS CONTAINED WITHIN THE APPURTENANCES;
  3. DEVELOP A SITE DESIGN THAT WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A TWO-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A NATURAL CHANNEL OR WILL NOT CAUSE THE PRE-DEVELOPMENT PEAK RUNOFF RATE FROM A 10-YEAR STORM TO INCREASE WHEN RUNOFF OUTFALLS INTO A MAN-MADE CHANNEL; OR
  4. PROVIDE A COMBINATION OF CHANNEL IMPROVEMENT, STORMWATER DETENTION OR OTHER MEASURES WHICH IS SATISFACTORY TO THE VESCP AUTHORITY TO PREVENT DOWNSTREAM EROSION.
- d. THE APPLICANT SHALL PROVIDE EVIDENCE OF PERMISSION TO MAKE THE IMPROVEMENTS.
- e. ALL HYDROLOGIC ANALYSES SHALL BE BASED ON THE EXISTING WATERSHED CHARACTERISTICS AND THE ULTIMATE DEVELOPMENT CONDITION OF THE SUBJECT PROJECT.
- f. IF THE APPLICANT CHOOSES AN OPTION THAT INCLUDES STORMWATER DETENTION, HE SHALL OBTAIN APPROVAL FROM THE VESCP OF A PLAN FOR MAINTENANCE OF THE DETENTION FACILITIES. THE PLAN SHALL SET FORTH THE MAINTENANCE REQUIREMENTS OF THE FACILITY AND THE PERSON RESPONSIBLE FOR PERFORMING THE MAINTENANCE.
- g. OUTFALL FROM A DETENTION FACILITY SHALL BE DISCHARGED TO A RECEIVING CHANNEL, AND ENERGY DISSIPATORS SHALL BE PLACED AT THE OUTFALL OF ALL DETENTION FACILITIES AS NECESSARY TO PROVIDE A STABILIZED TRANSITION FROM THE FACILITY TO THE RECEIVING CHANNEL.
- h. ALL ON-SITE CHANNELS MUST BE VERIFIED TO BE ADEQUATE.
- i. INCREASED VOLUMES OF SHEET FLOWS THAT MAY CAUSE EROSION OR SEDIMENTATION ON ADJACENT PROPERTY SHALL BE DIVERTED TO A STABLE OUTLET, ADEQUATE CHANNEL, PIPE OR PIPE SYSTEM, OR TO A DETENTION FACILITY.
- j. IN APPLYING THESE STORMWATER MANAGEMENT CRITERIA, INDIVIDUAL LOTS OR PARCELS IN A RESIDENTIAL, COMMERCIAL OR INDUSTRIAL DEVELOPMENT SHALL NOT BE CONSIDERED TO BE SEPARATE DEVELOPMENT PROJECTS. INSTEAD, THE DEVELOPMENT, AS A WHOLE, SHALL BE CONSIDERED TO BE A SINGLE DEVELOPMENT PROJECT. HYDROLOGIC PARAMETERS THAT REFLECT THE ULTIMATE DEVELOPMENT CONDITION SHALL BE USED IN ALL ENGINEERING CALCULATIONS.
- k. ALL MEASURES USED TO PROTECT PROPERTIES AND WATERWAYS SHALL BE EMPLOYED IN A MANNER WHICH MINIMIZES IMPACTS ON THE PHYSICAL, CHEMICAL AND BIOLOGICAL INTEGRITY OF RIVERS, STREAMS AND OTHER WATERS OF THE STATE.
- l. ANY PLAN APPROVED PRIOR TO JULY 1, 2014, THAT PROVIDES FOR STORMWATER MANAGEMENT THAT ADDRESSES ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS SHALL SATISFY THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS IF THE PRACTICES ARE DESIGNED TO (I) DETAIN THE WATER QUALITY VOLUME AND TO RELEASE IT OVER 48 HOURS; (II) DETAIN AND RELEASE OVER A 24-HOUR PERIOD THE EXPECTED RAINFALL RESULTING FROM THE ONE YEAR, 24-HOUR STORM; AND (III) REDUCE THE ALLOWABLE PEAK FLOW RATE RESULTING FROM THE 1.5, 2, AND 10-YEAR, 24-HOUR STORMS TO A LEVEL THAT IS LESS THAN OR EQUAL TO THE PEAK FLOW RATE FROM THE SITE ASSUMING IT WAS IN A GOOD FORESTED CONDITION, ACHIEVED THROUGH MULTIPLICATION OF THE FORESTED PEAK FLOW RATE BY A REDUCTION FACTOR THAT IS EQUAL TO THE RUNOFF VOLUME FROM THE SITE WHEN IT WAS IN A GOOD FORESTED CONDITION DIVIDED BY THE RUNOFF VOLUME FROM THE SITE IN ITS PROPOSED CONDITION, AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS AS DEFINED IN ANY REGULATIONS PROMULGATED PURSUANT TO § 62.1-44.15:54 OR 62.1-44.15:65 OF THE ACT.
- m. FOR PLANS APPROVED ON AND AFTER JULY 1, 2014, THE FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS OF § 62.1-44.15:52 A OF THE ACT AND THIS SUBSECTION SHALL BE SATISFIED BY COMPLIANCE WITH WATER QUANTITY REQUIREMENTS IN THE STORMWATER MANAGEMENT ACT (§ 62.1-44.15:24 ET SEQ. OF THE CODE OF VIRGINIA) AND ATTENDANT REGULATIONS, UNLESS SUCH LAND-DISTURBING ACTIVITIES ARE IN ACCORDANCE WITH 9VAC25-870-48 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) REGULATION OR ARE EXEMPT PURSUANT TO SUBDIVISION C 7 OF § 62.1-44.15:34 OF THE ACT.
- n. COMPLIANCE WITH THE WATER QUANTITY MINIMUM STANDARDS SET OUT IN 9VAC25-870-66 OF THE VIRGINIA STORMWATER MANAGEMENT PROGRAM (VSMP) REGULATION SHALL BE DEEMED TO SATISFY THE REQUIREMENTS OF THIS SUBDIVISION 19.

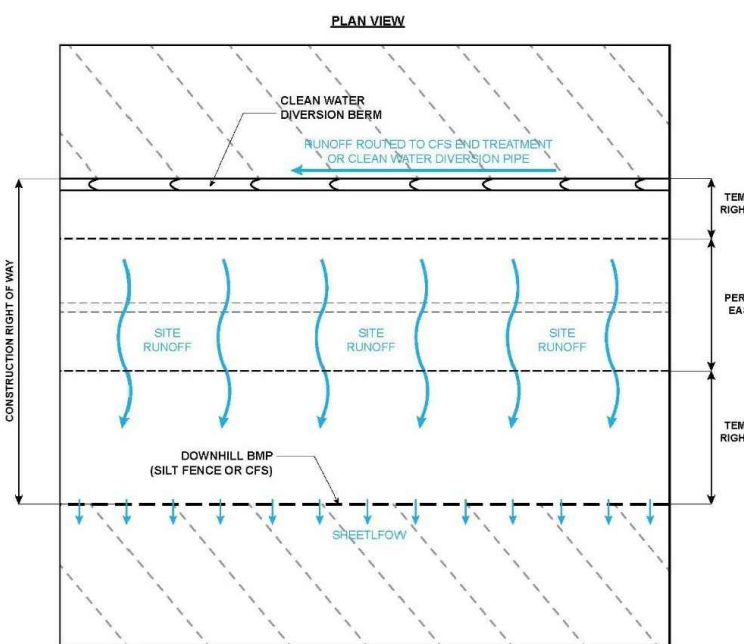
**15. MS-19 COMPLIANCE DURING CONSTRUCTION:**

**A. INTRODUCTION**

THE PRIMARY INTENT OF MS-19 IS TO ENSURE THAT DOWN GRADIENT PROPERTIES ARE PROTECTED FROM ADVERSE IMPACTS RESULTING FROM INCREASES IN STORMWATER RUNOFF FROM DEVELOPMENT ACTIVITIES. IN ACCORDANCE WITH 9VAC25-870-66, WATER QUANTITY, COMPLIANCE WITH THE WATER QUALITY REQUIREMENTS CONTAINED IN THAT SECTION SATISFIES THE REQUIREMENTS OF M.S. 19:

*"COMPLIANCE WITH THE MINIMUM STANDARDS SET OUT IN THIS SECTION SHALL BE DEEMED TO SATISFY THE REQUIREMENTS OF SUBDIVISION 19 OF 9VAC25-840-40 (MINIMUM STANDARDS, VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS)."*

THERE ARE TWO PRIMARY FLOW REGIMES ASSOCIATED WITH THE CONSTRUCTION PHASE OF THE PROJECT THAT WILL NEED TO BE ASSESSED FOR COMPLIANCE WITH MS-19. THESE INCLUDE FLOWS GENERATED DIRECTLY WITHIN THE DISTURBED PROJECT AREA THAT ARE CONTROLLED BY PERIMETER CONTROLS CONSISTING OF COMPOST FILTER SOCKS (CFS) OR SILT FENCE, AS WELL AS FLOWS ROUTED AROUND THE PROJECT AREA VIA CLEAN WATER DIVERSIONS (THROUGH EITHER A CFS END TREATMENT RELEASE FOR SITUATIONS WHERE CLEAN WATER DOES NOT CROSS THE ROW, OR THROUGH A CLEAN WATER DIVERSION PIPE WITH A STILLING BASIN WHEN A PARTICULAR LOCATION REQUIRES CLEAN WATER TO BE DIVERTED THROUGH THE ROW). THE FOLLOWING FIGURE DEPICTS THE DIRECT RUNOFF SCENARIOS, FOR MORE SPECIFICS ON THE CLEAN WATER DIVERSION SCENARIOS, SEE DETAILS MVP-ESS0, MVP-ESS1, AND MVP-ESS1.



REGARDLESS OF THE SPECIFIC LOCATION AND/OR FLOW REGIME, ALL EROSION AND SEDIMENT CONTROL MEASURES INCLUDED IN THE DESIGN PLANS FOR THE PROJECT HAVE BEEN DEVELOPED AND DESIGNED TO BE IN FULL COMPLIANCE WITH STATE REQUIREMENTS, AS CONTAINED IN THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), AS WELL AS THE APPROVED PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS. AS A RESULT, ALL IMPLEMENTED PRACTICES (CLEAN WATER DIVERSION, SILT FENCE, CFS, SOIL STABILIZATION, TEMPORARY WATER BARS, ETC.) WILL MEET ALL STATE REQUIREMENTS. IN ALL INSTANCES OF OFFSITE STORMWATER FLOW DURING THE CONSTRUCTION PHASE OF THE PROJECT, COMPLIANCE WITH MS-19 IS PROVIDED THROUGH THE PROVISION OF SHEETFLOW BELOW THE RESPECTIVE EROSION AND SEDIMENT CONTROL PRACTICES ALONG THE PERIMETER (CFS, SILT FENCE, OR CLEAN WATER DIVERSION END TREATMENTS). A DESCRIPTION OF THE FLOW REGIME FOR BOTH THE CLEAN WATER DIVERSIONS AND DIRECT RUNOFF FROM DISTURBED AREAS OF THE PROJECT IS PROVIDED BELOW, FOLLOWED BY AN ANALYSIS THAT DEMONSTRATES THAT FLOW FROM THE PROPOSED PRACTICES WILL PROVIDE FOR NON-EROSIVE SHEET FLOW AND IS THEREFORE IN FULL COMPLIANCE WITH MS-19.

**B. RUNOFF FROM PROJECT SITE**

PROPERLY DESIGNED AND IMPLEMENTED EROSION AND SEDIMENT CONTROLS IN THE FORM OF SOIL STABILIZATION, TEMPORARY WATER BARS WITH STILLING BASINS THAT FLOW TO CFS, STAND-ALONE CFS, AND/OR SILT FENCE WILL ENSURE DISTURBED AREAS WITHIN THE PROJECT SITE ARE PROTECTED IN ACCORDANCE WITH VESCH SPECIFICATIONS. PERIMETER CONTROLS (CFS AND/OR SILT FENCE, DEPENDING ON THE SPECIFIC LOCATION) WILL FILTER RUNOFF AND PROVIDE SHEETFLOW TO DOWNGRADIENT AREAS IN A NON-EROSIVE MANNER. THIS WILL RESULT IN RUNOFF FROM THE PROJECT SITE MEETING MS-19 REQUIREMENTS.

**1. SHEETFLOW DISCHARGES**

THE RELEVANT STANDARD REFERRED TO IN 9VAC25-870-66 IS IN SECTION D THAT CONTAINS THE REQUIREMENTS WHEN DISCHARGING STORMWATER IN THE FORM OF SHEETFLOW:

*"D. INCREASED VOLUMES OF SHEET FLOW RESULTING FROM PERVIOUS OR DISCONNECTED IMPERVIOUS AREAS, OR FROM PHYSICAL SPREADING OF CONCENTRATED FLOW THROUGH LEVEL SPREADERS, MUST BE IDENTIFIED AND EVALUATED FOR POTENTIAL IMPACTS ON DOWN-GRADIENT PROPERTIES OR RESOURCES. INCREASED VOLUMES OF SHEET FLOW THAT WILL CAUSE OR CONTRIBUTE TO EROSION, SEDIMENTATION, OR FLOODING OF DOWN GRADIENT PROPERTIES OR RESOURCES SHALL BE DIVERTED TO A STORMWATER MANAGEMENT FACILITY OR A STORMWATER CONVEYANCE SYSTEM THAT CONVEYS THE RUNOFF WITHOUT CAUSING DOWN-GRADIENT EROSION, SEDIMENTATION, OR FLOODING. IF ALL RUNOFF FROM THE SITE IS SHEET FLOW AND THE CONDITIONS OF THIS SUBSECTION ARE MET, NO FURTHER WATER QUANTITY CONTROLS ARE REQUIRED."*

SHEETFLOW DOWN GRADIENT OF THE ROW DURING THE CONSTRUCTION PHASE WILL BE PROVIDED BY PERIMETER CONTROLS THAT HAVE BEEN DESIGNED IN ACCORDANCE WITH THE APPROVED PROJECT SPECIFIC STANDARDS AND SPECIFICATIONS, AS WELL AS THE RELEVANT SPECIFICATIONS CONTAINED IN THE VESCH (AS NOTED ABOVE). EACH PRACTICE (SILT FENCE AND CFS) HAS BEEN SELECTED BASED ON THE SITE SPECIFIC CONDITIONS TO MAKE CERTAIN THAT THEY WILL FUNCTION PROPERLY AND AS INTENDED. CONFIRMATION THAT SHEETFLOW WILL BE PROVIDED DOWNGRADIENT OF EACH PRACTICE IS PROVIDED BELOW.

**a) SILT FENCE**

BY DEFINITION, SILT FENCE IS A FILTERING PRACTICE THAT HAS A STATED PERMEABILITY OF 0.3 GAL/MIN/SF (VESCH TABLE 3.05-A). ASSUMING A MAXIMUM PONDING DEPTH OF 24-IN, THIS WILL RESULT IN A FLOW RATE THROUGH THE FENCING OF 0.6 GAL/MIN/FT OF FENCING. CONVERTING, THIS EQUATES TO APPROXIMATELY 0.00134 CFS/FT (448.83 GPM = 1 CFS). THIS FLOW RATE CAN BE INSERTED INTO MANNING'S EQUATION TO SOLVE FOR THE CORRESPONDING DEPTH OF FLOW:

$$Q = (1.49/N) A R^{2/3} S^{1/2}$$

WHERE:

$$Q = \text{OVERLAND FLOW RATE, CFS}$$

$$A = \text{CROSS-SECTIONAL FLOW AREA PER LF OF FENCE (I.E. DEPTH X 1), FT}^2$$

$$N = \text{MANNING'S COEFFICIENT.}$$

THIS PARAMETER WAS ASSUMED TO BE 0.24 FOR SHEETFLOW IN "DENSE GRASSES" (TR-55, TABLE 3-1). AREAS BELOW THE END TREATMENTS WILL BE SEEDED WITH A NATIVE GRASSES AND WOODY SPECIES, SO THE "DENSE GRASSES" N VALUE WAS DEEMED TO BE THE MOST APPROPRIATE VS THE "SHORT PRAIRIE GRASS" (N = 0.15) OR "BERMUDA GRASS" (N = 0.41) ALTERNATIVES.

$$R = \text{HYDRAULIC RADIUS, FT.}$$

THIS TERM IS DEFINED AS THE CROSS-SECTIONAL FLOW AREA DIVIDED BY THE WETTED PERIMETER. HOWEVER, FOR SHALLOW, WIDE FLOW THIS CAN BE ASSUMED TO BE EQUAL TO THE FLOW DEPTH. TO ILLUSTRATE, ASSUME A FLOW DEPTH OF 0.10 FT OVER A LENGTH OF 10 FT:

$$R = A / WP$$

$$= (0.1 \text{ FT} \times 10 \text{ FT}) / (0.1 \text{ FT} + 10 \text{ FT} + 0.1 \text{ FT})$$

$$= 1.0 \text{ FT}^2 / 10.2 \text{ FT}$$

$$= 0.098 \text{ FT}$$

$$\text{DEPTH} = 0.10 \text{ FT IS A VALID ASSUMPTION}$$

$$S = \text{DOWN-GRADIENT OVERLAND SLOPE, FT/FT.}$$

ASSUMING AN OVERLAND SLOPE OF 0.5 FT/FT AND AN "N" VALUE OF 0.24 (MEADOW), RESULTS IS A NOMINAL FLOW DEPTH OF 0.0078 FT:

$$0.00134 = (1.49/0.24) (\text{DEPTH} \times 1) \text{ DEPTH}^{2/3} 0.5^{1/2}$$

REARRANGING,

$$\text{DEPTH}^{5/3} = 0.000305$$

$$\text{DEPTH} = 0.0078 \text{ FT}$$

THIS FLOW DEPTH CAN THEN BE USED TO COMPUTE THE VELOCITY IN ACCORDANCE WITH:

$$V = Q/A$$

$$= 0.00134 / 0.0078$$

$$= 0.17 \text{ FPS}$$

THIS VALUE IS AN ORDER OF MAGNITUDE LOWER THAN THE CONSERVATIVELY ASSUMED ALLOWABLE VELOCITY OF 2 FPS (BARE EARTH). THIS RESULT IS NOT UNEXPECTED AS THE PURPOSE OF SILT FENCE IS TO SLOWLY FILTER STORMWATER RUNOFF.

**b) CFS**

THE OTHER PERIMETER CONTROL THAT WILL BE IMPLEMENTED, DEPENDING ON THE SPECIFIC LOCATION, WILL BE CFS. THE COMPOST FILTER SOCKS ARE RATED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) IN THE DOCUMENT "FILTER BERMS AND FILTER SOCKS: STANDARD SPECIFICATIONS FOR COMPOST FOR EROSION/SEDIMENT CONTROL" TO PASS A RANGE OF FLOWS, FROM 4 TO OVER 10 GPM/FT (TABLE 2). A PRODUCT SPECIFIC CITATION OBTAINED FROM FILTREXX® STIPULATES A FLOW THROUGH RATE OF 22.5 GAL/MIN/FT FOR A 24-IN DIAMETER CFS (THE EFFECTIVE SIZE THAT WILL BE USED FOR THIS PROJECT). IN ORDER TO ENSURE A SHEETFLOW DEPTH OF NOT MORE THAN 0.10 FT BELOW THE CFS, AN EVEN HIGHER FLOW RATE OF 43 GPM WAS ASSUMED (VERY CONSERVATIVE).

ASSUMING A WORST CASE OF 43 GPM, THIS EQUATES TO A FLOW RATE OF 0.095 CFS/FT. USING MANNING'S EQUATION TO SOLVE FOR THE DEPTH OF FLOW USING THE SAME ASSUMPTIONS AND METHODOLOGY NOTED ABOVE RESULTS IN AN OVERLAND FLOW DEPTH OF 0.10 FT:

$$0.095 = (1.49/0.24) (\text{DEPTH} \times 1) \text{ DEPTH}^{2/3} 0.5^{1/2}$$

REARRANGING,

$$\text{DEPTH}^{5/3} = 0.022 \text{ FT}$$

$$\text{DEPTH} = 0.10 \text{ FT}$$

THIS FLOW DEPTH CAN THEN BE USED TO COMPUTE THE VELOCITY IN ACCORDANCE WITH:

$$V = Q/A$$

$$= 0.095 / 0.10$$

$$= 0.95 \text{ FPS}$$

THUS, THE CFS WILL ALSO PRODUCE SHEETFLOW IN A NON-EROSIVE MANNER THAT WILL NOT IMPACT DOWN GRADIENT PROPERTIES. AS A RESULT, SHEETFLOW DOWNGRADIENT FROM THE CFS PERIMETER CONTROL IMMEDIATELY FOLLOWING CONSTRUCTION IS ALSO IN FULL COMPLIANCE WITH M.S. 19.

**c) FLOODING**

BECAUSE SHEETFLOW HAS BEEN DEMONSTRATED FOR DOWNGRADIENT FLOWS DURING THE CONSTRUCTION PROCESS, COMPLIANCE WITH THE FLOODING PROVISION OF THE REGULATIONS (9VAC25-870-66 C. FLOOD PROTECTION) IS NOT REQUIRED. HOWEVER, THE SHEETFLOW PROVISION CITED IN THIS NARRATIVE DOES REQUIRE THAT "FLOODING" OF DOWNGRADIENT PROPERTIES OR RESOURCES" DOES NOT OCCUR. THE DEFINITION OF "FLOODING" PROVIDED IN THE REGULATIONS IS:

*"FLOODING" MEANS A VOLUME OF WATER THAT IS TOO GREAT TO BE CONFINED WITHIN THE BANKS OR WALLS OF A STREAM, WATER BODY, OR CONVEYANCE SYSTEM AND THAT OVERFLOWS ONTO ADJACENT LANDS, THEREBY CAUSING OR THREATENING DAMAGE."*

IN THIS INSTANCE, THERE ARE NO CONVEYANCES (I.E. SHEETFLOW), THEREFORE THE APPLICABLE PORTION OF THE DEFINITION IS RELATED TO OVERLAND FLOW THAT CAUSES OR THREATENS TO CAUSE DAMAGE. THIS ANALYSIS HAS DEMONSTRATED THAT THE SHEETFLOW FROM EITHER THE SILT FENCE OR CFS IS NON-EROSIVE. THEREFORE, THE TEMPORARY, NOMINAL INCREASES IN DOWN GRADIENT FLOW RATES THAT MAY OCCUR IN SOME SITUATIONS (NOTE - IN MANY INSTANCES THE FLOW RATES WILL ACTUALLY BE REDUCED AS A RESULT OF PONDING BEHIND THE SILT FENCE AND/OR CFS) WILL NOT RESULT IN DAMAGE AND THEREFORE COMPLIES WITH THE REQUIREMENTS OF MS-19.

**C. CLEAN WATER DIVERSIONS**

CLEAN WATER DIVERSIONS WILL BE INSTALLED IN ACCORDANCE WITH VESCH STD & SPEC 3.09 (DIVERSION DIKES) AND PROJECT DETAILS MVP-ESS0.1 (CLEAN WATER DIVERSION WITH END RELEASE) AND MVP-ESS0 (CLEAN WATER DIVERSION WITH CLEAN WATER PIPE) TO ROUTE CLEAN STORMWATER AROUND THE PROJECT WORK AREA.

**1. CLEAN WATER DIVERSION WITH END RELEASE (MVP-ESS0.1)**

THE END TREATMENTS ARE COMPRISED OF CFS (DETAIL MVP-ES3) THAT HAVE BEEN PROPERLY DESIGNED TO FILTER RUNOFF PRIOR TO BEING DISCHARGED OFF SITE. THE STORAGE/PEAK FLOW ATTENUATION PROVIDED BY THE ROCK CHECK DAMS SPACED ACROSS THE CLEAN WATER DIVERSION, IN COMBINATION WITH THE PROPOSED CLEAN WATER DIVERSION CFS END TREATMENT, ENSURE A NON-EROSIVE SHEETFLOW DISCHARGE AS DEMONSTRATED PREVIOUSLY IN SECTION B(1)(B). FURTHER DISCUSSION OF THE METHODOLOGY/APPROACH, ASSUMPTIONS, AND THE RESULTING CFS END TREATMENT DESIGN ARE PROVIDED BELOW.

**a) 10-YEAR PEAK FLOW CALCULATIONS**

PEAK FLOW CALCULATIONS WERE COMPLETED FOR THE 10-YEAR STORM EVENT USING THE RATIONAL METHOD:

$$Q = CIA$$

WHERE:

$$Q = \text{OVERLAND FLOW RATE, CFS}$$

$$C = \text{RUNOFF COEFFICIENT}$$

$$\text{ASSUMED } C=0.21 \text{ FOR "WOODED" LAND USE CONDITION IN HSG D SOILS WITH 6\%+ SLOPES PER VA SWM HANDBOOK VOLUME II, TABLE 4-5B TO BE CONSERVATIVE.}$$

$$I = \text{RAINFALL INTENSITY (10 YR STORM)}$$

RAINFALL INTENSITIES CORRESPONDING TO TRAVEL TIMES FOR SLOPES RANGING FROM 10-40% WERE USED TO CALCULATE A RANGE OF PEAK FLOWS REPRESENTATIVE OF THE VARIABLE SLOPES ACROSS THE PIPELINE. THE TRAVEL TIME FOR EACH SLOPE CONDITION WAS CALCULATED IN ACCORDANCE WITH TR-55 ASSUMING A TOTAL FLOW LENGTH OF 600 FT (100 FT SHEETFLOW AND 500 FT SHALLOW CONCENTRATED FLOW) AND A SHEETFLOW MANNING'S N-VALUE OF 0.24 FOR "DENSE GRASSES" (TR-55, TABLE 3-1) TO BE CONSERVATIVE; RAINFALL INTENSITIES CORRESPONDING TO THE CALCULATED TRAVEL TIMES WERE DEVELOPED USING THE 2015 VDOT DRAINAGE MANUAL, APPENDIX 6C-1 "B, D AND E FACTORS - APPLICATION" USING THE FACTORS FOR PITTSYLVANIA COUNTY TO BE CONSERVATIVE. A SUMMARY TABLE WITH THE CALCULATED TRAVEL TIME AND RAINFALL INTENSITY FOR EACH SLOPE CONDITION IS PROVIDED BELOW:

SLOPE (%)	TRAVEL TIME (MIN)	10-YEAR RAINFALL INTENSITY (IN/HR)
10	9	5.52
20	6	6.29
30	5	6.61
40	5	6.61

$$A = \text{DRAINAGE AREA, AC}$$

ASSUMED A = 5 AC, WHICH IS THE MAXIMUM ALLOWABLE DRAINAGE AREA FOR TEMPORARY DIVERSION DIKES PER VESCH STD & SPEC 3.09.

A SUMMARY WITH THE CALCULATED 10-YEAR PEAK FLOW FOR EACH SLOPE CONDITION IS PROVIDED BELOW:

SLOPE (%)	10-YEAR PEAK FLOW (CFS)
10	5.8
20	6.6
30	6.94
40	6.94

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

**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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FOSTER PLAZA 7  
PITTSBURGH, PA 15220

**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
NARRATIVE 2 OF 4	

b) CLEAN WATER DIVERSION MODELING APPROACH AND ASSUMPTIONS

CALCULATIONS TO DETERMINE THE PEAK FLOW ATTENUATION PROVIDED BY THE ROCK CHECK DAMS SPACED ACROSS THE CLEAN WATER DIVERSION WERE COMPLETED USING THE *HYDRAFLOW HYDROGRAPHS* EXTENSION FOR *AUTOCAD CIVIL 3D*. TO MODEL THE STORAGE/PEAK FLOW ATTENUATION PROVIDED BY THE ROCK CHECK DAMS SPACED ACROSS THE CLEAN WATER DIVERSION, A DIVERSION LENGTH OF 550 FT WAS ASSUMED FOR THE CONTRIBUTING 5 AC DRAINAGE AREA BASED ON A REVIEW OF PROPOSED DIVERSION LENGTHS AND THEIR CORRESPONDING DRAINAGE AREAS. A LINEAR REGRESSION ANALYSIS WAS COMPLETED FOR AN EXAMPLE SECTION OF THE PIPELINE (SPREAD 8, ESCP SHEETS 12.02 THROUGH 12.10) BY PLOTTING THE DIVERSION LENGTH VERSUS THE CORRESPONDING DRAINAGE AREA, AND THE FOLLOWING DATA POINTS WERE EXCLUDED FROM THE ANALYSIS TO ENSURE A CONSERVATIVE DIVERSION LENGTH ESTIMATION:

- OBVIOUS OUTLIERS (E.G., LARGE DRAINAGE AREAS CORRESPONDING TO DRAINAGE FEATURES)
- DATA POINTS THAT ARE TIED TO SECTIONS OF THE PIPELINE THAT RUN RIDGELINE SINCE THOSE DATA POINTS FAVORABLY (I.E., NON-CONSERVATIVELY) SKEW THE LINEAR REGRESSION ANALYSIS

THE DATA THAT WAS USED TO PERFORM THE LINEAR REGRESSION ANALYSIS, ALONG WITH THE RESULTING EQUATION THAT WAS USED TO ESTIMATE THE DIVERSION LENGTH CORRESPONDING TO A 5 AC DRAINAGE AREA, IS PROVIDED IN THE SUMMARY TABLE BELOW:

PLAN SHEET NO.	DIVERSION ID	DIVERSION LENGTH (FT)	DIVERSION DRAINAGE AREA (AC)	COMMENTS
	1	498	4	
12.02	2	74	0.1	
	3	407	3.1	
	4	121	2.7	
	5	83	1.5	
	6	112	1.3	
12.02	7	78	18.3	DRAINAGE AREA TIED TO A DRAINAGE FEATURE, AND IS OMITTED FROM ANALYSIS
	8	96	0.1	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
12.03	1	234	1.2	
	2	262	1.6	
	3	500	3.2	
12.04	1	377	1.3	
	2	81	0.2	
	3	604	1	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	4	160	0.5	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	5	402	0.8	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
12.05	1	347	0.3	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	2	214	0.6	
12.06	1	37	0.1	
	2	167	0.8	
	3	351	4.9	DRAINAGE AREA TIED TO A DRAINAGE FEATURE, AND IS OMITTED FROM ANALYSIS
12.06	4	88	0.1	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	5	127	0.2	DRAINAGE AREA LIMITED BY E&S PERIMETER CONTROLS AND IS OMITTED FROM ANALYSIS
	6	425	0.8	DRAINAGE AREA LIMITED BY E&S PERIMETER CONTROLS AND IS OMITTED FROM ANALYSIS
	1	250	0.6	
	2	49	0.1	
12.07	3	155	0.3	
	5	93	0.3	
	6	209	0.4	
	7	21	0.1	
12.08	2	307	0.3	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	1	126	0.1	
	2	284	1.6	
12.09	4	492	1	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	5	477	0.4	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	1	292	2	
	2	191	1.4	
	3	234	1.6	
12.1	4	148	0.1	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS
	5	695	1.4	DRAINAGE AREA NEAR RIDGE AND IS OMITTED FROM ANALYSIS

RESULTING LINEAR REGRESSION EQUATION:  $Y = 96.439X + 86.264$

$R^2 = 0.6217$

FOR A 5 AC DRAINAGE AREA (X=5), THE DIVERSION LENGTH IS ESTIMATED AS 568 FT. A DIVERSION LENGTH OF 550 FT WAS ASSUMED FOR THE ANALYSIS.

OTHER ASSUMPTIONS PERTAINING TO THE CLEAN WATER DIVERSION AND ROCK CHECK DAMS ARE AS FOLLOWS:

- CLEAN WATER DIVERSION GEOMETRY IS TRAPEZOIDAL WITH THE FOLLOWING DIMENSIONS:
  - 8 FT BOTTOM WIDTH
  - 2H:1V SIDE SLOPES
  - TOTAL DEPTH OF 1.5 FT (I.E., HEIGHT OF TEMPORARY DIVERSION PER VESCH STD & SPEC 3.09)
- ROCK CHECK DAMS HAVE A HEIGHT OF 1 FT, WHICH IS BELOW TOP-OF-DIVERSION AND THE MAXIMUM HEIGHT OF 3 FT PER VESCH STD & SPEC 3.20.
- ROCK CHECK DAMS HAVE A TOP WIDTH OF 12 FT (I.E., [8 FT BOTTOM WIDTH] + [2\*2H:1V\*1 FT])

A DEPTH-STORAGE CURVE FOR THE CLEAN WATER DIVERSION WITH CHECK DAMS WAS DEVELOPED USING THE FOLLOWING EQUATION FROM SECTION 6.4.8 OF THE PENNSYLVANIA BEST MANAGEMENT PRACTICES (BMP) MANUAL:

$$V = [0.5 * L * D * (WT + WB / 2)] * N$$

WHERE:

$$V = \text{STORAGE VOLUME, CF}$$

$$L = \text{LENGTH OF DIVERSION IMPOUNDMENT AREA PER CHECK DAM, FT}$$

L = 550 FT/N WHERE 550 FT IS THE ASSUMED DIVERSION LENGTH AND "N" IS THE NUMBER OF CHECK DAMS SPACED ALONG THE DIVERSION

$$D = \text{DEPTH OF CHECK DAM, FT}$$

ASSUMED D = 1 FT

$$WT = \text{TOP WIDTH OF CHECK DAM, FT}$$

$$WT = WB + (2 * [2H:1V * 1 FT]) = 8 FT + (2 * 2 FT) = 12 FT$$

$$WB = \text{BOTTOM WIDTH OF CHECK DAM, FT}$$

ASSUMED WB = 8 FT

N = NUMBER OF CHECK DAMS, WHERE "D" IS THE DEPTH OF THE CHECK DAM (1 FT) AND "S" IS THE SLOPE CONDITION IN FT/FT.

THE CALCULATED DEPTH-STORAGE CURVE FOR EACH SLOPE CONDITION IS PROVIDED IN THE TABLE BELOW. NOTE THAT THE STORAGE VOLUME BEHIND EACH ROCK CHECK DAM VARIES BASED ON THE SLOPE CONDITION, BUT THE TOTAL STORAGE VOLUME WITHIN THE DIVERSION REMAINS THE SAME SINCE THE SAME DIVERSION LENGTH AND GEOMETRY IS ASSUMED FOR ALL SLOPE CONDITIONS. THE REDUCED STORAGE BEHIND EACH CHECK DAM FOR STEEPER SLOPES IS ACCOUNTED FOR BY AN INCREASED NUMBER OF CHECK DAMS, AS DESCRIBED ABOVE.

CLEAN WATER DIVERSION DEPTH-STORAGE DATA			
SLOPE (%)	DEPTH (FT)	STORAGE VOLUME IN DIVERSION BEHIND EACH CHECK DAM (CF)	TOTAL STORAGE VOLUME WITHIN DIVERSION (CF)
10	0	0	0
	0.5	25	1,375
	1	50	2,750
	1.5	75	4,125
	2	100	5,500
20	0	0	0
	0.5	13	1,375
	1	25	2,750
	1.5	38	4,125
	2	50	5,500
30	0	0	0
	0.5	8.3	1,375
	1	17	2,750
	1.5	25	4,125
	2	33	5,500
40	0	0	0
	0.5	6.3	1,375
	1	13	2,750
	1.5	19	4,125
	2	25	5,500

c) COMPOST FILTER SOCK END TREATMENT MODELING APPROACH AND ASSUMPTIONS

DISCHARGE FROM THE CLEAN WATER DIVERSION IS ROUTED TO A CFS END TREATMENT. CALCULATIONS TO DETERMINE THE ADDITIONAL PEAK FLOW ATTENUATION PROVIDED BY THE PROPOSED CFS END TREATMENT WERE ALSO COMPLETED WITHIN *HYDRAFLOW HYDROGRAPHS*. TO MODEL THE STORAGE/PEAK FLOW ATTENUATION PROVIDED BY THE CFS END TREATMENT, A DEPTH-STORAGE CURVE WAS DEVELOPED FOR EACH SLOPE CONDITION (10-40%) ASSUMING "WEDGE" STORAGE BEHIND THE LENGTH OF THE END TREATMENT USING THE FOLLOWING EQUATION:

$$V = [0.5 * (D * 1/S) * D] * L$$

WHERE:

$$V = \text{STORAGE VOLUME, CF}$$

$$D = \text{PONDING DEPTH BEHIND CFS END TREATMENT, FT}$$

FOR 24-IN DIAMETER CFS END TREATMENT (OR EQUIVALENT, SUCH AS 12-IN TRIPLE STACK), THE MAXIMUM PONDING DEPTH (D) IS 2 FT

$$S = \text{SLOPE, FT/FT}$$

$$L = \text{LENGTH OF CFS END TREATMENT, FT}$$

ASSUMED L = 10 FT

THE CALCULATED DEPTH-STORAGE CURVE FOR EACH SLOPE CONDITION IS PROVIDED IN THE TABLE BELOW:

CFS END TREATMENT DEPTH-STORAGE DATA		
SLOPE (%)	DEPTH (FT)	PONDING VOLUME, V (CF)
10	0	0
	1	50
	2	200
	3	450
20	0	0
	1	25
	2	100
	3	225
30	0	0
	1	17
	2	67
	3	150
40	0	0
	1	13
	2	50
	3	113

CFS IS AN APPROVED E&S CONTROL FOR THE PROJECT (SEE DETAIL MVP-ES3) AND IS CLASSIFIED AS "FLOW-THROUGH" TECHNOLOGY. THEREFORE, IN ADDITION TO DEFINING THE WEIR OUTLET AT THE TOP OF THE END TREATMENT, A DEPTH-DISCHARGE CURVE WAS DEVELOPED TO ACCOUNT FOR FLOW THROUGH THE CFS AT A RATE OF 0.095 CFS/LF (OR 43 GPM/LF, AS DISCUSSED IN SECTION B.1.B) ABOVE).

d) COMPOST FILTER SOCK END TREATMENT DESIGN

BASED ON THE CALCULATIONS AND ASSUMPTIONS NOTED IN SECTIONS C.1.A) THROUGH C.1.C) ABOVE, IT WAS DETERMINED THAT FLOW FROM THE CLEAN WATER DIVERSION WILL NOT OVERTOP A 10 FT LONG, 24-IN DIAMETER CFS END TREATMENT (OR EQUIVALENT, SUCH AS 12 IN. TRIPLE STACK), WITH A WORST CASE MAXIMUM DEPTH OF 1.32 FT FOR THE 10 % SLOPE CONDITION. NOTE THAT A 12 FT TOP OF CHECK DAM WIDTH IS NEEDED IN ORDER TO ENSURE THAT THE CFS END TREATMENT DOES NOT OVERTOP, SO 16 FT OF THE TEMPORARY ROW (I.E., 12 FT + [2H:1V\*0.5 FT] + [2H:1V\*1.5 FT] = 16 FT) WILL BE OCCUPIED BY THE CLEAN WATER DIVERSIONS.

THEREFORE, SINCE NO OVERTOPPING WILL OCCUR AND AS DEMONSTRATED PREVIOUSLY IN SECTION B.1.B), THE CFS WILL PRODUCE SHEETFLOW IN A NON-EROSIVE MANNER THAT WILL NOT IMPACT DOWN GRADIENT PROPERTIES.

1. CLEAN WATER DIVERSION WITH CLEAN WATER PIPE (MVP-ES50)

CLEAN WATER DIVERSIONS CAN ALSO DISCHARGE VIA TEMPORARY SLOPE DRAINS PER DETAIL MVP-ES50 AS AN ALTERNATIVE TO USING CFS END TREATMENTS WHEN CONDITIONS ARE MORE APPROPRIATE; ALL TEMPORARY SLOPE DRAINS WILL DISCHARGE TO A PLUNGE POOL OUTLET (SEE DETAILS MVP-ES51 AND MVP-ES51.1). CALCULATIONS CORRESPONDING TO THESE PROJECT DETAILS (SPECIFICALLY, THE SIZING OF THE TEMPORARY SLOPE DRAINS AND PLUNGE POOL OUTLET) WERE SUBMITTED WITH THE FOLLOWING DEVIATION REQUESTS AND APPROVED BY THE DEQ:

- REQUEST 24-IN SLOPE DRAIN PIPE SIZE FOR CLEAN WATER DIVERSIONS
- REQUEST CLEAN WATER PIPE PLUNGE POOL OUTLET DESIGN

D. SUMMARY

SINCE IT HAS BEEN DEMONSTRATED THAT UNDER THE MOST CONSERVATIVE ASSUMPTIONS THAT SHEETFLOW DOWN GRADIENT OF THE PERIMETER CONTROLS, AS WELL AS FROM THE END TREATMENTS ASSOCIATED WITH THE CLEAN WATER DIVERSION SCENARIOS, DURING AND IMMEDIATELY FOLLOWING CONSTRUCTION WILL NOT "CAUSE OR CONTRIBUTE TO EROSION, SEDIMENTATION, OR FLOODING OF DOWN GRADIENT PROPERTIES", THE CONSTRUCTION PHASE OF THE PROJECT WILL BE IN FULL COMPLIANCE WITH MS-19.

16. BEST MANAGEMENT PRACTICES INSTALLATION AND 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, SHOWN ON DETAIL SHEET, 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 SILT FENCE OR COMPOST FILTER SOCK 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.
- 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.
- 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.
- 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.
- THE PERMANENT WATERBARS WILL BE CONSTRUCTED WITH A FIVE PERCENT (MAXIMUM) 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. 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.

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

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

**MOUNTAIN VALLEY PIPELINE, LLC**  
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CANONSBURG, PA 15317

**TETRA TECH**  
complex world | CLEAR SOLUTIONS™

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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
NARRATIVE	3 OF 4

