APPENDIX W

Best-in-Class Control Measures and Site Specific Designs

Best-In-Class Decision Tool/ Work Flow Process

WORKING DRAFT
Implementing the BIC Steep Slope Hazard Mitigation Program – Decision Tree/Work Flow Process (WFP) Outline
Revised 10-04-2016_UPDATED Feb 15, 2017

Work Flow Process (WFP) for Implementation of the BIC Program – Review and Selection of Typical Scenarios and corresponding Incremental Controls.

Refer to the project document titled "Virginia Stormwater Pollution Prevention Plan (SWPPP)", Rev 5 dated February 2017 (refer to subsequent revisions to this document, as needed) for a detailed summary and definitions for the Best in Class (BIC) program. The following offers an abbreviated summary of the program.

Typical BIC mitigation designs, i.e. Typical Designs (TDs), for any given pipeline alignment location show defined "Typical Scenarios" that describe right-of-way conditions relative to steep slope areas (i.e. planar or side slope conditions, steep slopes without evidence of instability, steep slopes with potential for instability when disturbed, ridge tops, etc.). These Typical Scenarios (there are 6 scenarios, labeled A-F) characterize the kinds of steep slope and erosion related hazards at that location and thereby support development of mitigation actions. TDs provide a comprehensive and programmatic approach to address the hundreds of BIC locations along the pipeline alignment. Each TD includes a listing of applicable Incremental Controls (i.e. individual mitigation control measures shown on fly-sheets; examples include: silt fence, erosion control cloth, slope breakers, trench breakers, surface run-off controls, subsurface drains, etc.) that can be used at that site to address a range of potential conditions. TDs include mitigation measures that go above and beyond the minimum regulatory requirements.

TDs can be further developed into a Site Specific Design (SSD) for targeted locations, or to address special site conditions. Development of a SSD requires selecting the applicable Incremental Controls listed for a TD for a given site; and then defining the location, quantity, configuration, and any other site specific information needed to support construction. SSDs typically have stand-alone drawing packages showing site specific information.

The following outlines general steps for selecting site specific Incremental Controls corresponding to a TD, or for developing a SSD. The following approach is organized as a work flow process (WFP) that describes the general steps, as follows:

1. Convene team consisting (at a minimum) of BIC representatives from Dominion Engineering, Environmental, Construction, and a representative from the contractor.

2. Identify the pipeline alignment sheet corresponding to the site location; and review ESC measures (i.e. the baseline permit requirements) shown on the alignment sheet, the defined BIC Typical Steep Slope Scenario classification (A-F) for the site (also shown on the alignment sheet), the geohazards resource report assessment (typically a separate

technical reference document), and the SSURGO soils information (indicated on alignment sheets and/or as separate data).

3. Incremental Controls are organized into similar Groups that bundle corresponding mitigation measures together, to allow for practical review and selection of the best Incremental Control for the applicable site conditions, as follows:

    a. Identify and mitigate for potential sub-surface/surface drainage issues (Group 1);

    b. Identify and mitigate for temporary ROW surface or subsurface drainage (Groups 1 and 2);

    c. Identify and mitigate for disturbed ROW backfill resulting from construction, including short- and long-term mitigation/stabilization measures (Group 2);

    d. Identify and mitigate for potential erosion of surface soils (Group 3);

    e. Identify and mitigate for stabilization of trench and ROW backfill (Group 4);

    f. Identify and mitigate for potential for surface run-off on and within the ROW (Group 5);

    g. Identify and mitigate for potential surface run-off coming onto (from outside sources), across, along, and adjacent the ROW (Group 6);

    h. Identify and mitigate for temporary erosion and sediment control issues, primarily using Silt Fence (addressed under ES&C Plan) (Group 7);

    i. Identify and mitigate for oversized backfill, bedrock trench, etc.; and shallow groundwater and buoyancy issues (Groups 8 and 9);

    j. Identify and mitigate for special considerations for construction through benched topography (Group 10);

    k. Identify and mitigate for monitoring for active/future movement during construction or long-term Operation (Group 11);

    l. Identify and mitigate for active movement through stress relief excavations (during construction short-term), over the long-term (Operations), or isolate ROW in active land movement areas (shear trench) (Group 12);

    m. Identify and mitigate for ROW layout and configuration (Group 13), use these typical layouts and geometries to plan and coordinate construction and engineering mitigation measures;

    n. Identify and mitigate for special engineering conditions through development of studies, investigations, special contractors or other specialized detailed engineering, as needed (Group 14);

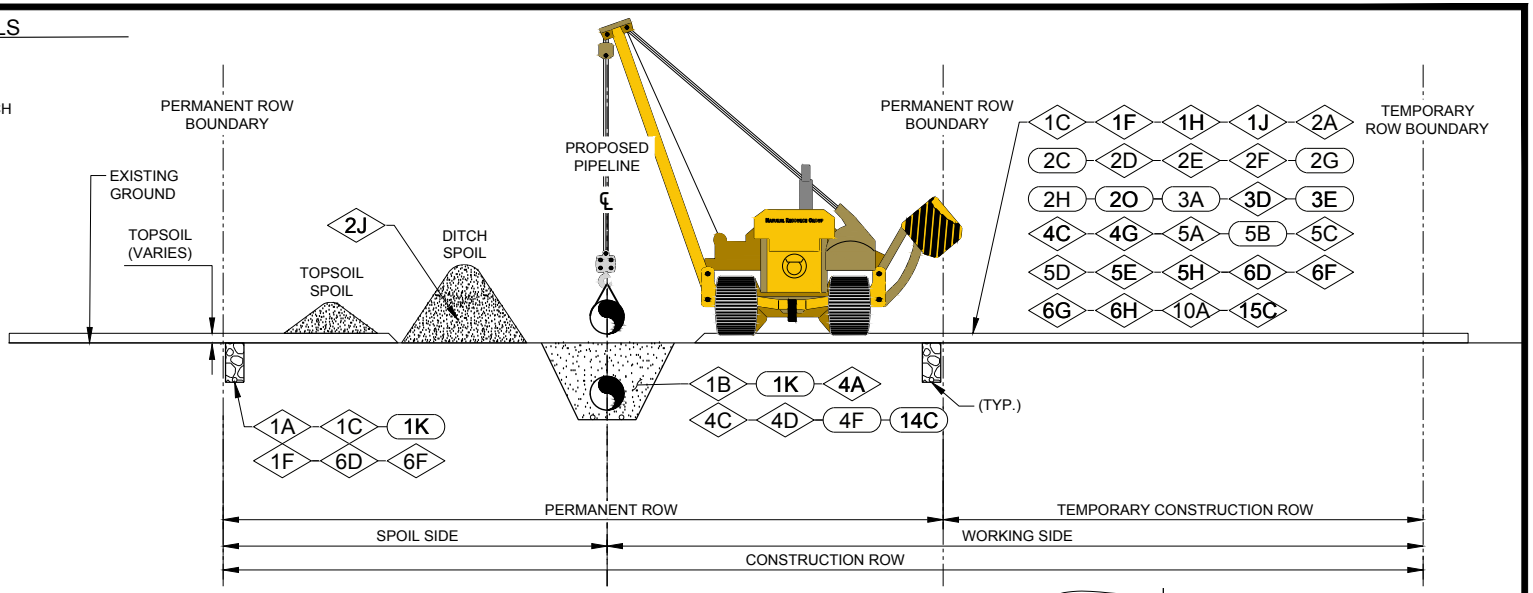
o. Identify and mitigate through avoidance by excavation, HDD, deeper trench, micro-re-route, larger re-route, etc.), or develop special access (i.e. when access is limited to the temporary constructed ROW, and other permanent access needs to be developed to provide long-term access for maintenance and operation), (Group 15);

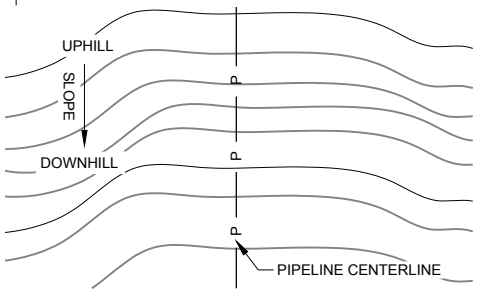
p. Identify and mitigate for karst hazards using special engineering studies and measures (Group 16).

Dominion Typical Scenarios with Typical Designs

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN), IN PIPELINE TRENCH
- 1C TARGETED SEEP DRAINS, AT INTERSEPTED SEEPS
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1I CHANGED SEEP CHARACTERISTICS
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2J SPOILS MANAGEMENT
- 2O BENCH AND REGRADE WITH BACKFILL
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS
- 6D ARMORED CHANNEL
- 6F RIPRAP GRADATIONS
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS





PLANAR SLOPE ORIENTATION (N.T.S.)

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
1	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

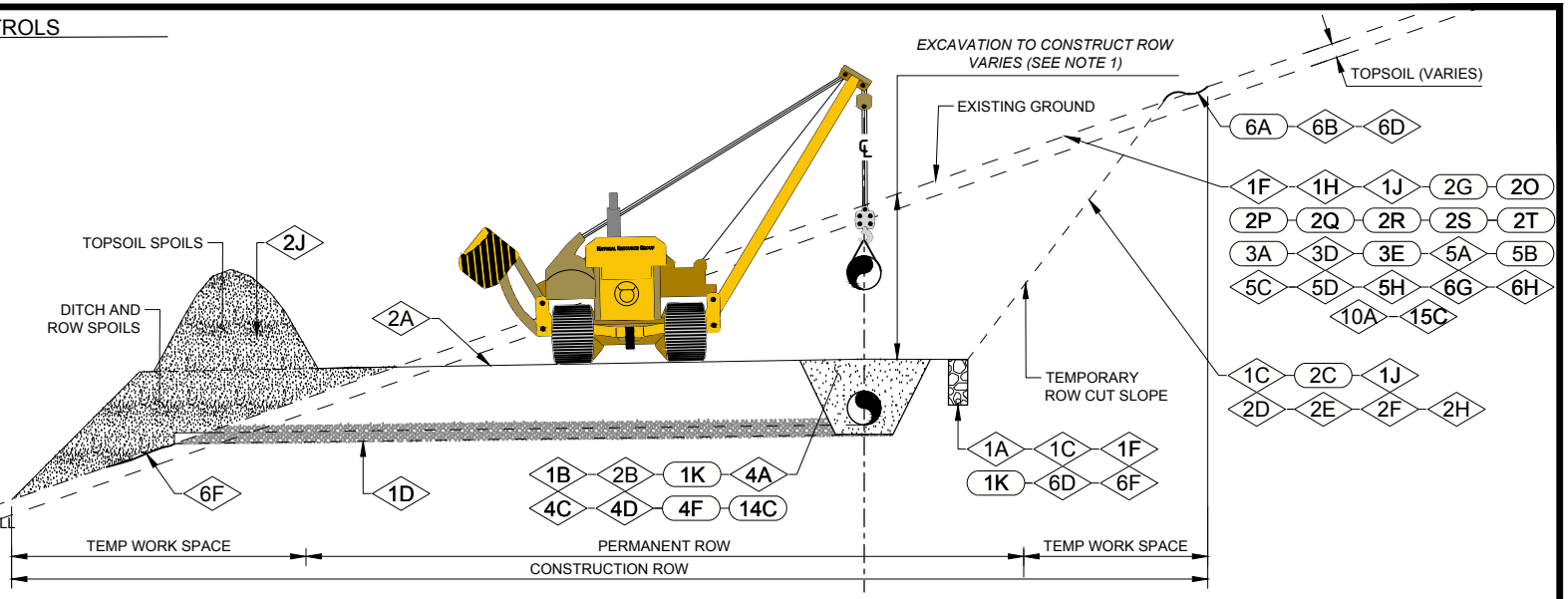
A1 – STEEP SLOPES WITHOUT EVIDENCE OF PREVIOUS MOVEMENT (PLANAR SLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios1
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	
CHECK	-	2017-02-28		1 OF 2
REVIEW	AQK	2017-02-28		

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 1C TARGETED SEEP DRAINS
- 1D BLEEDER DRAIN
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1I CHANGED SEEP CHARACTERISTICS
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2B GRADING TRENCH WITH OUTBOARD WEDGE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 2O BENCH AND REGRADE WITH BACKFILL
- 2P CUT AND FILL CONSTRUCTION
- 2Q TYP SIDE HILL CUT AND FILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

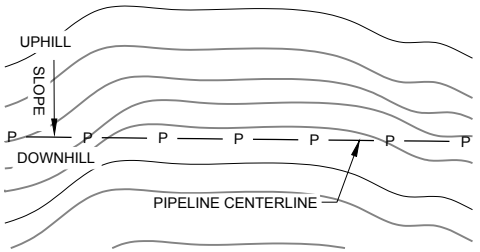
- 5H SURFACE WATER DIVERSIONS
- 6A COIR-LINED VEGETATED DIVERSION CHANNEL
- 6B BROW DITCH
- 6D ARMORED CHANNEL
- 6F RIPRAP GRADATIONS
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B



SIDESLOPE ORIENTATION (N.T.S.)

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

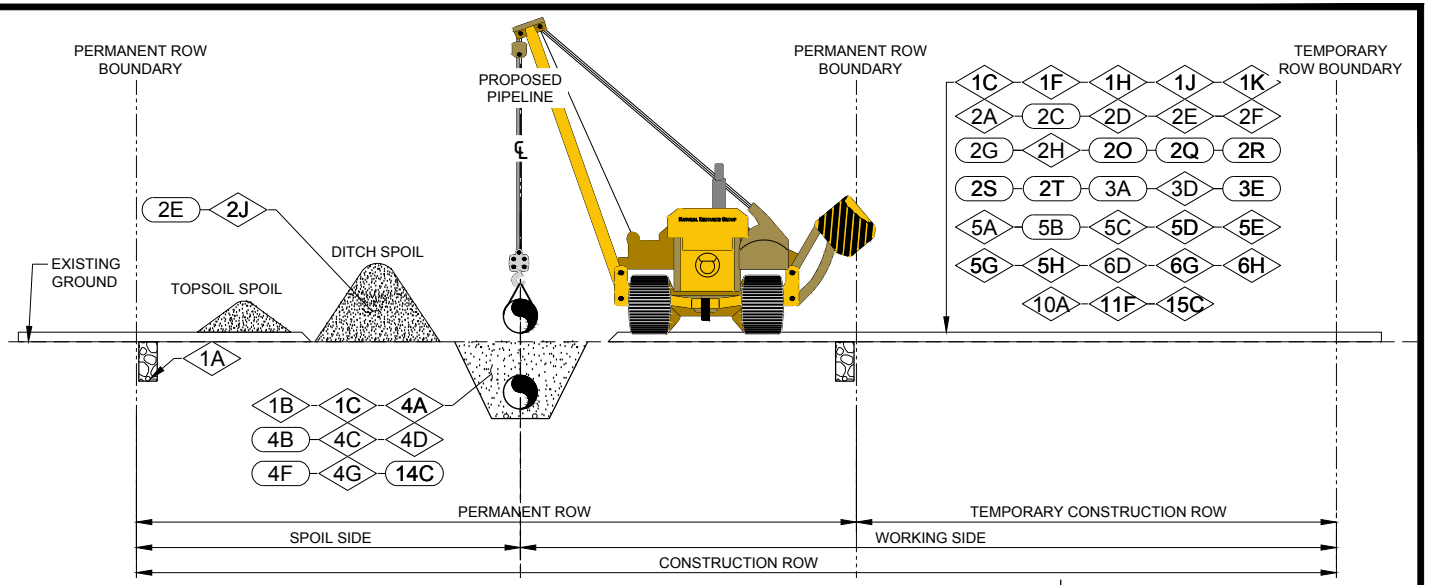
A2 - STEEP SLOPES WITHOUT EVIDENCE OF PREVIOUS MOVEMENT (SIDESLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios1
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	
CHECK	-	2017-02-28		2 OF 2
REVIEW	AQK	2017-02-28		

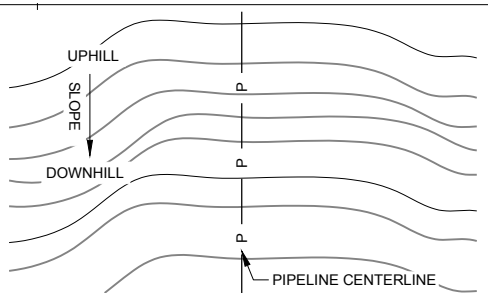
BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 1C TARGETED SEEP DRAINS
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 2O BENCH AND REGRADE WITH BACKFILL
- 2Q TYP SIDE HILL CUT AND FILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4B TRENCH DAMS (FOAM BAGS OR FINE GRAINED SOILS)
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS (OLD ROADS)
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS
- 6D ARMORED CHANNEL
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS,
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS



PLANAR SLOPE ORIENTATION (N.T.S.)

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

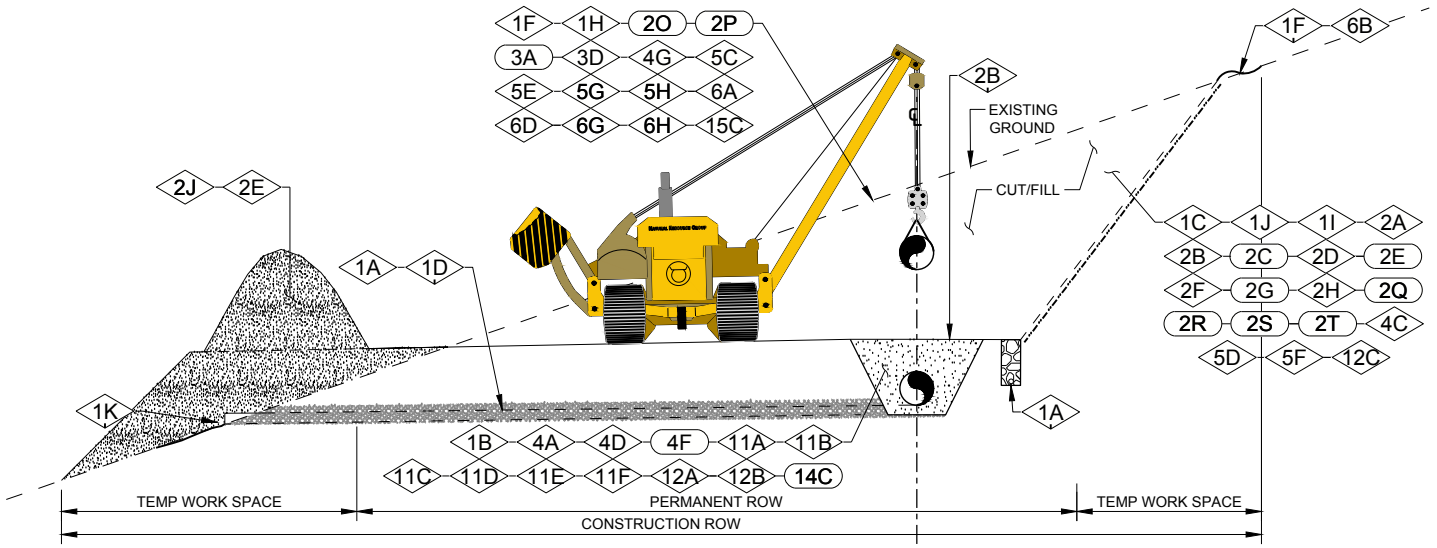
B1 - STEEP SLOPES WITH EVIDENCE OF ACTIVE MOVEMENT (PLANAR SLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios2
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	
CHECK	-	2017-02-28		1 OF 2
REVIEW	AQK	2017-02-28		

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 1C TARGETED SEEP DRAINS
- 1D BLEEDER DRAIN
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1I CHANGED SEEP CHARACTERISTICS
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2B GRADING TRENCH WITH OUTBOARD WEDGE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 2O BENCH AND REGRADE WITH BACKFILL
- 2P CUT AND FILL CONSTRUCTION
- 2Q TYP SIDE HILL CUT AND FILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4B TRENCH DAMS (FOAM BAGS OR FINE GRAINED SOILS)
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5F SACK-CRETE WEDGE
- 5G NO WOOD CHIPS IN ROW



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

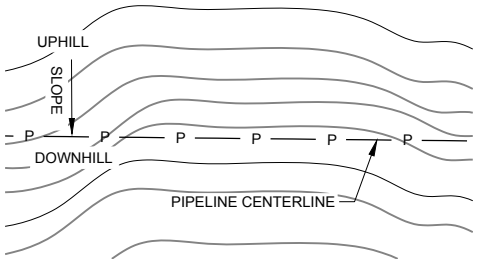
- 5H SURFACE WATER DIVERSIONS
- 6A COIR-LINED VEGETATED DIVERSION CHANNEL
- 6B BROW DITCH
- 6D ARMORED CHANNEL
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 11A GEODETIC MONITORING
- 11B STRAIN GAUGE MONITORING
- 11C SLOPE INCLINOMETER MONITORING
- 11D SLOPE INCLINOMETER CASING
- 11E STANDPIPE PIEZOMETER MONITORING
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 12A STRESS RELIEF EXCAVATIONS
- 12B SELECT (DEFORMABLE) TRENCH BACKFILL
- 12C SHEAR TRENCH
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B



SIDESLOPE ORIENTATION (N.T.S.)

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

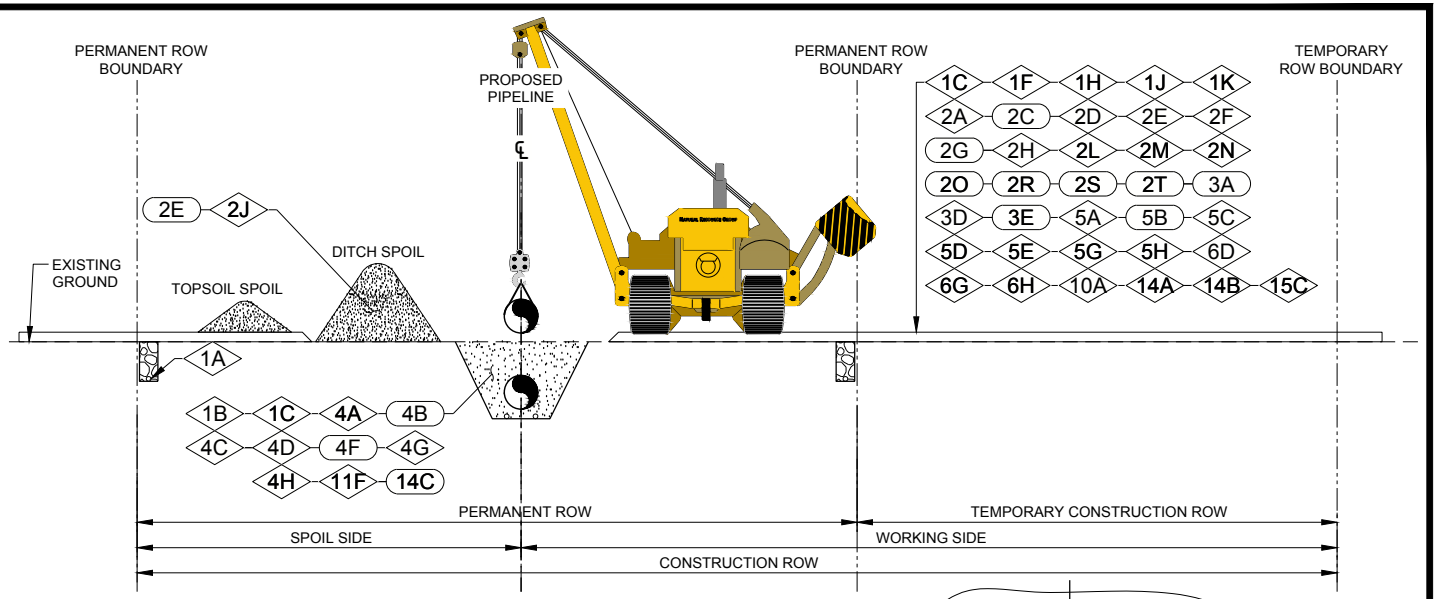
B2 - STEEP SLOPES WITH EVIDENCE OF ACTIVE MOVEMENT (SIDESLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios3
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	2 OF 2
CHECK	-	2017-02-28		
REVIEW	AQK	2017-02-28		

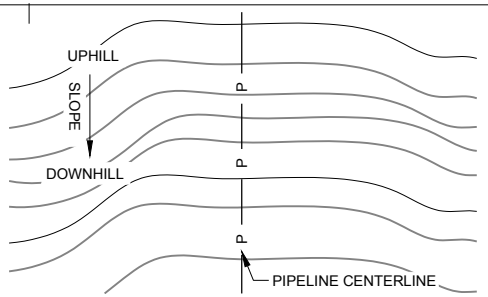
BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 1C TARGETED SEEP DRAINS
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 2L SOIL-NAIL WITH TECCO MESH
- 2M EXTERNALLY STABILIZED RETAINING WALL SYSTEMS
- 2N GEOTEXTILE REINFORCED SYSTEMS
- 2O BENCH AND REGRADE WITH BACKFILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4B TRENCH DAMS (FOAM BAGS OR FINE GRAINED SOILS)
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS (OLD ROADS)
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 6D ARMORED CHANNEL
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14A SITE SPECIFIC DETAILED ENGINEERING
- 14B MESH ROCK FALL PROTECTION
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS



PLANAR SLOPE ORIENTATION (N.T.S.)

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

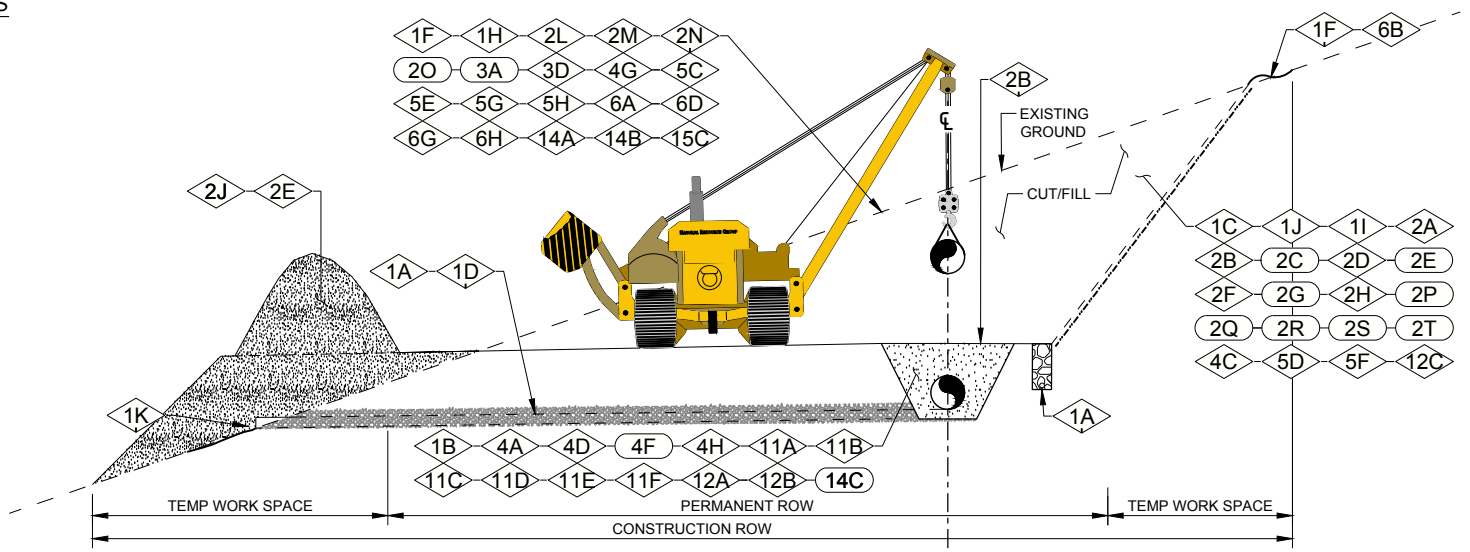
C1 – STEEP SLOPES WITH INCREASED POTENTIAL FOR INSTABILITY WHEN DISTURBED (PLANAR SLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios2
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	
CHECK	-	2017-02-28		1 OF 2
REVIEW	AQK	2017-02-28		

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 1C TARGETED SEEP DRAINS
- 1D BLEEDER DRAIN
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1I CHANGED SEEP CHARACTERISTICS
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2B GRADING TRENCH WITH OUTBOARD WEDGE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 2L SOIL-NAIL WITH TECCO MESH
- 2M EXTERNALLY STABILIZED RETAINING WALL SYSTEMS
- 2N GEOTEXTILE REINFORCED SYSTEMS
- 2O BENCH AND REGRADE WITH BACKFILL
- 2P CUT AND FILL CONSTRUCTION
- 2Q TYP SIDE HILL CUT AND FILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4B TRENCH DAMS (FOAM BAGS OR FINE GRAINED SOILS)
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

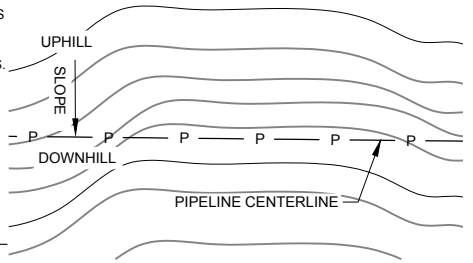
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5F SACK-CRETE WEDGE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS
- 6A COIR-LINED VEGETATED DIVERSION CHANNEL
- 6B BROW DITCH
- 6D ARMORED CHANNEL
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 11A GEODETIC MONITORING
- 11B STRAIN GAUGE MONITORING
- 11C SLOPE INCLINOMETER MONITORING
- 11D SLOPE INCLINOMETER CASING
- 11E STANDPIPE PIEZOMETER MONITORING
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 12A STRESS RELIEF EXCAVATIONS
- 12B SELECT (DEFORMABLE) TRENCH BACKFILL
- 12C SHEAR TRENCH
- 14A SITE SPECIFIC DETAILED ENGINEERING
- 14B MESH ROCK FALL PROTECTION
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B



SIDESLOPE ORIENTATION (N.T.S.)

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
1	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

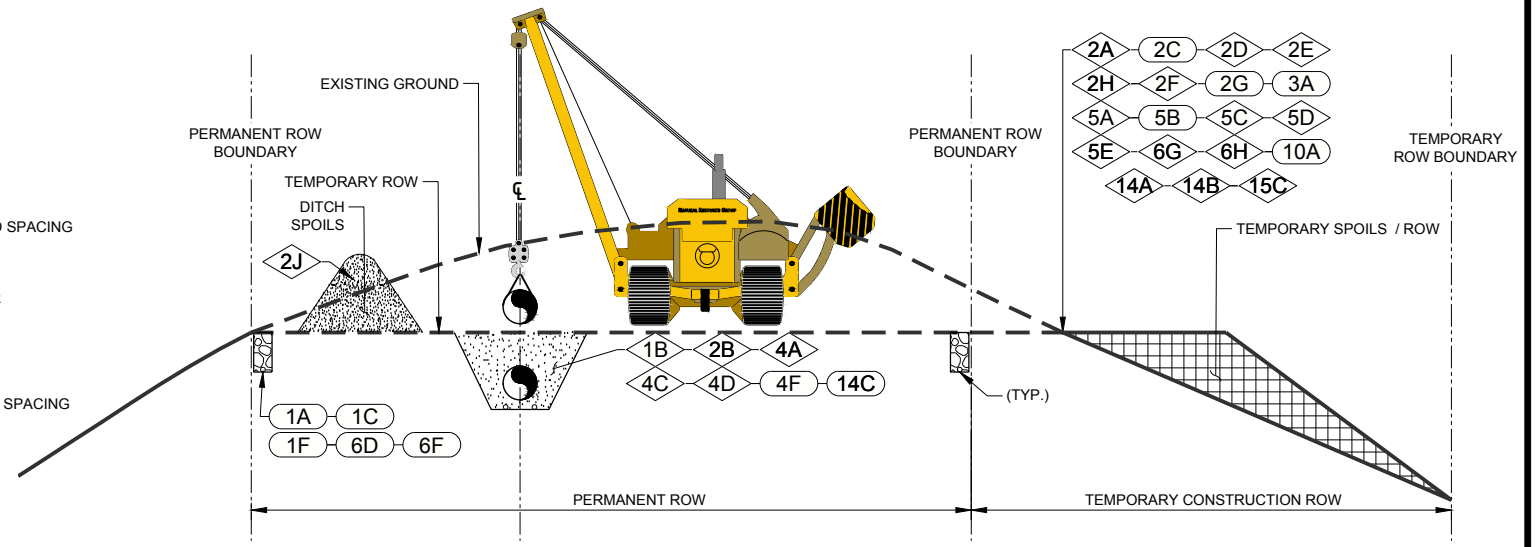
C2 – STEEP SLOPES WITH INCREASED POTENTIAL FOR INSTABILITY WHEN DISTURBED (SIDE SLOPE)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios3
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	2 OF 2
CHECK	-	2017-02-28		
REVIEW	AQK	2017-02-28		

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1B ENHANCED DRAIN (GERMAN DRAIN)
- 2A GRADING TEMPORARY ROW SURFACE
- 2B GRADING TRENCH WITH OUTBOARD WEDGE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2H GRADING TO MINIMIZE BACKFILL
- 2J SPOILS MANAGEMENT
- 3A TRACK DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14A SITE SPECIFIC DETAILED ENGINEERING
- 14B MESH ROCK FALL PROTECTION
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS



NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. SCENARIO SHOWN WHERE RIDGE TOP IS GENERALLY CENTERED, BUT MAY VARY WITH CUT/FILL TO ONE SIDE OR THE OTHER.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

D - STEEP SLOPES NEAR NARROW RIDGE TOPS

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.		TypScenarios1
DESIGN	DBC	2017-02-28	SCALE		AS SHOWN
CADD	THR	2017-02-28	FIGURE		
CHECK	-	2017-02-28			1 OF 1
REVIEW	AQK	2017-02-28			

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN), IN PIPELINE TRENCH
- 1C TARGETED SEEP DRAINS, AT INTERSEPTED SEEPS
- 1D BLEEDER DRAIN
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1G DEWATERING
- 1H STEEP CONVEYANCE CHANNEL
- 1I CHANGED SEEP CHARACTERISTICS
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 1L DEWATERING DISCHARGE BAG
- 1M DEWATERING DISCHARGE IN UPLAND AREA
- 2A GRADING TEMPORARY ROW SURFACE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2J SPOILS MANAGEMENT
- 2K GABIONS
- 2L SOIL-NAIL WITH TECCO MESH
- 2M EXTERNALLY STABILIZED RETAINING WALL SYSTEMS
- 2N GEOTEXTILE REINFORCED SYSTEMS
- 2O BENCH AND REGRADE WITH BACKFILL
- 2P CUT AND FILL CONSTRUCTION
- 2Q TYP SIDE HILL CUT AND FILL
- 2R TYP FILL WITH ROCK UNDER DRAIN
- 2S TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS
- 2T TYP FILL WITH MULTIPLE ROCK CHANNELS

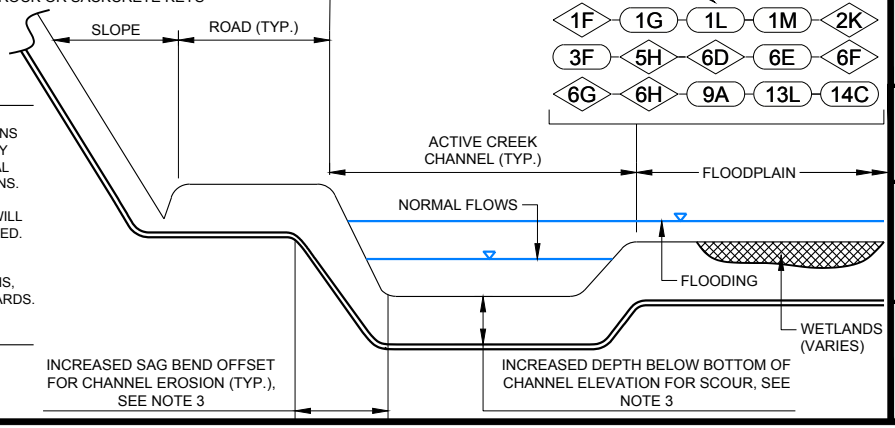
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 3F SUBMAR MATTS
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4B TRENCH DAMS (FOAM BAGS OR FINE GRAINED SOILS)
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER)
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS

- 6D ARMORED CHANNEL
- 6E TYP STREAM BANK STABILIZATION WITH VARIOUS CONCEPTUAL CONTROLS
- 6F RIPRAP GRADATIONS
- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 9A BUOYANCY MITIGATION
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 13A TYP WATERBODY OPEN CUT
- 13B TYP WATERBODY FLUME METHOD
- 13C TYP WATERBODY DAM AND PUMP
- 13D TYP WATERBODY HDD METHOD
- 13E TYP ADDITIONAL WORKSPACE AT WATERBODY ACP SHP
- 13F TYP WETLAND OPEN CUT METHOD ACP AP-1 AP-2 AP-3 AP-4 AP-5
- 13G TYP CONSTRUCTION ROW IN WETLANDS ACP SHP
- 13H TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS ACP SHP
- 13I TYP ADDITIONAL WORKSPACE AT BORED CROSSINGS FOR TWO-LANE ROADS AND RAILROADS ACP SHP
- 13J TYP CONSTRUCTION ROW IN NON-AG AREAS ACP SHP
- 13K TYP CONSTRUCTION ROW IN AG AREAS ACP SHP
- 13L TYP COFFERDAM CROSSING
- 14A SITE SPECIFIC DETAILED ENGINEERING
- 14B MESH ROCK FALL PROTECTION
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS

1A 1B 1C 1D 1H 1I 1J 1K
2A 2C 2D 2E 2F 2G 2J 2L
2M 2N 2O 2P 2Q 2R 2S 2T
3A 3D 3E 4A 4B 4C 4D 4F
4G 4H 5A 5B 5C 5D 5E 5G
10A 11F 14A 14B 15C

13A THROUGH 13K

1F 1G 1L 1M 2K
3F 5H 6D 6E 6F
6G 6H 9A 13L 14C



NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. SEPARATE TECHNICAL STUDY MAY BE NEEDED TO DETERMINE SAGBEND SETBACKS AND BURIAL DEPTHS, BASED ON SITE SPECIFIC EROSION AND SCOUR HAZARDS.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
A	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT
BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

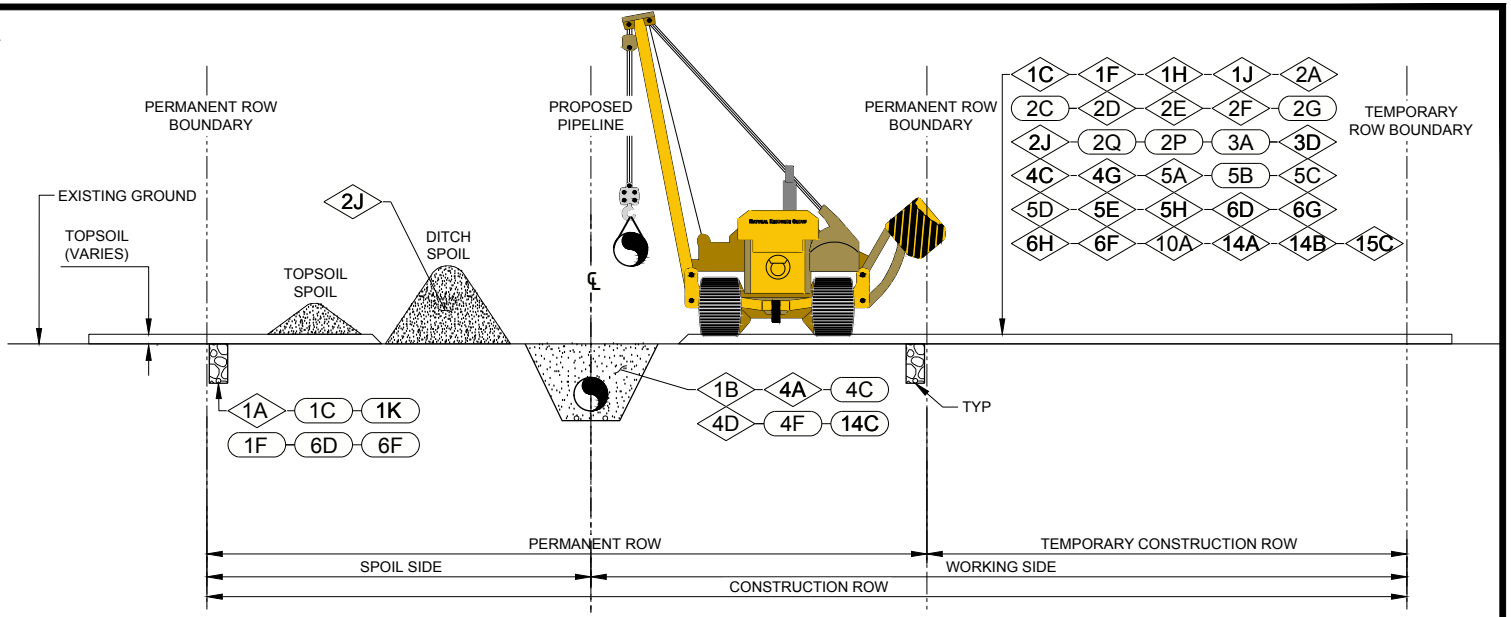
TITLE
E - STEEP SLOPES WITH A SENSITIVE RESOURCE AT TOE (I.E. STREAM, WETLAND, ROAD)

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.		TypScenarios1
DESIGN	DBC	2017-02-28	SCALE		AS SHOWN
CADD	THR	2017-02-28	FIGURE		
CHECK	-	2017-02-28			1 OF 1
REVIEW	AQK	2017-02-28			

BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 1A FRENCH DRAIN (SIMPLE)
- 1B ENHANCED DRAIN (GERMAN DRAIN), IN PIPELINE TRENCH
- 1C TARGETED SEEP DRAINS, AT INTERSEPTED SEEPS
- 1F ARMORED CHANNEL WITH DRAIN PIPE
- 1H STEEP CONVEYANCE CHANNEL
- 1J SINGLE TARGETED SEEP COLLECTOR
- 1K ENERGY DISSIPATION BASIN
- 2A GRADING TEMPORARY ROW SURFACE
- 2C COMPACT BACKFILL
- 2D DRY SOILS AND BACKFILL
- 2E REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL
- 2F ROCK BACKFILL
- 2G GRADING TO MATCH EXISTING CONTOURS
- 2J SPOILS MANAGEMENT
- 2K GABIONS
- 2L SOIL-NAIL WITH TECCO MESH
- 2M EXTERNALLY STABILIZED RETAINING WALL SYSTEMS
- 2N GEOTEXTILE REINFORCED SYSTEMS
- 2O BENCH AND REGRADE WITH BACKFILL
- 2P CUT AND FILL CONSTRUCTION
- 2Q TYP SIDE HILL CUT AND FILL
- 3A TRACK DISTURBED SLOPES
- 3D ROCK ARMORING ON DISTURBED SLOPES
- 3E COIR LOGS ON DISTURBED SLOPES
- 4A TRENCH BREAKERS (FOAM AND SANDBAGS), MODIFIED SPACING
- 4C SACK-CRETE BREAKERS (STRUCTURAL BREAKER), SEE NOTE 1 FOR UNSTABLE FILL
- 4D SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER
- 4F TRENCH BREAKER WITH DRAINAGE
- 4G SACK-CRETE ARMOR WITH BREAKERS
- 4H FLOWABLE FILL FOR TRENCH BACKFILL
- 5A SLOPE BREAKERS (TEMP AND PERMANENT), MODIFIED SPACING
- 5B SLOPE BREAKER ARMORED OUTLET
- 5C SLOPE BREAKERS WITH DIVERSION CHANNELS
- 5D ACCESS ROADS
- 5E TEMPORARY SLOPE BREAKER WITH DRAIN PIPE
- 5G NO WOOD CHIPS IN ROW
- 5H SURFACE WATER DIVERSIONS
- 6D ARMORED CHANNEL
- 6F RIPRAP GRADATIONS



BEST IN CLASS (BIC) INCREMENTAL CONTROLS

- 6G ARMORED V-SHAPED AND U-SHAPED CHANNELS
- 6H TYP SURFACE WATER CONTROL LAYOUT
- 10A BENCH RE-CONSTRUCTION THROUGH NATURAL STEPS
- 11F AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS
- 14A SITE SPECIFIC DETAILED ENGINEERING
- 14B MESH ROCK FALL PROTECTION
- 14C BLASTING PLAN(S)
- 15C ACCESS TO REMOTE ROW LOCATIONS

NOTES

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. EXAMPLE SECTION SHOWS A TYPICAL SCENARIO. ACTUAL CUT/FILL CONDITIONS MAY VARY FOR EACH SITE.

LEGEND

- XX SCHEDULE A
- XX SCHEDULE B

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
1	2017-02-28	FINAL	DBC	THR	-	AQK

NOTES

PROJECT

BIC STEEP SLOPE
HAZARD MITIGATION PROGRAM

TITLE

F - STEEP SLOPES PREVIOUSLY MODIFIED BY CUTTING AND FILLING

Atlantic Coast Pipeline

PROJECT No.		1535050	FILE No.	TypScenarios4
DESIGN	DBC	2017-02-28	SCALE	AS SHOWN
CADD	THR	2017-02-28	FIGURE	
CHECK	-	2017-02-28		1 OF 1
REVIEW	AQK	2017-02-28		

Best-In-Class Incremental Controls

DOMINION BIC PROGRAM FOR ACP/SHP
SUMMARY LISTING OF INCREMENTAL CONTROLS (SUPPORTING TYPICAL SCENARIOS)
REVISED Feb 28, 2017

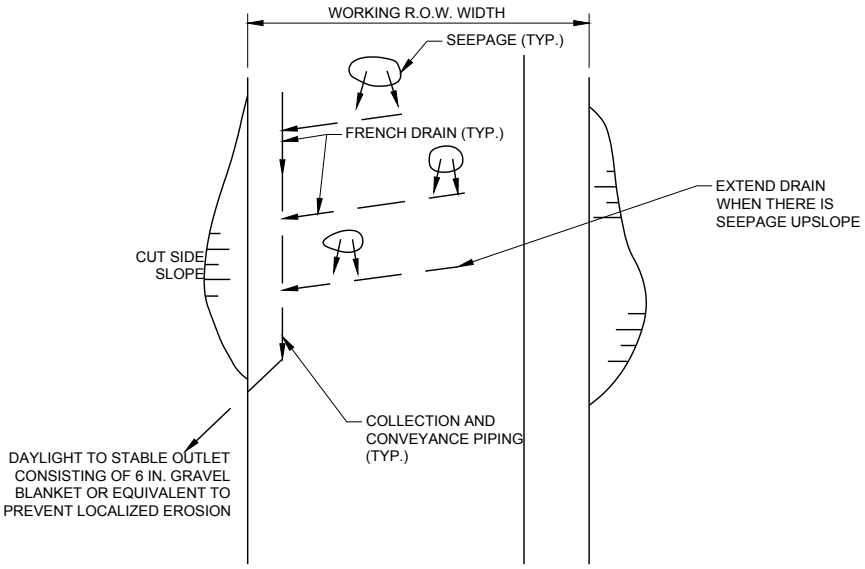
No.	GROUP	GROUP NO.	INCREMENTAL CONTROL SHEET TITLE	REV.	DATE	SHEET NO.	(C)omplete/(P)ending/(U)pdated	SOURCE DOCUMENT:
1	COVER	0	COVER SHEET	F	2/28/2017	0	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
2	SUBSURFACE DRAINAGE	1	FRENCH DRAIN (SIMPLE)	F	2/28/2017	1A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
3			ENHANCED DRAIN (GERMAN DRAIN)	F	2/28/2017	1B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
4			TARGETED SEEP DRAINS	F	2/28/2017	1C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
5			BLEEDER DRAIN	F	2/28/2017	1D	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
6			DRAIN PIPE OUTFALL RIPRAP APRON	F	2/28/2017	1E	C	2017 ANNUAL STANDARDS AND SPECIFICATIONS, EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT FOR CONSTRUCTION AND MAINTENANCE OF PIPELINE PROJECTS IN VIRGINIA, DOMINION TRANSMISSION, INC. (FEBRUARY 2017)
7			ARMORED CHANNEL WITH DRAIN PIPE	F	2/28/2017	1F	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
8			DEWATERING	F	2/28/2017	1G	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
9			STEEP CONVEYANCE CHANNEL	F	2/28/2017	1H	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
10			CHANGED SEEP CHARACTERISTICS	F	2/28/2017	1I	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
11			TARGETED SEEP COLLECTOR	F	2/28/2017	1J	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
12			ENERGY DISSIPATION BASIN	F	2/28/2017	1K	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
13			DEWATERING DISCHARGE BAG	F	2/28/2017	1L	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
14			DEWATERING DISCHARGE IN UPLAND AREA	F	2/28/2017	1M	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
15	GRADING, BACKFILL, MECH STABILIZE, CUT/FILL	2	GRADING TEMPORARY ROW SURFACE	F	2/28/2017	2A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
16			GRADING TRENCH WITH OUTBOARD WEDGE	F	2/28/2017	2B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
17			COMPACT BACKFILL	F	2/28/2017	2C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
18			DRY SOILS AND BACKFILL	F	2/28/2017	2D	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
19			REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL	F	2/28/2017	2E	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
20			ROCK BACKFILL (WITH DRAIN)	F	2/28/2017	2F	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
21			GRADING TO MATCH EXISTING CONTOURS	F	2/28/2017	2G	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
22			GRADING TO MINIMIZE BACKFILL OVER LANDSLIDE	F	2/28/2017	2H	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
23			TYPICAL TRENCH DIMENSIONS IN GENERALLY FLAT TERRAIN	F	2/28/2017	2I	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
24			SPOILS MANAGEMENT	F	2/28/2017	2J	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
25			GABIONS	F	2/28/2017	2K	C	2017 ANNUAL STANDARDS AND SPECIFICATIONS, EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT FOR CONSTRUCTION AND MAINTENANCE OF PIPELINE PROJECTS IN VIRGINIA, DOMINION TRANSMISSION, INC. (FEBRUARY 2017)
26			SOIL NAIL TECCO MESH	F	2/28/2017	2L	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
27			EXTERNALLY STABILIZED RETAINING WALL SYSTEMS	F	2/28/2017	2M	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
28			GEOTEXTILE REINFORCED SYSTEMS	F	2/28/2017	2N	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
29			BENCH AND REGRADE WITH BACKFILL	F	2/28/2017	2O	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
30			CUT/FILL CONSTRUCTION	F	2/28/2017	2P	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
31			TYP SIDE HILL CUT AND FILL	F	2/28/2017	2Q	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
32			TYP FILL WITH ROCK UNDER DRAIN	F	2/28/2017	2R	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
33			TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS	F	2/28/2017	2S	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
34			TYP FILL WITH MULTIPLE ROCK CHANNELS	F	2/28/2017	2T	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
35	SURFACE EROSION	3	TRACK DISTURBED SLOPES	F	2/28/2017	3A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
36			RE-VEGETATE DISTURBED SLOPES	F	2/28/2017	3B	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
37			COIR CLOTH ON DISTRUBED SLOPES	F	2/28/2017	3C	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
38			ROCK ARMORING ON DISTRUBED SLOPES	F	2/28/2017	3D	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
39			COIR LOGS ON DISTURBED SLOPES	F	2/28/2017	3E	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
40			SUBMAR MATTS	F	2/28/2017	3F	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
41	AKERS, TRENCH OVEMENTS	4	TRENCH BREAKERS (FOAM AND SANDBAGS)	F	2/28/2017	4A	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
42			TRENCH DAMS (FOAM, BAGS, OR FINE GRAINED SOILS)	F	2/28/2017	4B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
43			SACK-CRETE BREAKERS (STRUCTURAL BREAKER)	F	2/28/2017	4C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
44			SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER	F	2/28/2017	4D	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016

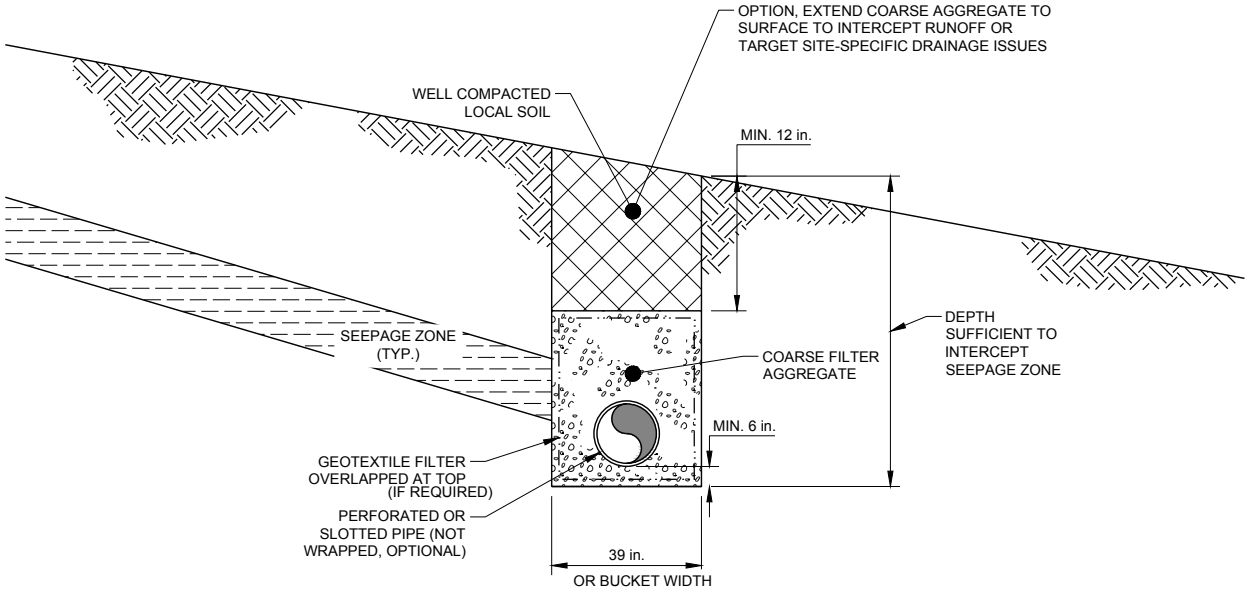
DOMINION BIC PROGRAM FOR ACP/SHP
SUMMARY LISTING OF INCREMENTAL CONTROLS (SUPPORTING TYPICAL SCENARIOS)
REVISED Feb 28, 2017

No.	GROUP	GROUP NO.	INCREMENTAL CONTROL SHEET TITLE	REV.	DATE	SHEET NO.	(C)omplete/(P)ending/(U)pdated	SOURCE DOCUMENT:
45	TRENCH BRE IMPRO		SEAL BOTTOM OF TRENCH WITH SANDBAGS	F	2/28/2017	4E	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
46			TRENCH BREAKER WITH DRAINAGE	F	2/28/2017	4F	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
47			SACK-CRETE ARMOR WITH BREAKERS	F	2/28/2017	4G	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
48			FLOWABLE FILL FOR TRENCH BACKFILL	F	2/28/2017	4H	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
49	ROW SURFACE, SLOPE BREAKERS	5	SLOPE BREAKERS (TEMP AND PERMANENT)	F	2/28/2017	5A	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
50			SLOPE BREAKER ARMORED OUTLET	F	2/28/2017	5B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
51			SLOPE BREAKERS WITH DIVERSION CHANNELS	F	2/28/2017	5C	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
52			ACCESS ROADS	F	2/28/2017	5D	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
53			TEMPORARY SLOPE BREAKER WITH DRAIN PIPE	F	2/28/2017	5E	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
54			SACK-CRETE WEDGE	F	2/28/2017	5F	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
55			NO WOOD CHIPS IN ROW	F	2/28/2017	5G	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
56			SURFACE WATER DIVERSIONS	F	2/28/2017	5H	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
57	ROW DIVERSIONS	6	COIR-LINED VEGETATED DIVERSION CHANNEL	F	2/28/2017	6A	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
58			BROW DITCH	F	2/28/2017	6B	C	SLOPE STABILITY POLICY AND PROCEEDURE FOR PIPELINE DESIGN, CONSTRUCTION AND RIGHT OF WAY MAINTENANCE, DOMINION TRANSMISSION, INC., ENGINEERING SERVICES REFERENCE MANUAL (SEPTEMBER 28, 2016)
59			ROCK FILTER IN TRENCH	F	2/28/2017	6C	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
60			ARMORED CHANNELS	F	2/28/2017	6D	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
61			TYP BANK ARMORING	F	2/28/2017	6E	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
62			RIPRAP GRADATIONS	F	2/28/2017	6F	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
63			ARMORED V-SHAPED AND U-SHAPED CHANNELS	F	2/28/2017	6G	C	2017 ANNUAL STANDARDS AND SPECIFICATIONS, EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT FOR CONSTRUCTION AND MAINTENANCE OF PIPELINE PROJECTS IN VIRGINIA, DOMINION TRANSMISSION, INC. (FEBRUARY 2017)
64			TYP SURFACE WATER CONTROL LAYOUT	F	2/28/2017	6H	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
65	SILT FENCE	7	SILT FENCE	F	2/28/2017	7A	C	2017 ANNUAL STANDARDS AND SPECIFICATIONS, EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT FOR CONSTRUCTION AND MAINTENANCE OF PIPELINE PROJECTS IN VIRGINIA, DOMINION TRANSMISSION, INC. (FEBRUARY 2017)
66			SUPER SILT FENCE	F	2/28/2017	7B	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
67	PL	8	ROCK GUARD ON PIPELINE	F	2/28/2017	8A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
68	PL	9	BUOYANCY MITIGATION	F	2/28/2017	9A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
69	BENCHES	10	TYP BENCH RE-CONSTRUCTION	F	2/28/2017	10A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
70	MONITORING	11	GEODETIC MONITORING	F	2/28/2017	11A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
71			STRAIN GAUGE MONITORING	F	2/28/2017	11B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
72			SLOPE INCLINOMETER MONITORING	F	2/28/2017	11C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
73			SLOPE INCLINOMETER CASING	F	2/28/2017	11D	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
74			STANDPIPE PIEZOMETER MONITORING	F	2/28/2017	11E	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
75			AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS	F	2/28/2017	11F	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
76	STRESS RELIEF	12	STRESS RELIEF EXCAVATIONS	F	2/28/2017	12A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
77			SELECT (DEFORMABLE) BACKFILL AROUND PIPELINE IN LANDSLIDE	F	2/28/2017	12B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
78			SHEAR TRENCH	F	2/28/2017	12C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
79	ONAL WORKSPACE, TYP CROSSING METHODS	13	TYP WATERBODY OPEN CUT	F	2/28/2017	13A	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
80			TYP WATERBODY FLUME METHOD	F	2/28/2017	13B	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
81			TYP WATERBODY DAM AND PUMP	F	2/28/2017	13C	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
82			TYP WATERBODY HDD METHOD	F	2/28/2017	13D	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
83			TYP ADDITIONAL WORKSPACE AT WATERBODY ACP AP-1	F	2/28/2017	13E-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
84			TYP ADDITIONAL WORKSPACE AT WATERBODY ACP AP-1 AP-2 AP-3 AP-4 AP-5	F	2/28/2017	13E-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
85			TYP ADDITIONAL WORKSPACE AT WATERBODY SHP TL-635 TL-636	F	2/28/2017	13E-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
86			TYP WETLAND OPEN CUT METHOD ACP AP-1 AP-2 AP-3 AP-4 AP-5	F	2/28/2017	13F	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
87			TYP CONSTRUCTION ROW IN WETLANDS ACP AP-1	F	2/28/2017	13G-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
88			TYP CONSTRUCTION ROW IN WETLANDS ACP AP-2	F	2/28/2017	13G-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
89			TYP CONSTRUCTION ROW IN WETLANDS COLLOCATED SHP TL-635 TL-636	F	2/28/2017	13G-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
90			TYP CONSTRUCTION ROW IN WETLANDS NOT-COLLOCATED SHP TL-635 TL-636	F	2/28/2017	13G-4	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
91			TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS ACP AP-1	F	2/28/2017	13H-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
92			TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS ACP AP-2 AP-3 AP-4 AP-5	F	2/28/2017	13H-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
93			TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS SHP TL-635 TL-636	F	2/28/2017	13H-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)

DOMINION BIC PROGRAM FOR ACP/SHP
SUMMARY LISTING OF INCREMENTAL CONTROLS (SUPPORTING TYPICAL SCENARIOS)
REVISED Feb 28, 2017

No.	GROUP	GROUP NO.	INCREMENTAL CONTROL SHEET TITLE	REV.	DATE	SHEET NO.	(C)omplete/(P)ending/(U)pdated	SOURCE DOCUMENT:
94	TYP ROW CONFIGURATIONS, ADDITIC		TYP ADDITIONAL WORKSPACE AT BORED CROSSINGS FOR TWO-LANE ROADS AND RAILROADS ACP AP-1	F	2/28/2017	13I-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
95			TYP ADDITIONAL WORKSPACE AT SINGLE-LANE ROADS AND BORED ROADS ACP AP-1 AP-2 AP-3 AP-4 AP-5	F	2/28/2017	13I-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
96			TYP ADDITIONAL WORKSPACE AT ALL BORED ROADS SHP TL-635 TL-636	F	2/28/2017	13I-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
97			TYP CONSTRUCTION ROW IN NON-AG AREAS ACP AP-2	F	2/28/2017	13J-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
98			TYP CONSTRUCTION ROW IN NON-AG AREAS AND WETLANDS ACP AP-3 AP-4 AP-5	F	2/28/2017	13J-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
99			TYP CONSTRUCTION ROW IN COLLOCATED NON-AG AREAS SHP TL-635 TL-636	F	2/28/2017	13J-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
100			TYP CONSTRUCTION ROW NOT-COLLOCATED IN NON-AG AREAS SHP TL-635 TL-636	F	2/28/2017	13J-4	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
101			TYP CONSTRUCTION ROW IN AG AREAS ACP AP-2	F	2/28/2017	13K-1	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
102			TYP CONSTRUCTION ROW IN AG AREAS ACP AP-3 AP-4 AP-5	F	2/28/2017	13K-2	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
103			TYP CONSTRUCTION ROW COLLOCATED IN AG AREAS SHP TL-635 TL-636	F	2/28/2017	13K-3	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
104			TYP CONSTRUCTION ROW NOT-COLLOCATED IN AG AREAS SHP TL-635 TL-636	F	2/28/2017	13K-4	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
105			TYP COFFERDAM CROSSING	F	2/28/2017	13L	C	EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, WEST VIRGINIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT (2016)
106	DETAILED ENG	14	SITE SPECIFIC DETAILED ENGINEERING	F	2/28/2017	14A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
107			MESH ROCK FALL PROTECTION	F	2/28/2017	14B	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
108			BLASTING PLANS	F	2/28/2017	14C	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1F (NOVEMBER 2016 REV 3)
109	PLANNING	15	AVOIDANCE	F	2/28/2017	15A	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
110			EXCAVATION REMOVAL OF HAZARD	F	2/28/2017	15B	C	ACP/SHP FERC RESOURCE REPORT 1, APPENDIX 1D (SEPTEMBER 2015)
111			ACCESS TO REMOTE ROW LOCATIONS	F	2/28/2017	15C	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016
112	SPECIAL HAZARD	16	KARST HAZARDS	F	2/28/2017	16A	C	GOLDER, "GEOTECHNICAL AND GEOLOGICAL ENGINEERING SUPPORT FOR PIPELINES IN STEEPLY SLOPING TERRAIN", MARCH 2016





NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

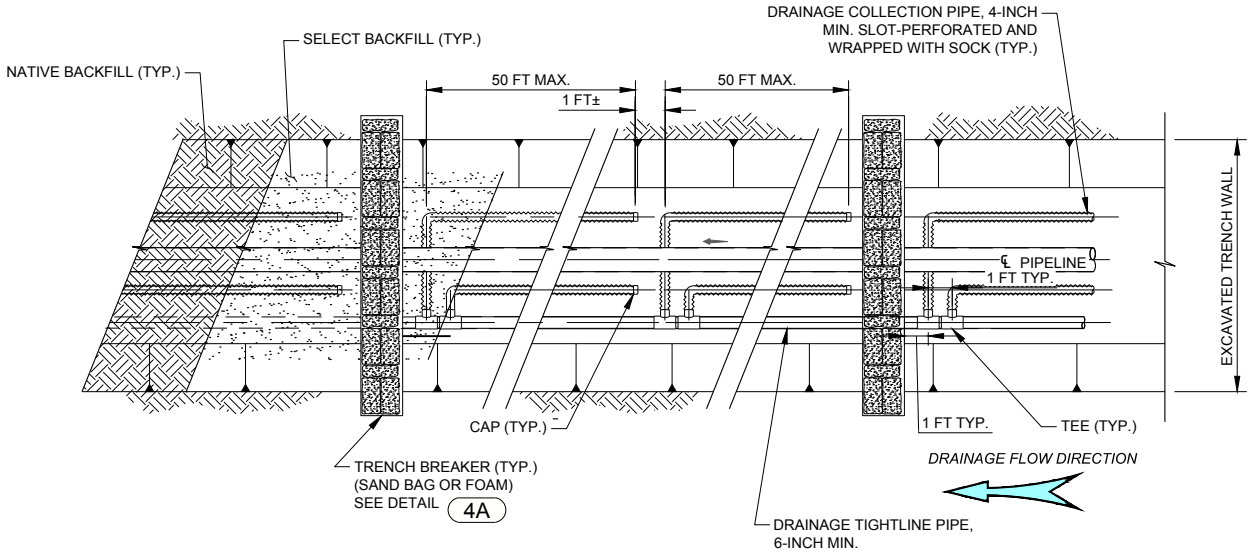
Golder Associates

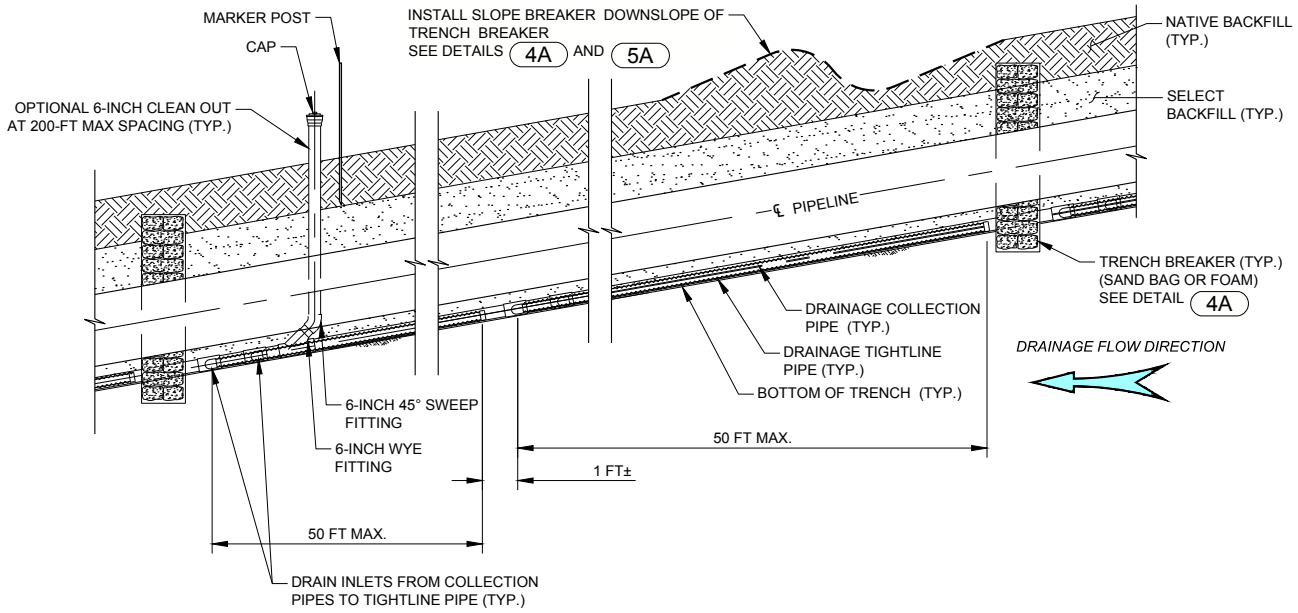
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
FRENCH DRAIN (SIMPLE)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1A

0 1 in. IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A





NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SPACING OF CLEAN-OUTS TO BE DETERMINED BASED ON SITE CONDITIONS AND OPERATION AND MAINTENANCE REQUIREMENTS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

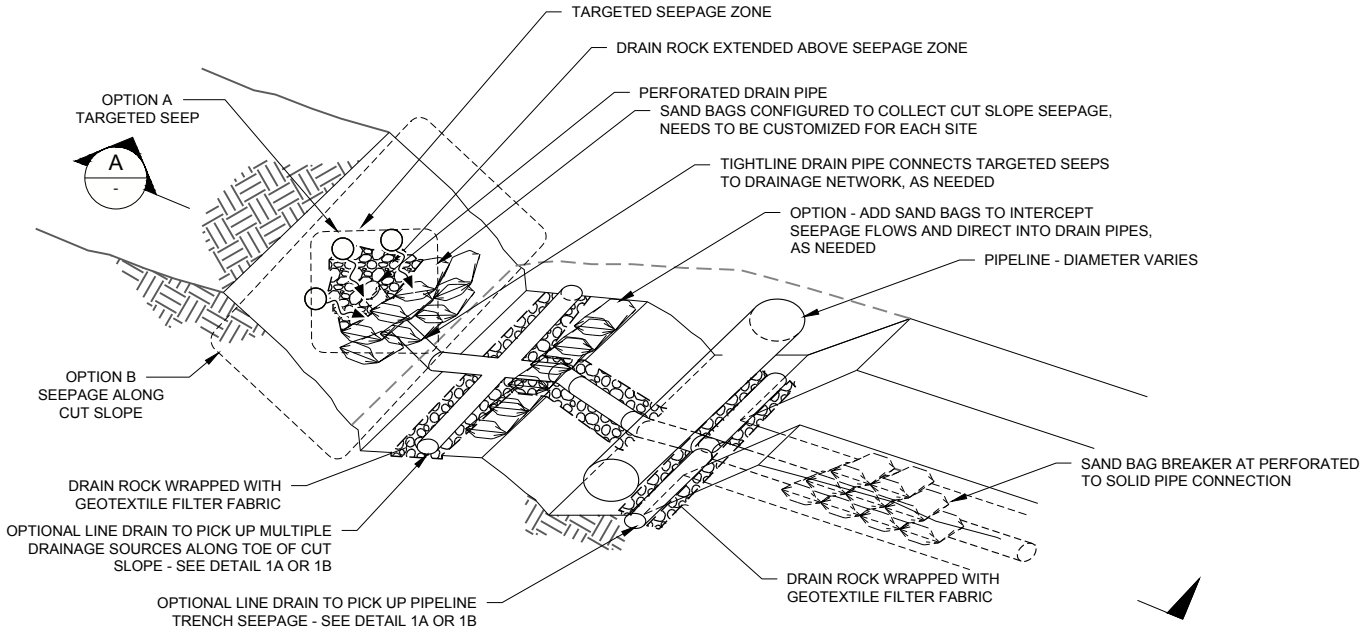
CONSULTANT
Golder Associates

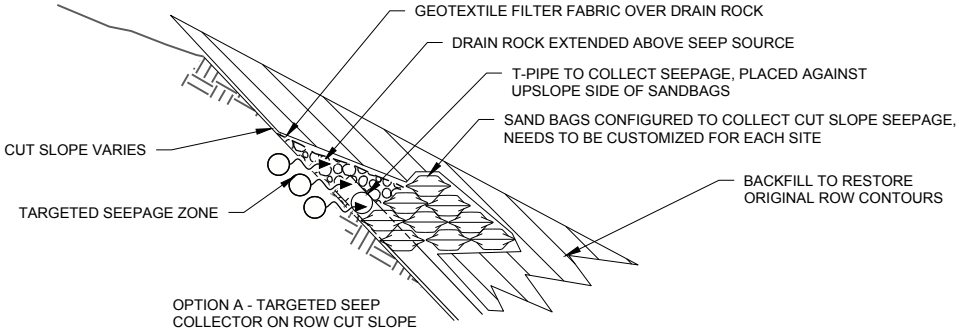
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ENHANCED DRAIN (GERMAN DRAIN)

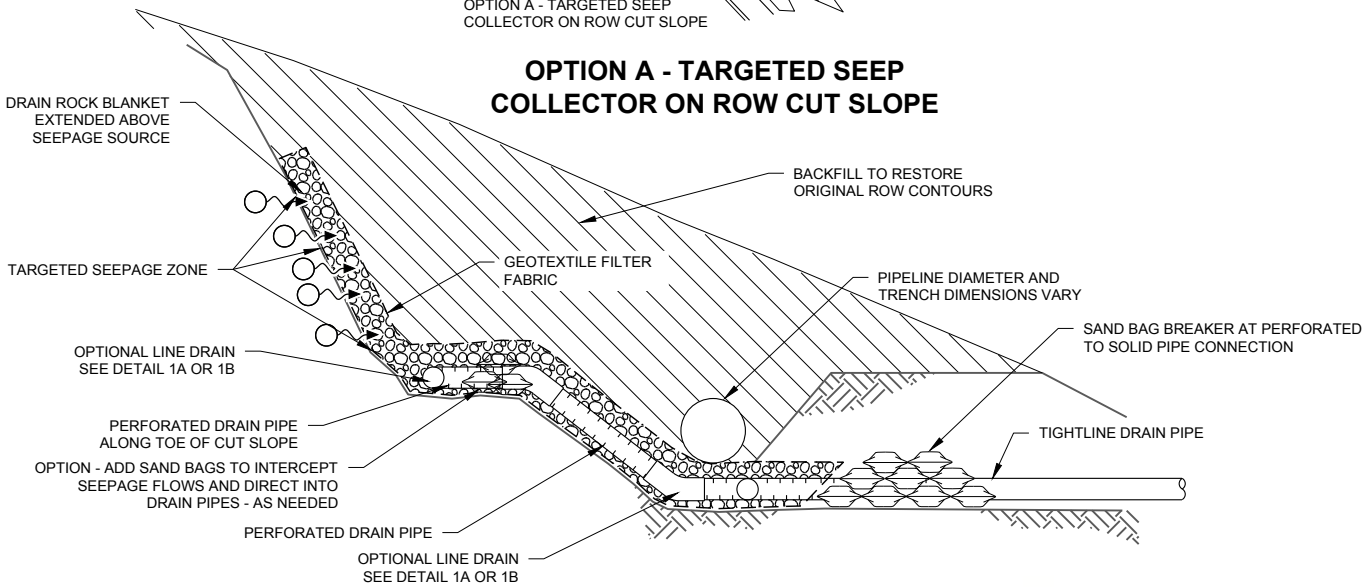
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1B

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A





OPTION A - TARGETED SEEP COLLECTOR ON ROW CUT SLOPE



OPTION B - TARGETED SEEP COLLECTOR ON ROW CUT SLOPE

A
-

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

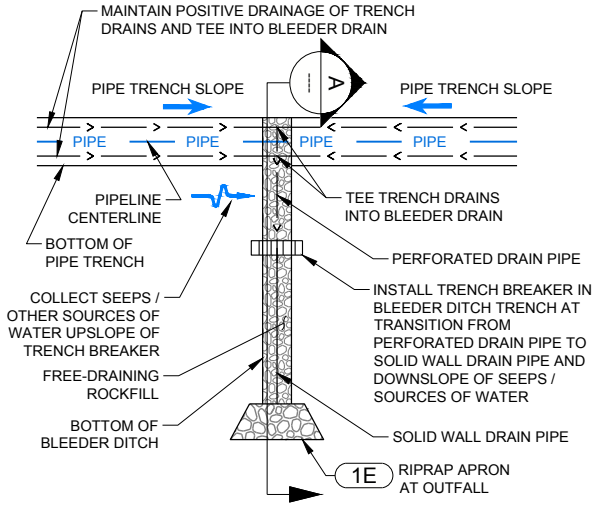
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

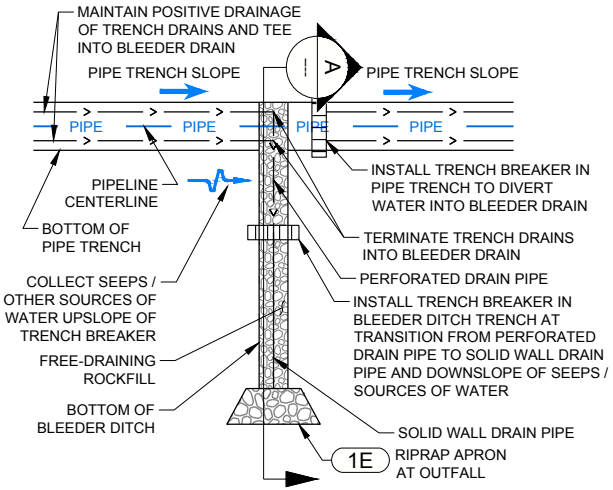
TITLE
TARGETED SEEP DRAINS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1C

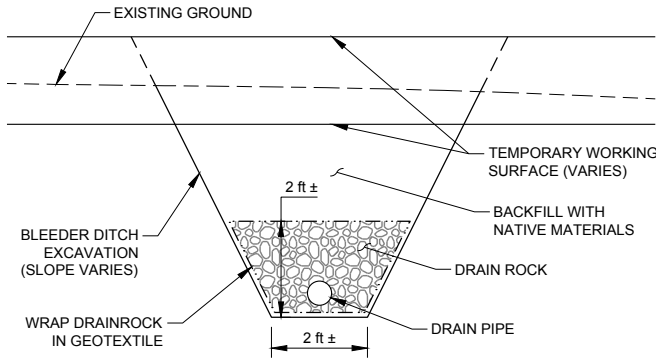
0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A



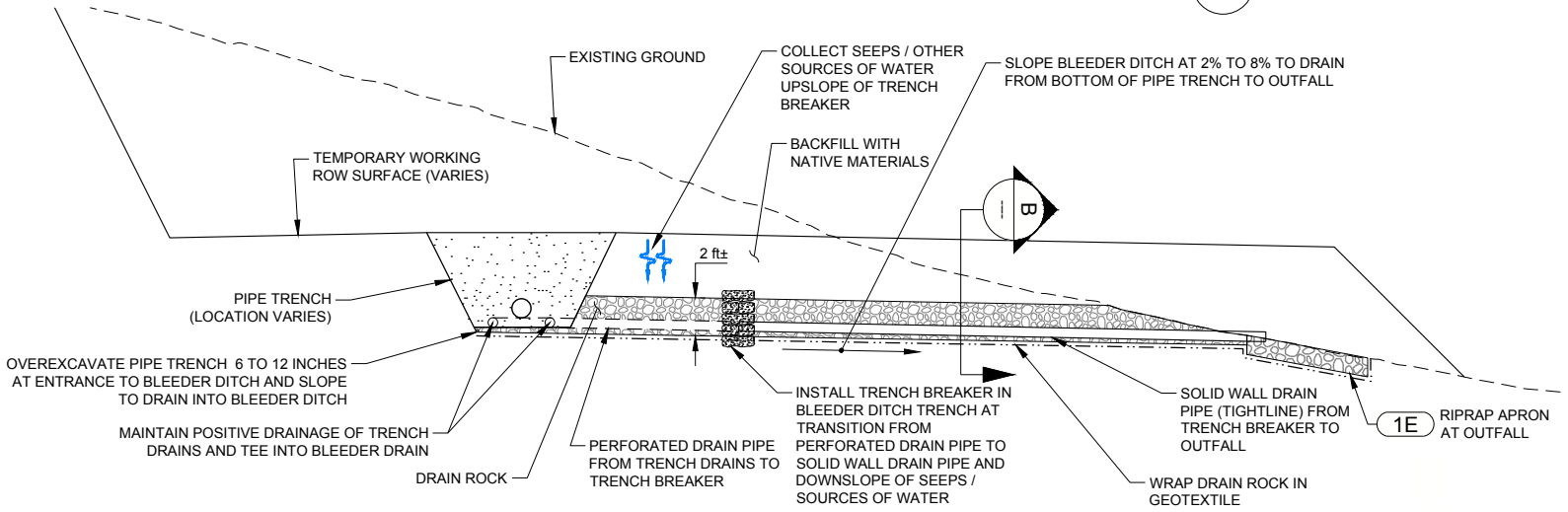
BLEEDER DRAIN WITH FLAT PIPE TRENCH



BLEEDER DRAIN WITH SLOPED PIPE TRENCH



B BLEEDER DRAIN DITCH SECTION



A BLEEDER DRAIN PROFILE

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. INSTALL BLEEDER DITCH IN SIDESLOPE SCENARIOS AT 100 FT INTERVALS, AT LOW POINTS IN THE PIPELINE TRENCH, OR AS NEEDED TO COLLECT SEEPS, SOURCES OF WATER, OR OTHER DRAINS.
3. NATIVE MATERIALS MAY BE USED DOWNSLOPE OF BLEEDER DITCH TRENCH BREAKER INSTEAD OF DRAINFILL PROVIDED THAT NATIVE BACKFILL MATERIALS ARE FREE-DRAINING AND NO SEEPS OR SOURCES OF WATER ARE IDENTIFIED DOWNSLOPE OF THE PIPE TRENCH.
4. LENGTH OF BLEEDER DRAIN WILL VARY AS NEEDED TO MAINTAIN POSITIVE DRAINAGE IN DITCH TO OUTFALL.

CLIENT
DOMINION

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
DESIGNED	DBC
PREPARED	REDMOND
REVIEWED	-
APPROVED	AQK

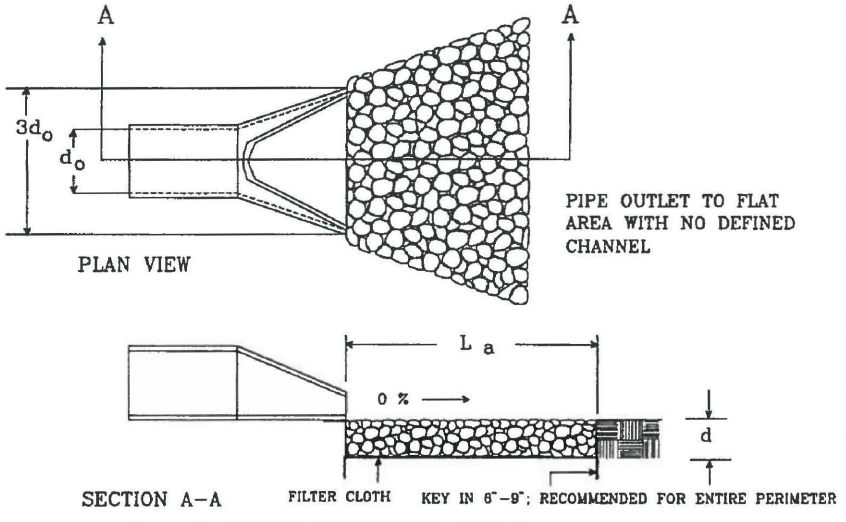
PROJECT
BIC/INCREMENTAL CONTROLS

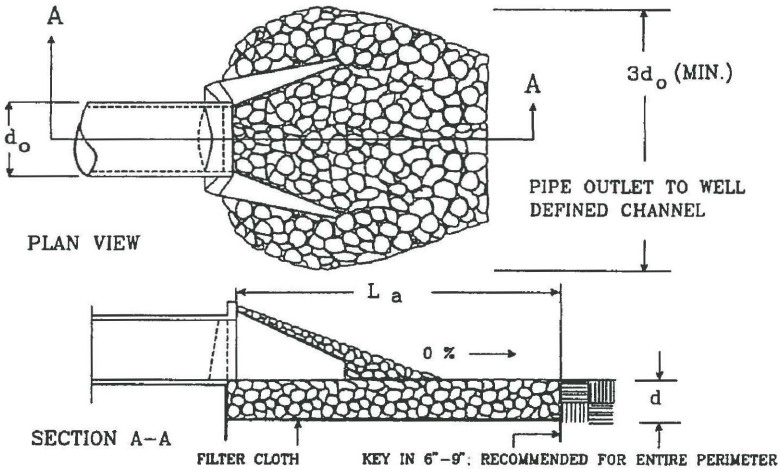
TITLE
BLEEDER DRAIN

PROJECT NO.	PHASE	REV.	FIGURE
1535050	500	F	1D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 1 in

PIPE OUTLET CONDITIONS





NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La 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.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

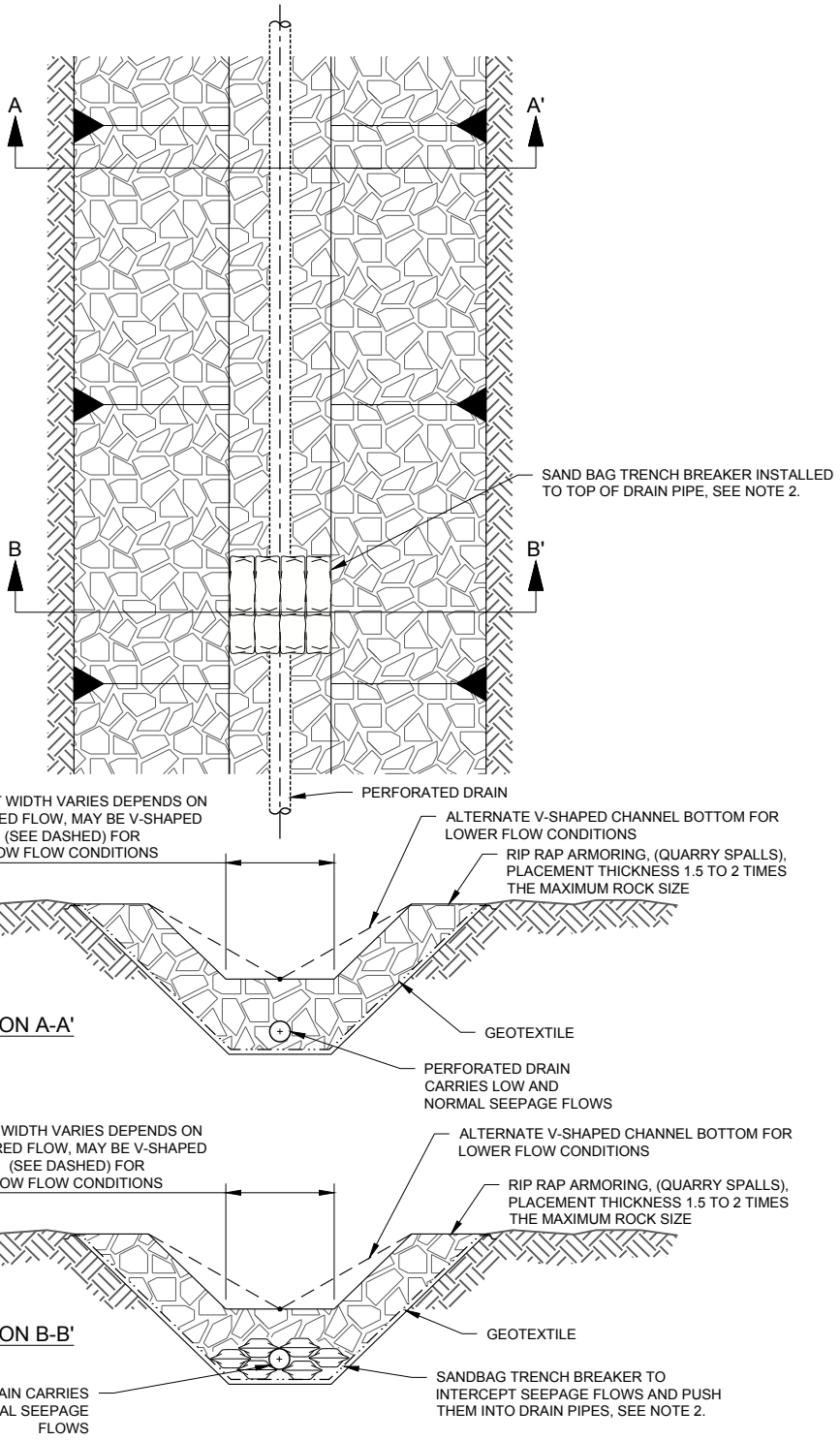
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
DRAIN PIPE OUTFALL RIPRAP APRON

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1E

0 1in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. 100-FT MAX SPACING FOR BREAKERS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ARMORED CHANNEL WITH DRAIN PIPE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1F

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SPECIAL STUDIES MAY BE REQUIRED TO SUPPORT DESIGN AND IMPLEMENTATION OF SUBSURFACE DEWATERING MEASURES, WHICH MAY INCLUDE USING WELL POINTS, SUMPS, WELLS, DRAINS, DIVERSIONS, ETC.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

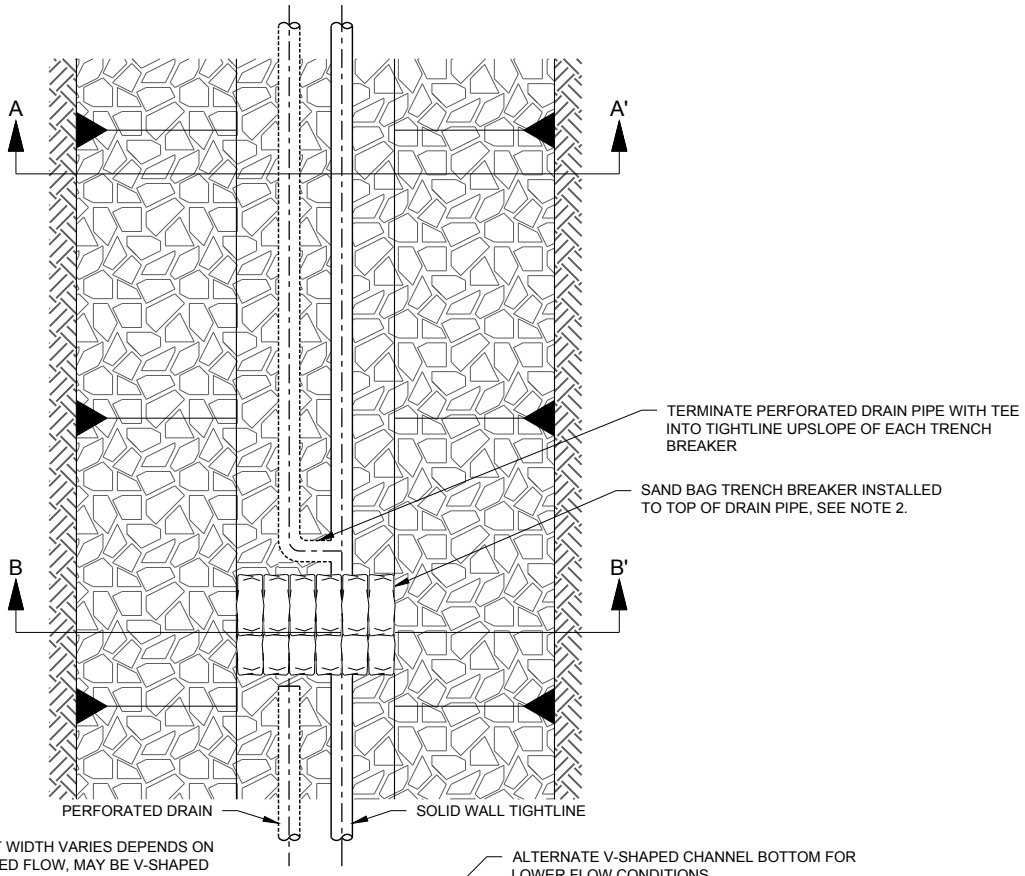
CONSULTANT
Golder Associates

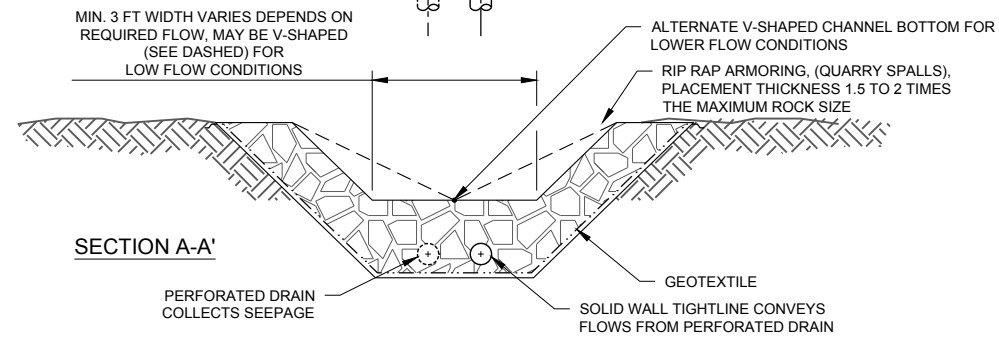
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

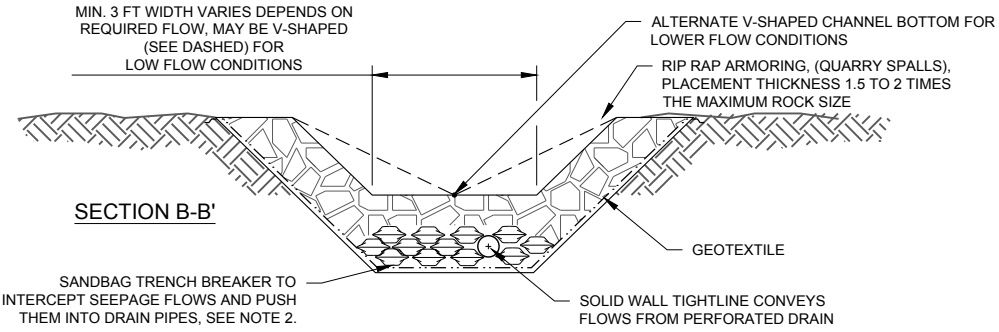
TITLE
DEWATERING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1G

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A







NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. 100-FT MAX SPACING FOR BREAKERS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

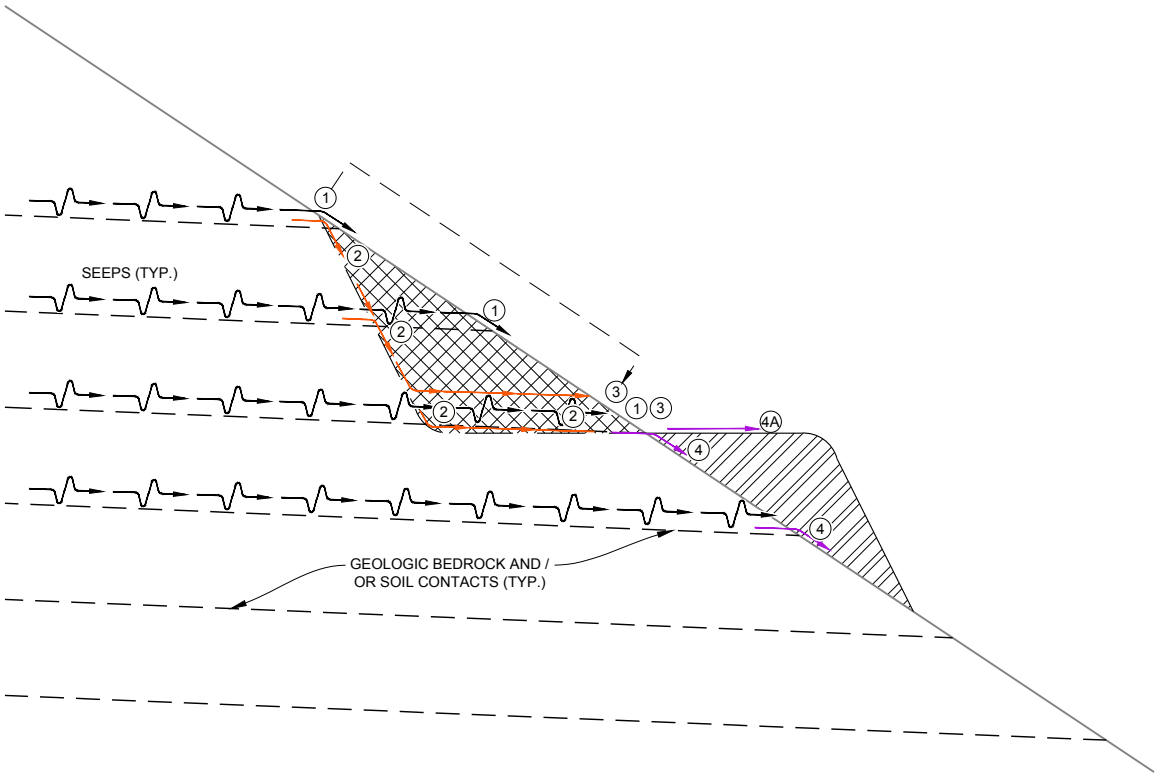
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
STEEP CONVEYANCE CHANNEL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1H

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOTE(S)

1. INSTALL PERMANENT AND / OR TEMPORARY SEEP COLLECTORS AT THE LOWEST OR DEEPEST CUT INTO NATIVE GROUND, AND AT CONTACTS AND TRANSITIONS BETWEEN BEDROCK OR SOIL UNITS (SEE (2)).
2. INSTALL TEMPORARY SEEP COLLECTORS TO PROTECT AGAINST SATURATION OF SPOILS (SEE (4)).
3. SEEP COLLECTORS SHOULD NOT BE LOCATED AT BACKFILL FACE AFTER RIGHT-OF-WAY RESTORATION (SEE (1)), UNLESS THAT IS THE LOWEST OR DEEPEST LOCATION OF DISTRIBUTION IN THE FINAL RIGHT-OF-WAY RESTORATION (SEE (5)).
4. ADDITIONAL MITIGATION MEASURES MAY BE NEEDED TO ADDRESS SATURATED BACKFILL AND / OR SPOILS, BASED ON SITE SPECIFIC CONDITIONS.

KEY

(1) SEEPS EXPOSED AT SURFACE BEFORE RIGHT-OF-WAY CONSTRUCTION.

(2) SEEP EXPOSED AFTER CONSTRUCTION OF THE RIGHT-OF-WAY, WITH POTENTIAL TO SATURATE BACKFILL, AND EXPRESSED IN DIFFERENT LOCATIONS AFTER CONSTRUCTION RESTORATION OF RIGHT-OF-WAY (3).

(4) SATURATES TEMPORARY SPOILS DURING CONSTRUCTION OF TEMPORARY RIGHT-OF-WAY, FROM BENEATH OR FROM SURFACE FLOWS (4A).

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

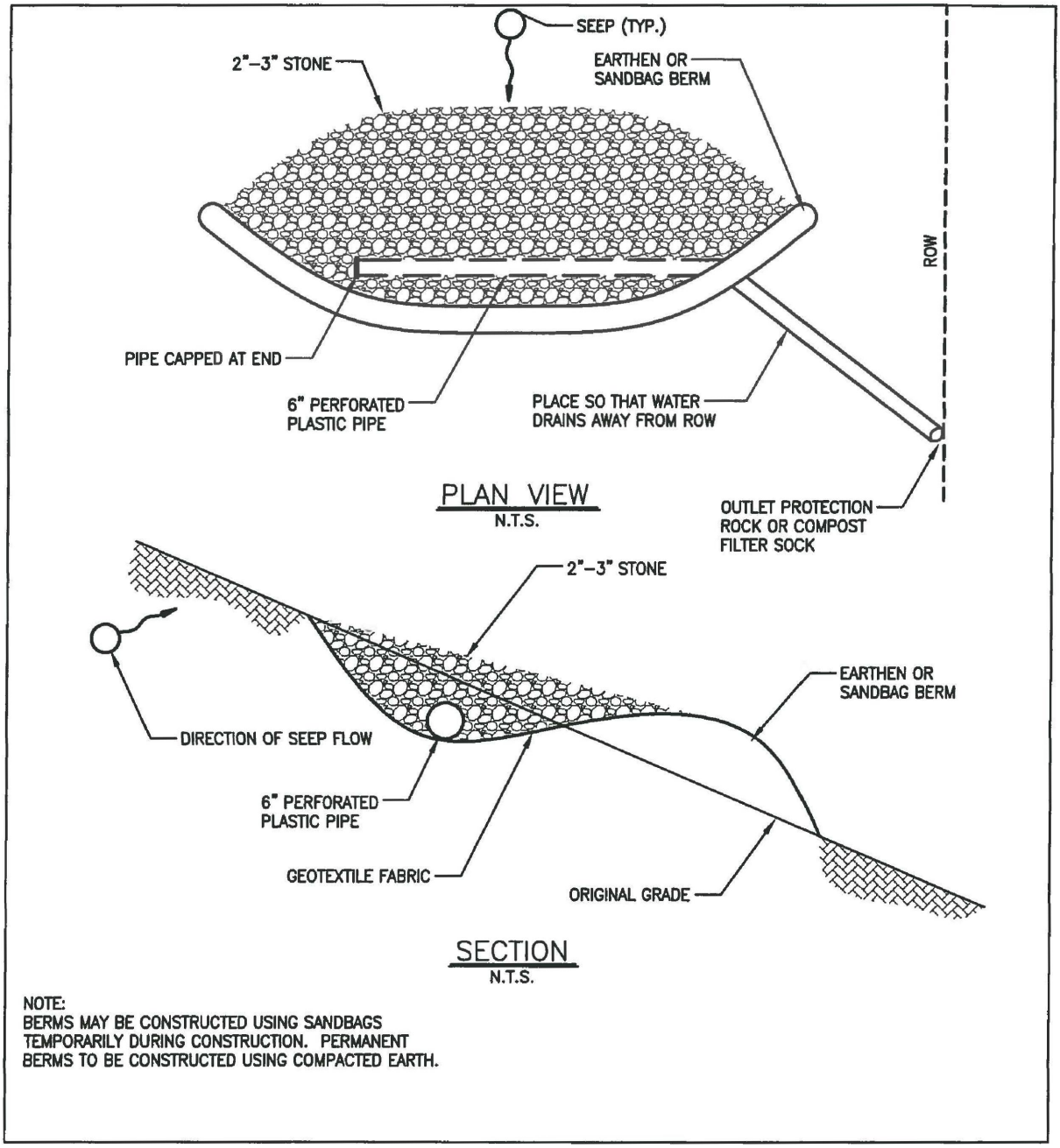
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
CHANGED SEEP CHARACTERISTICS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1l

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOTE:
BERMS MAY BE CONSTRUCTED USING SANDBAGS TEMPORARILY DURING CONSTRUCTION. PERMANENT BERMS TO BE CONSTRUCTED USING COMPACTED EARTH.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

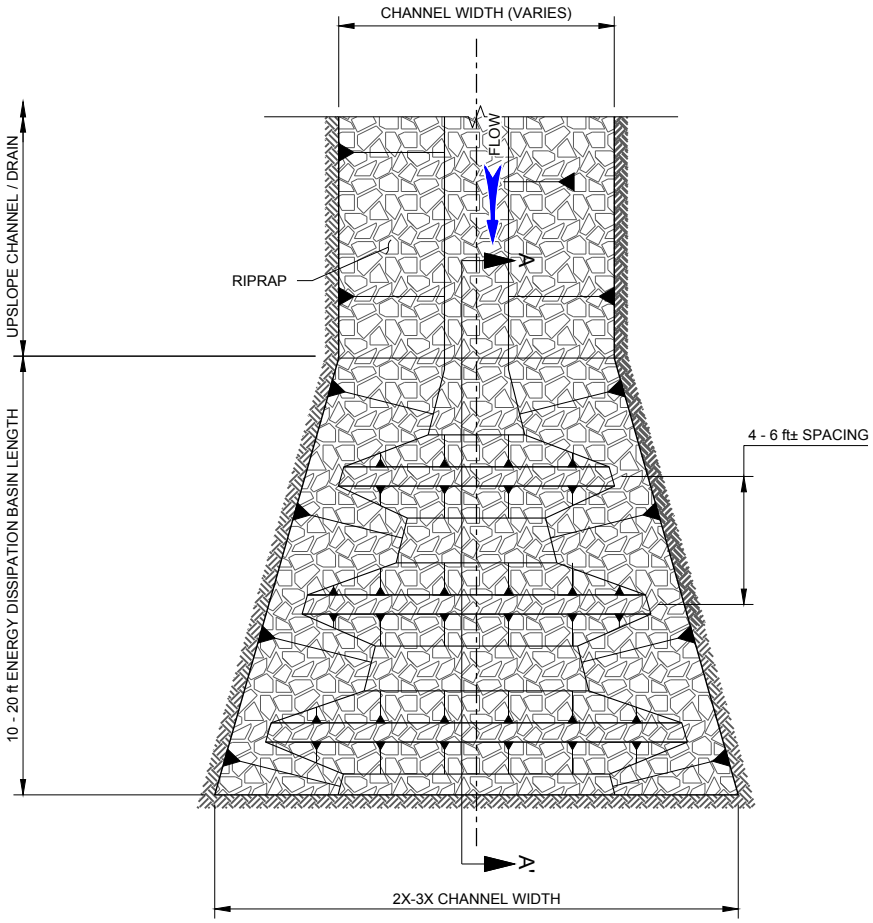
CONSULTANT
Golder Associates

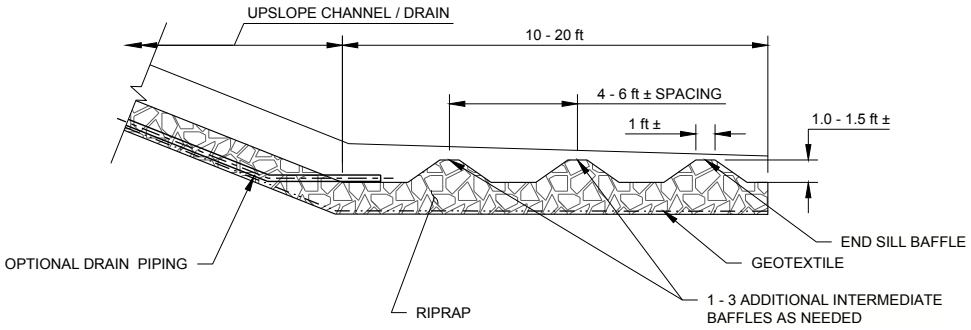
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TARGETED SEEP COLLECTOR

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1J

0 1in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A





NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. ENERGY DISSIPATION BASIN SHOULD BE CONSTRUCTED AT THE DOWNSTREAM END OF CHANNELS AND DRAINS WHERE HIGH WATER VELOCITY MAY BE EXPECTED AND/OR DEBRIS MAY TRAVEL DOWN THE CHANNEL.
3. INTERMEDIATE BAFFLES SHOULD BE CONSTRUCTED AS NEEDED TO INTERCEPT DEBRIS FROM THE CHANNEL AND BELOW STEEP CHANNELS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

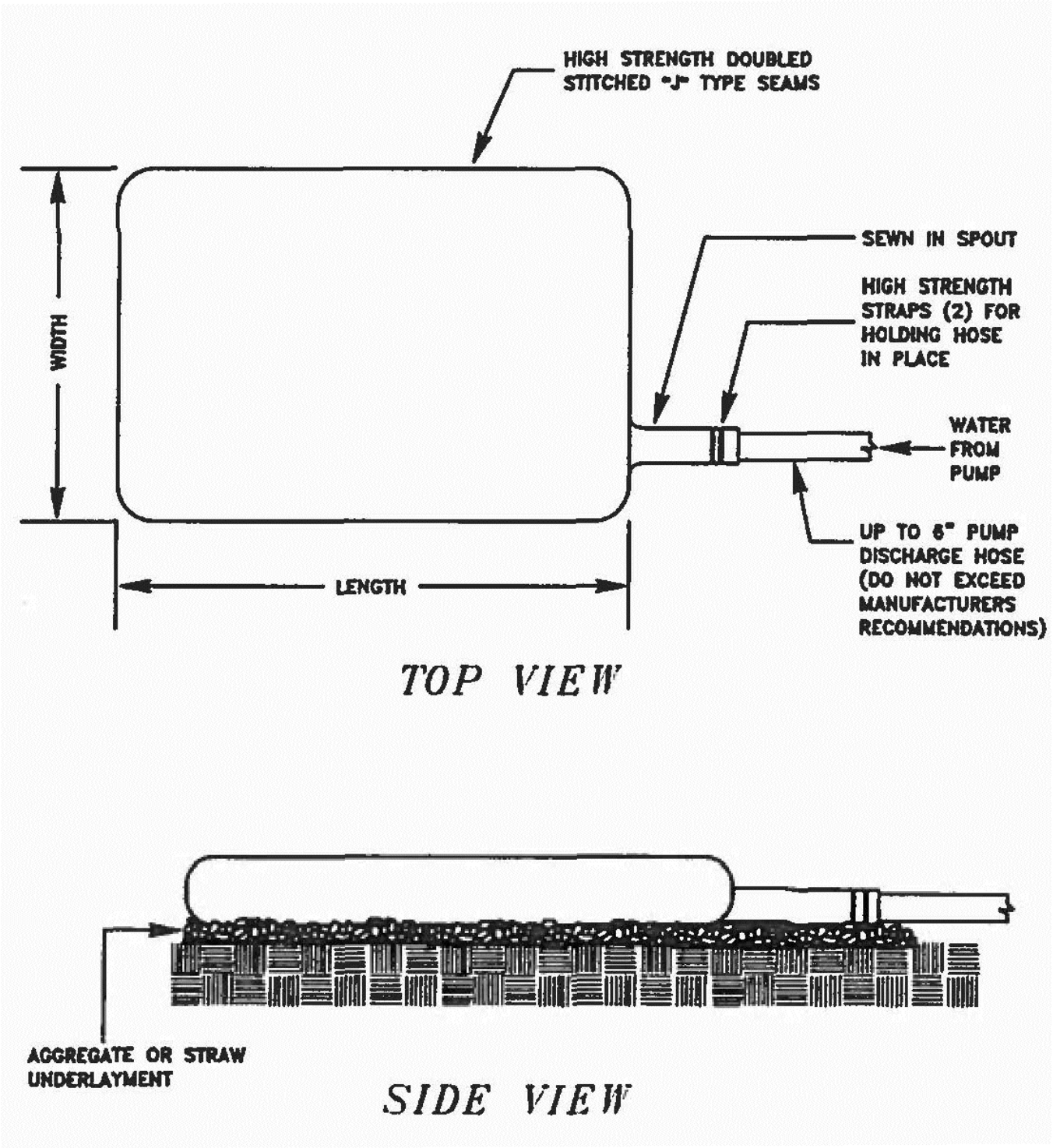
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ENERGY DISSIPATION BASIN

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1K

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

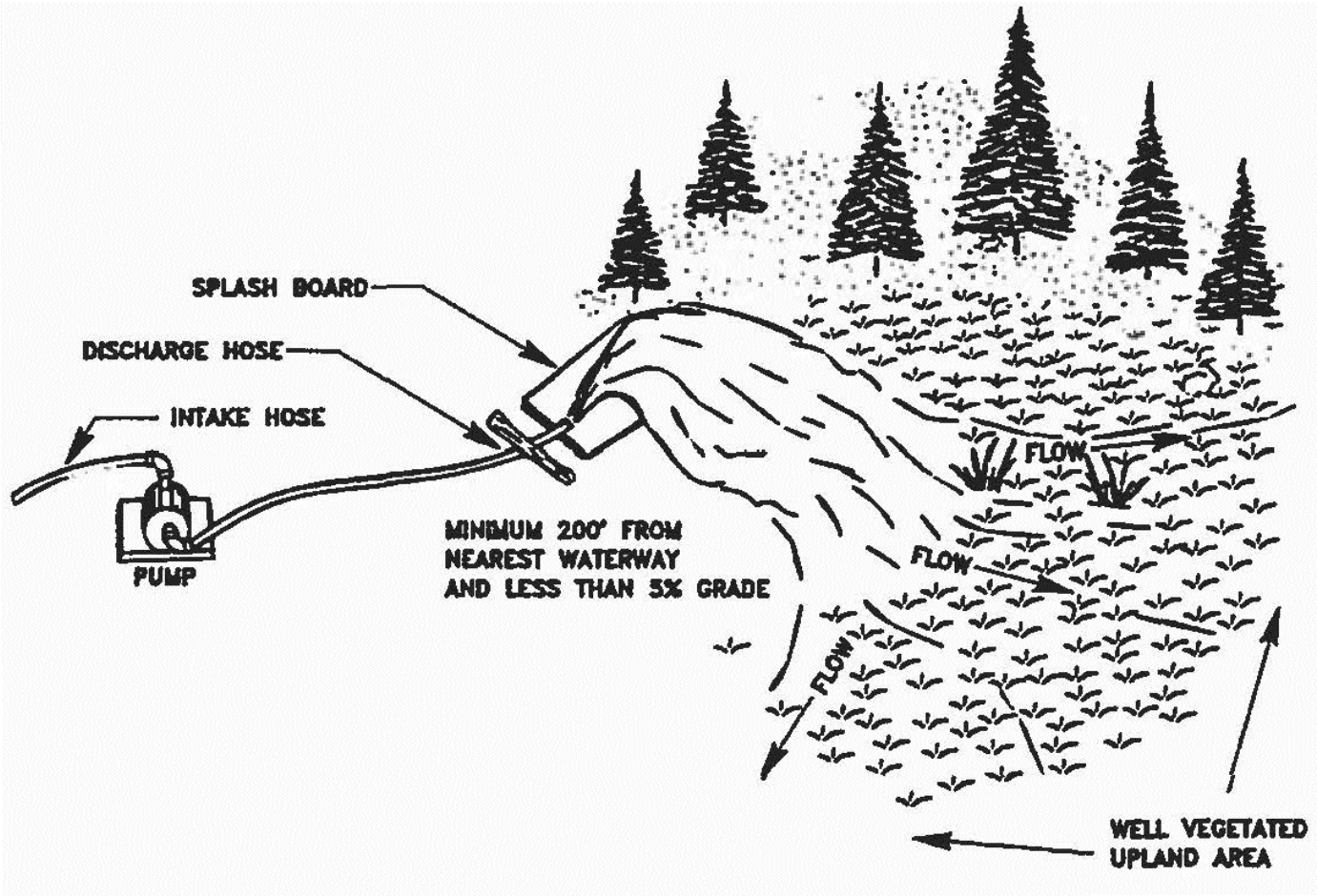
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
DEWATERING DISCHARGE BAG

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1L

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

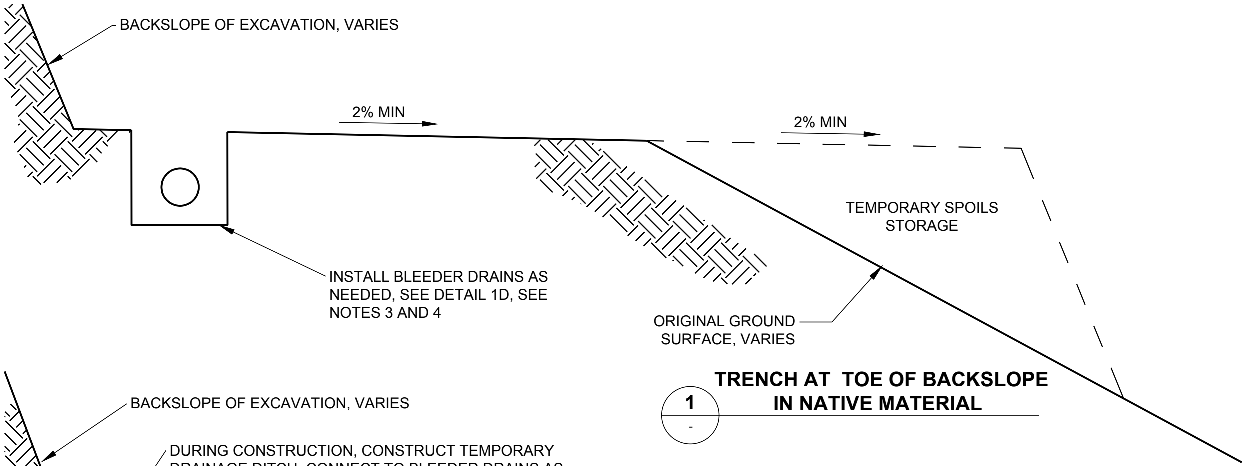
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

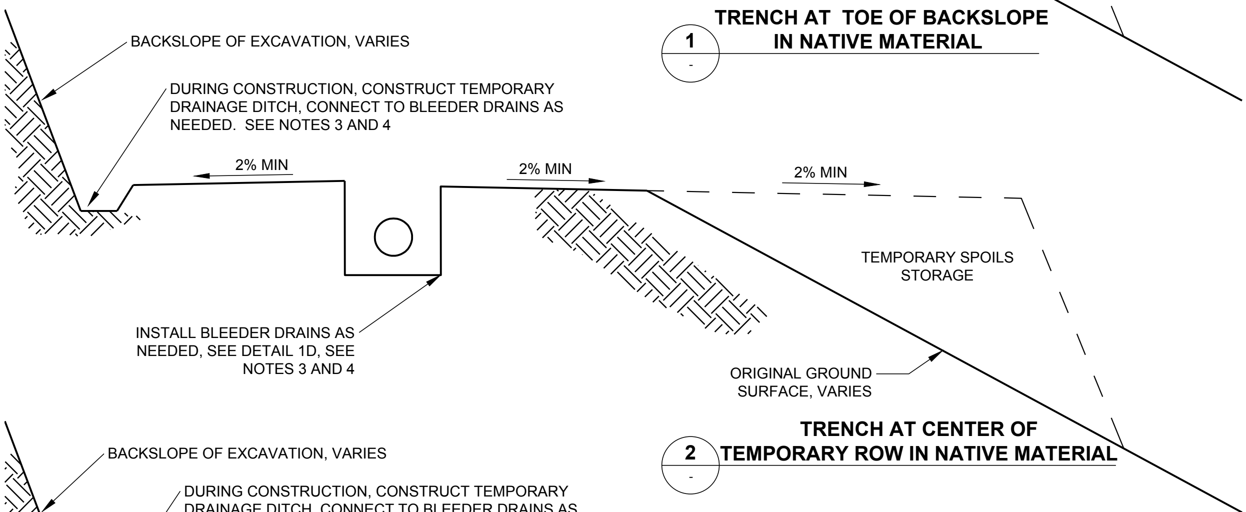
TITLE
DEWATERING DISCHARGE IN UPLAND AREA

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	1M

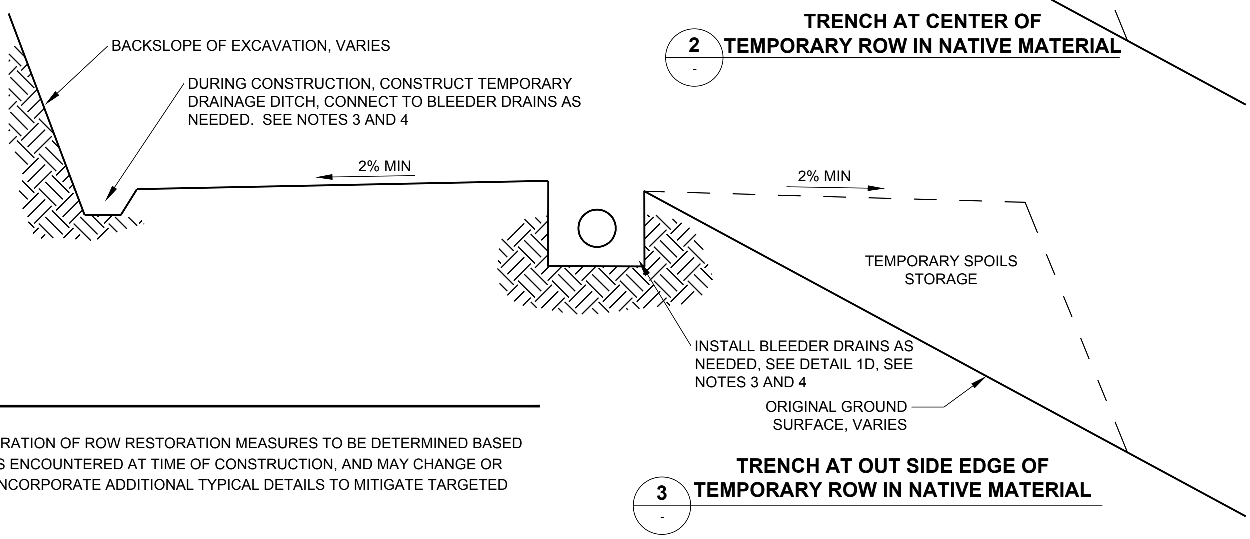
0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



TRENCH AT TOE OF BACKSLOPE IN NATIVE MATERIAL



TRENCH AT CENTER OF TEMPORARY ROW IN NATIVE MATERIAL



TRENCH AT OUT SIDE EDGE OF TEMPORARY ROW IN NATIVE MATERIAL

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. THE TEMPORARY ROW SURFACE, WHEN IT IS INITIALLY CONSTRUCTED, ACTS AS A SURFACE THAT DIRECTS AND CONTROLS RUNOFF DURING CONSTRUCTION AS WELL AS CONTROLLING SEEPAGE AND SUBSURFACE FLOWS AFTER THE ROW IS RESTORED AND BACKFILLED. THEREFORE, CONSTRUCTION AND GRADING OF THE TEMPORARY ROW SURFACE SHOULD BE COMPLETED TO SO AS TO MAINTAIN POSITIVE DRAINAGE (I.E. APPROXIMATELY 2% SLOPE) AWAY FROM THE PIPELINE TRENCH, AND TO OUTBOARD SIDES OF THE ROW THAT DISCHARGE ONTO NATURAL SLOPES DIRECTED AWAY FROM THE ROW, SO THAT RUNOFF ON THE TEMPORARY ROW SURFACE DOES NOT ACCUMULATE OR POND.

3. FOR TEMPORARY CONSTRUCTION WORK PERIOD, WHERE THE TEMPORARY ROW SURFACE MUST SLOPE TO AN INSIDE AREA, WHERE ACCUMULATED RUNOFF CAN POND, THEN DRAINAGE MEASURES SHOULD BE IMPLEMENTED THAT COLLECT AND EVACUATE THE PONDED WATER DURING TEMPORARY CONSTRUCTION PERIODS AND FOR PERMANENT RESTORATION.

4. FOR PERMANENT RESTORATION, CONVERT TEMPORARY DRAINAGE DITCH TO FRENCH DRAINS AND/OR TARGETED SEEP COLLECTORS, AS NEEDED. SEE DETAILS 1A, 1C, 1D AND 1E.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

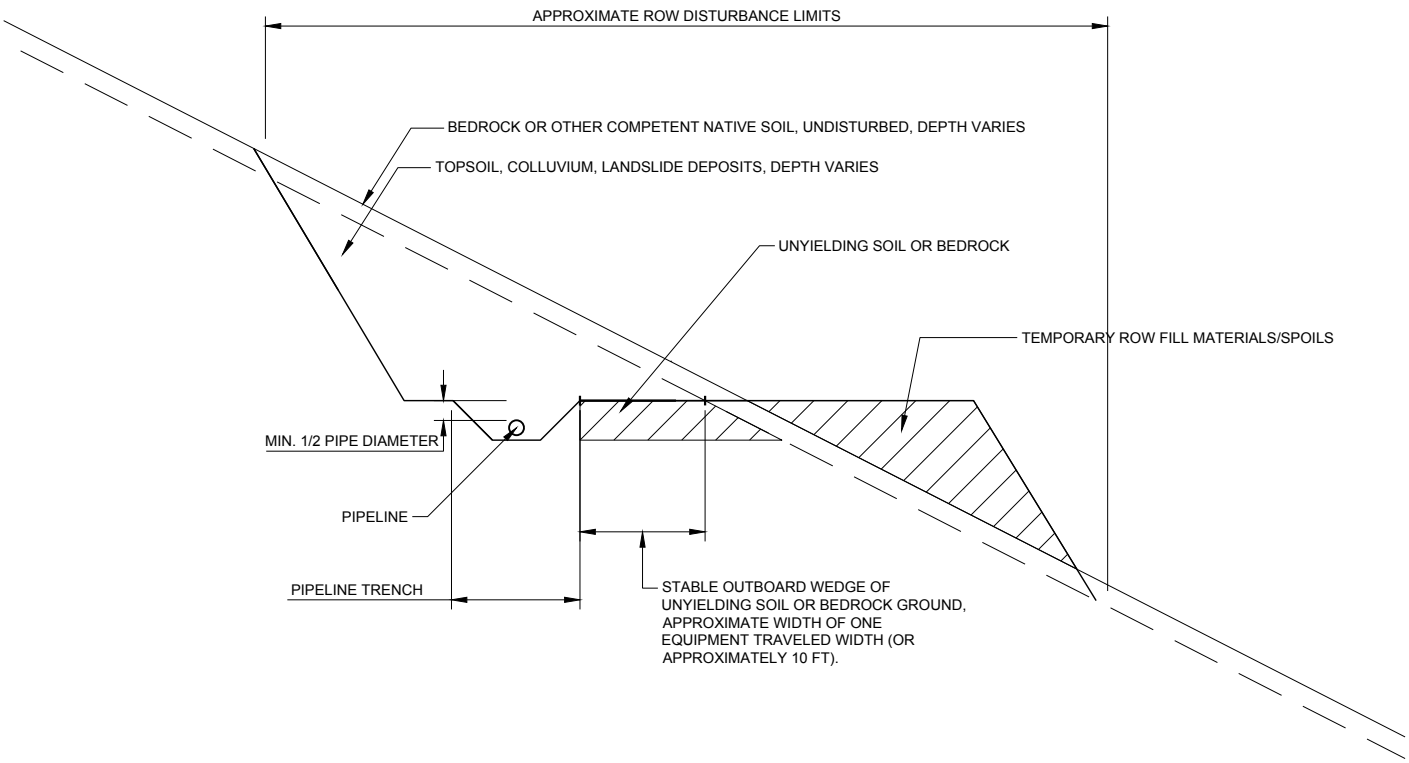
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GRADING TEMPORARY ROW SURFACE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0
1 in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

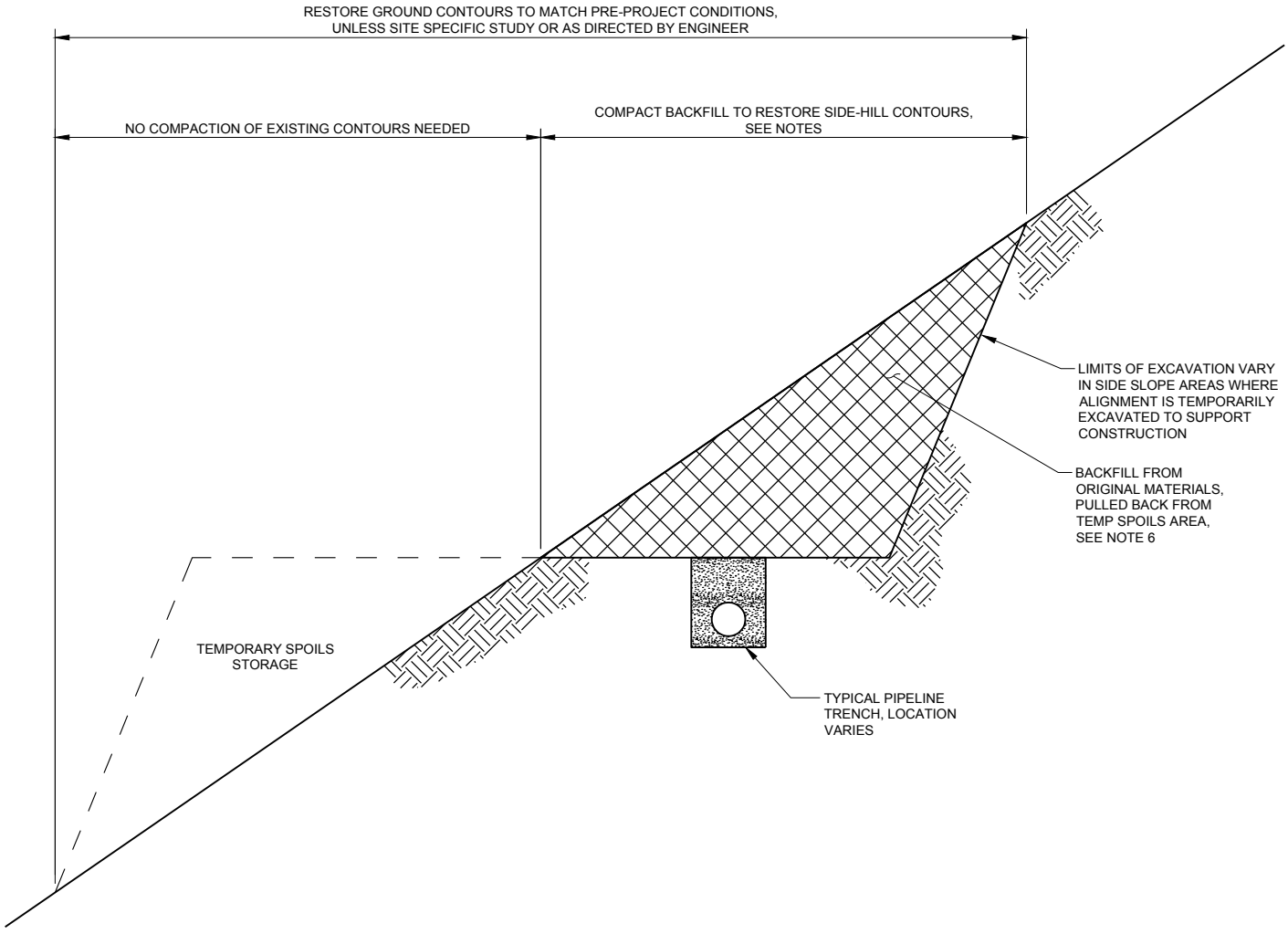
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GRADING TRENCH WITH STABLE OUTBOARD WEDGE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in 1 cm



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. RECOMMEND COMPACTING SIDE SLOPE AREAS USING “SHEEP’S FOOT” COMPACTION EQUIPMENT IN HORIZONTAL LAYERS.
3. BACKFILL MATERIALS SHOULD BE AT OR NEAR OPTIMUM MOISTURE CONTENT (DRYING SOILS OR ADDING WATER AS NECESSARY), VISUALLY DETERMINED BY A COMPETENT ON-SITE REPRESENTATIVE. SEE TYPICAL DETAIL 2D FOR DRYING BACKFILL.
4. SOILS COMPACTION SHOULD BE COMPLETED IN LIFTS SUCH THAT BACKFILL MATERIALS ARE STABLE, SHED WATER AND DO NOT EASILY BECOME SATURATED, AND ARE AT APPROXIMATELY THE MAXIMUM DRY DENSITY, VISUALLY DETERMINED BY A COMPETENT ON-SITE REPRESENTATIVE.
5. ADDITIONAL COMPACTION REQUIREMENTS MAY APPLY AT ROAD CROSSINGS, AREAS IDENTIFIED BY THE ENGINEER, OR AT OTHER LOCATIONS AS MAY BE REQUIRED BY LAWS AND REGULATIONS. SEE TYPICAL DETAIL 2I FOR COMPACTION REQUIREMENTS ACROSS ROADS.
6. BACKFILL CONFIGURATION MAY VARY TO FIT SITE CONDITIONS, AND MAY BE USED IN OTHER ROW CROSS-SECTION BACKFILL GEOMETRIES, AS DIRECTED BY ENGINEER.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
COMPACT BACKFILL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2C

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SATURATED ON-SITE SOILS MAY NEED TO BE DRIED BEFORE RE-USE AND PLACEMENT AS BACKFILL. DRYING MAY INCLUDE WIND-ROWING AND TURNING OVER IN FURROWS TO ALLOW FOR AIR EXCHANGE AND EVAPORATION TO DRY THE MATERIALS, OR ADDITION OF ADD-MIXTURES TO DRY THE SOILS.

3. THE USE OF ADD-MIXTURES TO SATURATED SOILS SHOULD BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO USE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
DRY SOILS AND BACKFILL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. WHERE THE PLACEMENT OF SPOILS ON THE SITE MAY INITIATE OR EXACERBATE LANDSLIDES OR RESULT IN SLOPE INSTABILITY, THE MATERIALS SHOULD BE REMOVED FROM THE SITE AND SPOILED AT A SAFE AND OFF-SITE LOCATION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

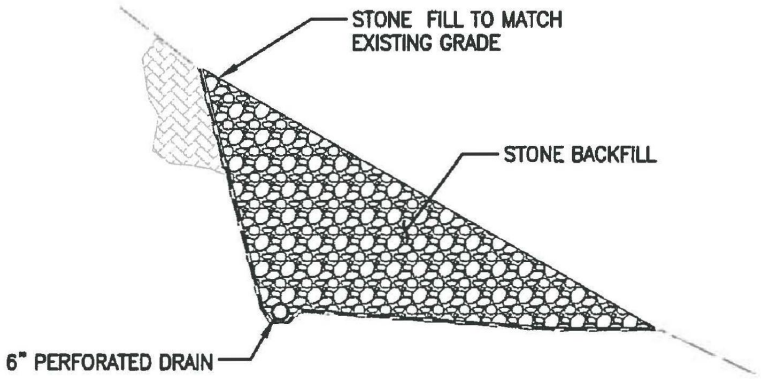
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
REMOVE UNSUITABLE EXISTING SOILS AS BACKFILL

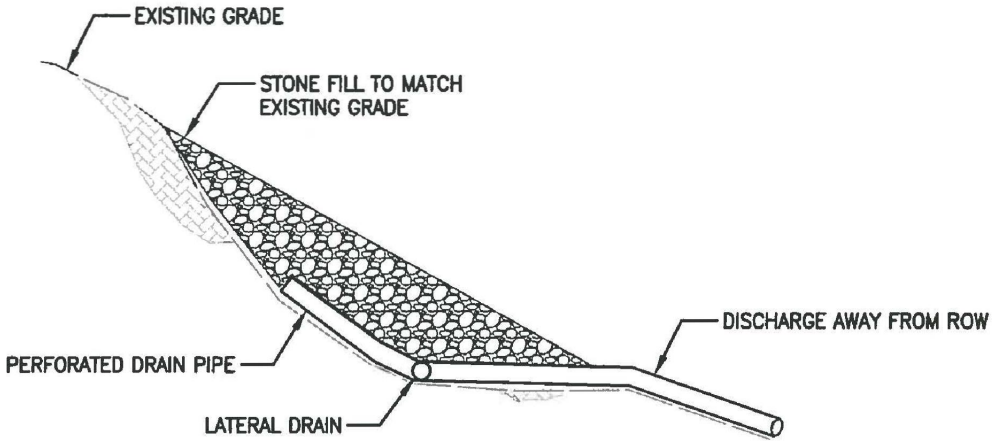
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2E

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



STONE WITH DRAIN TO RESTORE FAILING SLOPE

N.T.S.



SMALL SLIP REPAIR WITH LATERAL

N.T.S.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ROCK BACKFILL (WITH DRAIN)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2F

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. RESTORATION OF ROW SURFACES SHOULD GENERALLY RE-CONSTRUCT THE GROUND SURFACE TO MATCH THE PRE-PROJECT CONTOURS.

3. CHANGES IN THE FINAL GRADING MAY BE NEEDED TO ADDRESS SPECIFIC TARGETED GEOTECHNICAL OR HYDROTECHNICAL OR GEOLOGIC ENGINEERING ISSUES (I.E. CORRECT DRAINAGE PROBLEMS, MINIMIZE DELIVERY OF WATER TO LANDSLIDE SITES, ETC.).

4. FINAL GRADING TO BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO COMPLETION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GRADING TO MATCH EXISTING CONTOURS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2G

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. MINIMIZE THE PLACEMENT OF BACKFILL MATERIALS WHEN RESTORING AND RE-CONSTRUCTING LANDSLIDE SITES, IN ORDER TO REDUCE THE IMPOSED LOAD ON LANDSLIDE SITES.

3. MINIMIZE THE PLACEMENT OF SPOILS FROM GRADING WORK IN OTHER AREAS ALONG THE ROW THAT MAY OVERLAP OTHER LANDSLIDES, IN ORDER TO REDUCE THE POTENTIAL FOR INITIATING NEW LANDSLIDES.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

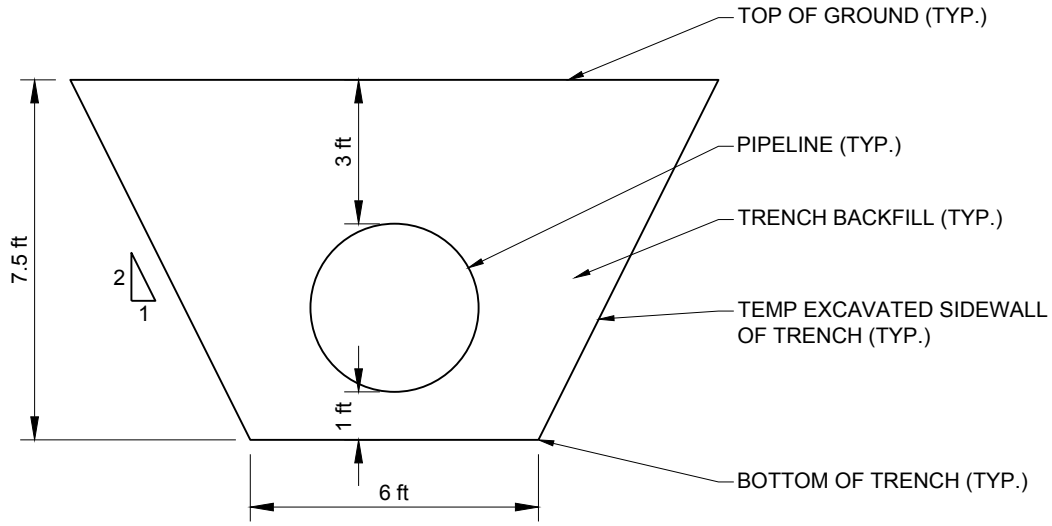
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GRADING TO MINIMIZE BACKFILL OVER LANDSLIDE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2H

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOT TO SCALE

NOTE(S)

1. REFER TO CONTRACT SPECIFIC REQUIREMENTS, FOR TYPICAL GRADING, BACKFILL, AND TRENCHING.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYPICAL TRENCH DIMENSION IN GENERALLY FLAT TERRAIN

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2I

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in

NOTE(S)

1. DEVELOP SPOILS MANAGEMENT PLAN THAT FITS THE SITE SPECIFIC CONDITIONS, AND MEETS THE PURPOSE OF THE DESIGN AND CONSTRUCTION PLANS FOR THE TARGETED SITE. THE FOLLOWING ARE INTENDED ONLY AS GENERAL GUIDELINES, TO BE CONSISTENT WITH THE SITE SPECIFIC PLAN. ADDITIONAL MEASURES ARE ANTICIPATED.

2. MINIMIZE THE PLACEMENT OF SPOILS FROM GRADING WORK IN OTHER AREAS ALONG THE ROW THAT MAY OVERLAP OTHER POTENTIAL UNSTABLE GROUND, IN ORDER TO REDUCE THE POTENTIAL FOR INITIATING NEW SLOPE INSTABILITIES.

3. MINIMIZE THE PLACEMENT OF SPOILS MATERIALS WHEN RESTORING AND RE-CONSTRUCTING THE ROW, IN ORDER TO REDUCE THE IMPOSED LOAD ON POTENTIALLY UNSTABLE GROUND SITES.

4. EXAMPLE SPOILS MANAGEMENT MEASURES MAY INCLUDE, BUT ARE NOT LIMITED TO: STACKING SPOILS ALONG THE ROW EDGE IN DRY CONDITIONS AND WITHIN ROW OR TEWA BOUNDARIES; USE TEMPORARY PILES AND MATS TO CREATE CRIBS .TO RETAIN SPOILS; USE LOCAL LARGE BOULDERS TO BUILD TEMPORARY CRIBS TO RETAIN SPOILS; BUILD TEMPORARY PIONEER ROADS OR EXCAVATED BERMS TO RETAIN SPOILS; SHORT-HAUL OR END-HAUL SPOILS TO OFF-SITE LOCATIONS FOR TEMPORARY STORAGE OR SPOILS; STACK SPOILS IN TRAVELED WAY TO TEMPORARILY STORE; COVER SPOILS WITH PLASTIC AND/OR GEOSYNTHETIC MATERIALS; ENCASE SPOILS IN GEOSYNTHETIC MATERIALS TO IMPROVE STABILITY OF SPOILS FOR TEMPORARY STORAGE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

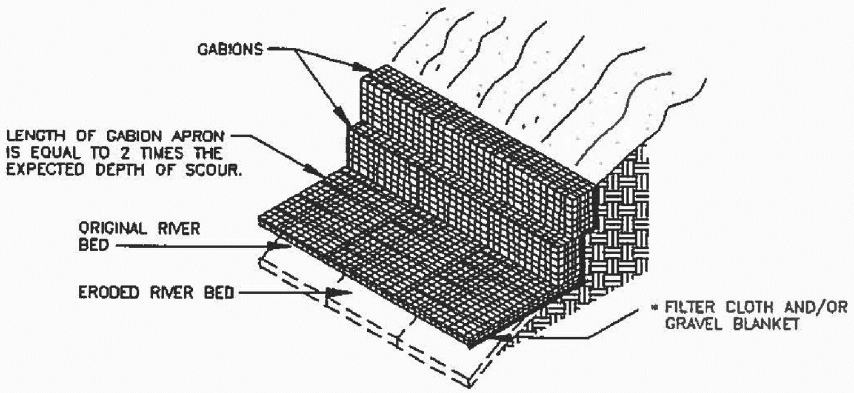
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SPOILS MANAGEMENT

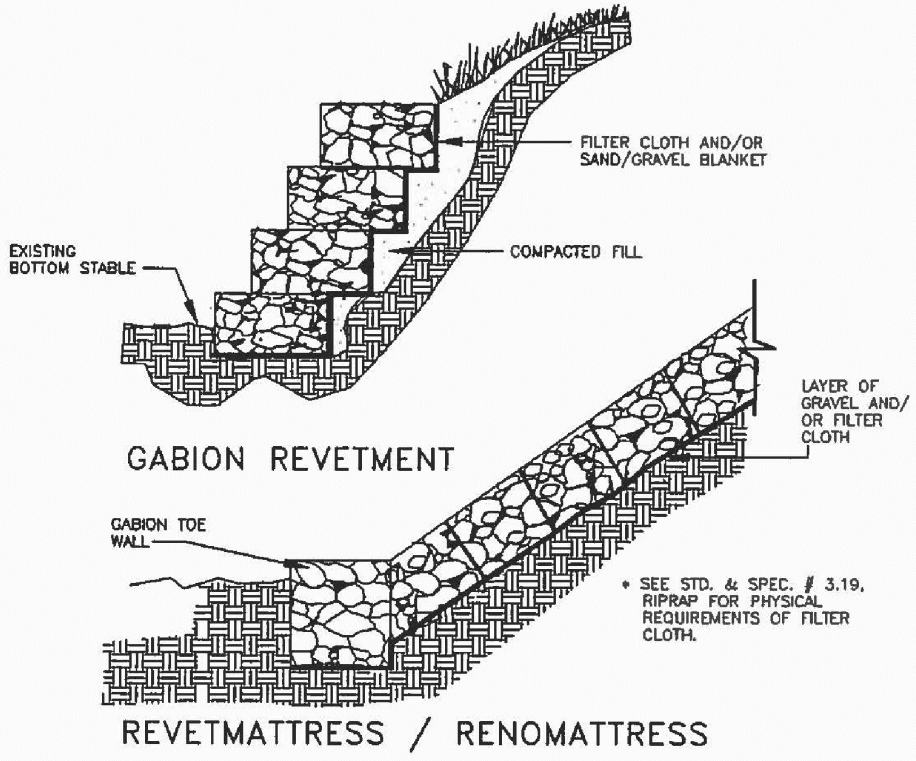
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2J

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

GABIONS



GABION TOE WALL



REVETMATTRESS / RENOMATTRESS

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATIONS MEASURES TO BE DETERMINED BASED ON CONDITION ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

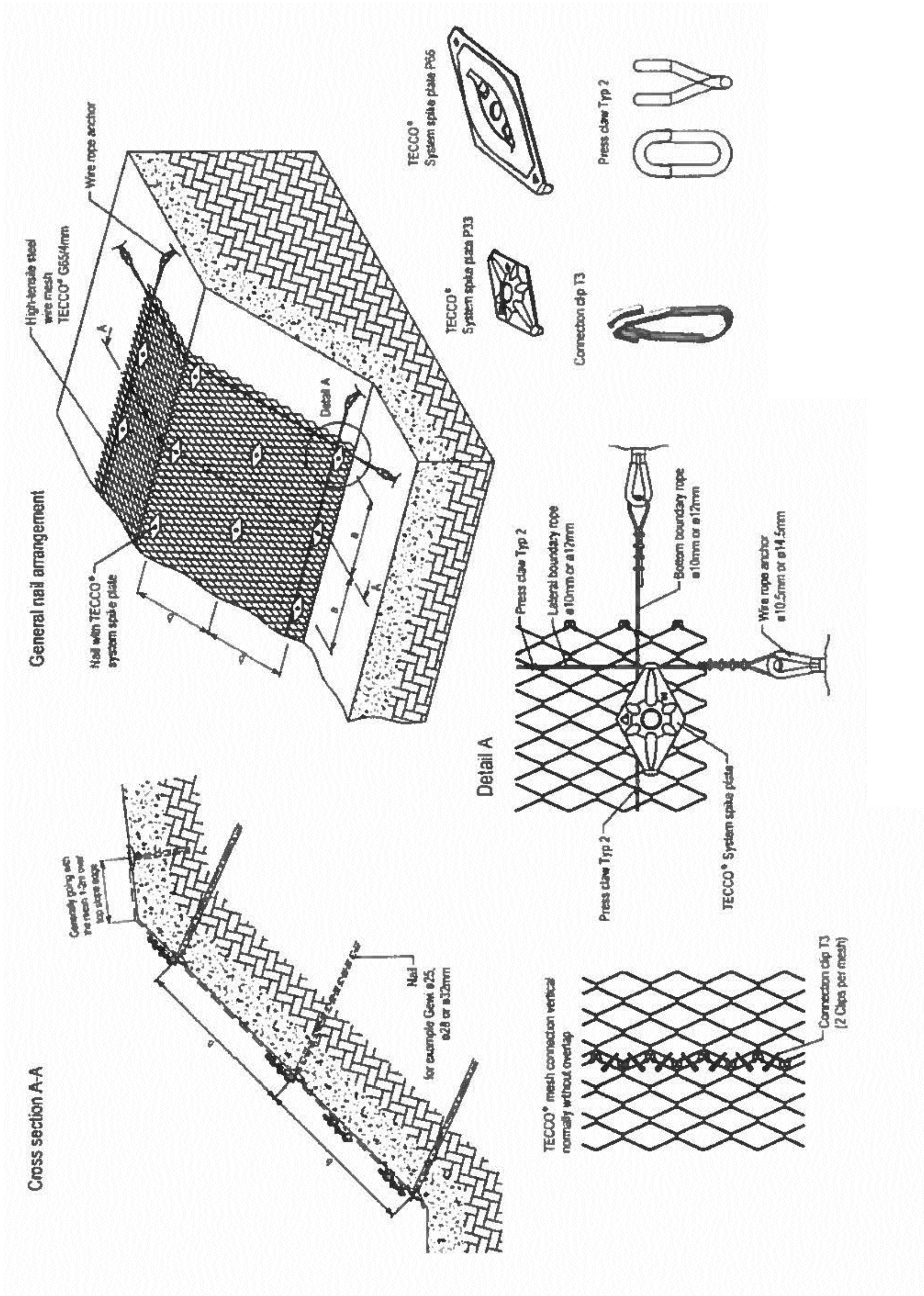
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GABIONS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2K

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATIONS MEASURES TO BE DETERMINED BASED ON CONDITION ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SOIL-NAIL WITH TECCO MESH

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2L

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

1 in

0

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

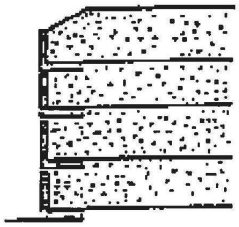
TITLE
EXTERNALLY STABILIZED RETAINING WALL SYSTEMS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2M

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

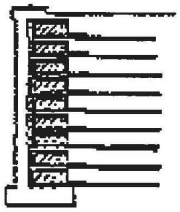
A) VERTICAL GEOTEXTILE FACING

E) SLOPING GEOTEXTILE FACING



B) VERTICAL PRECAST CONCRETE ELEMENT FACING

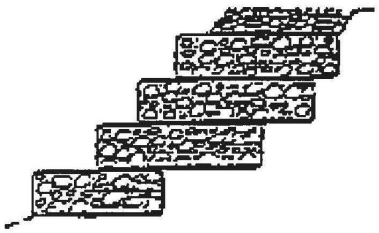
F) SLOPING GUNITE OR STRUCTURAL FACING



C) VERTICAL CAST IN-PLACE CONCRETE/MASONRY FACING

G) SLOPING SOIL AND VEGETATION FACING

D) VERTICAL MASONRY FACING



H) GEOTEXTILE GABION

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

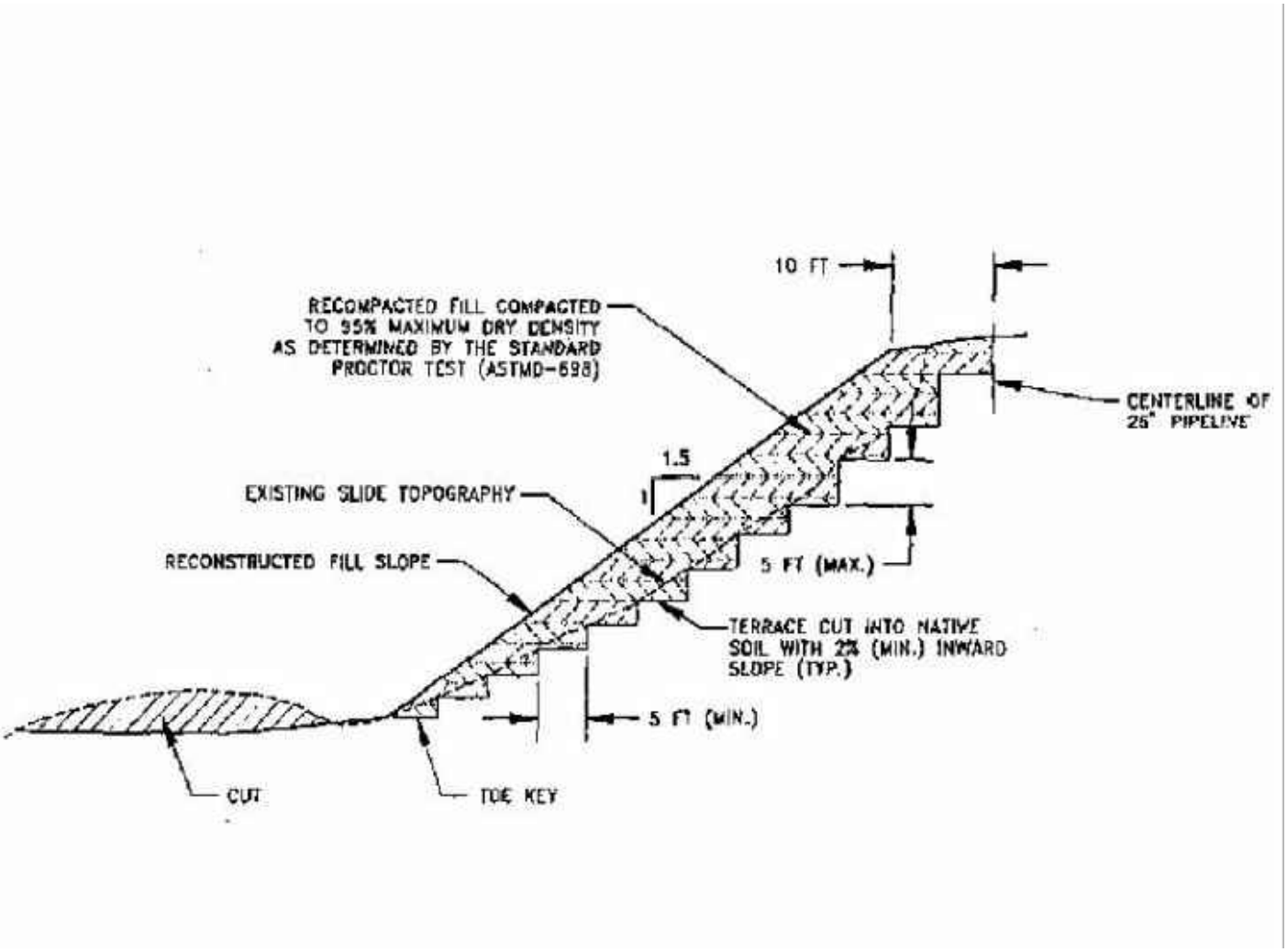
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GEOTEXTILE REINFORCED SYSTEMS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2N

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

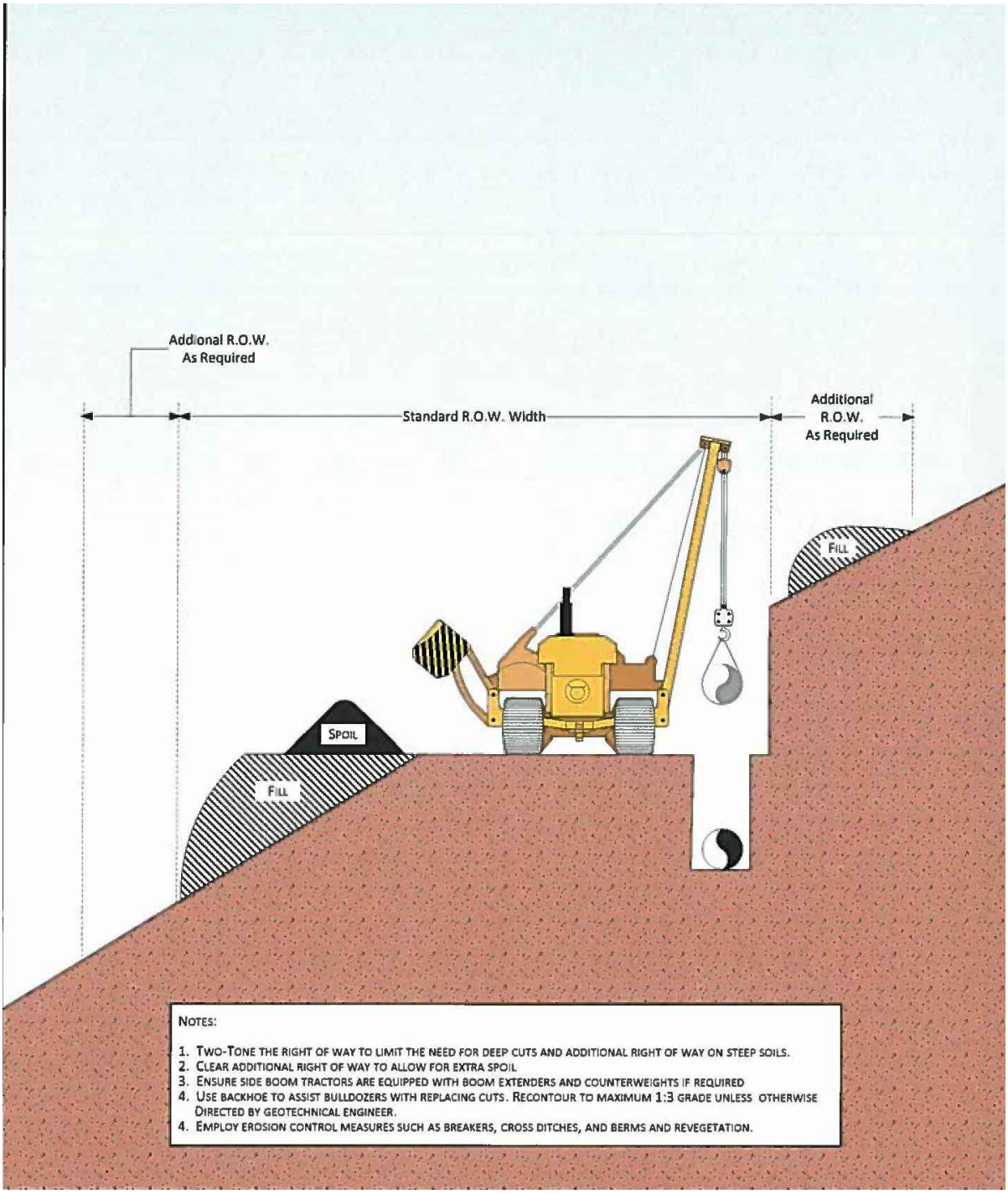
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
BENCH AND REGRADE WITH BACKFILL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

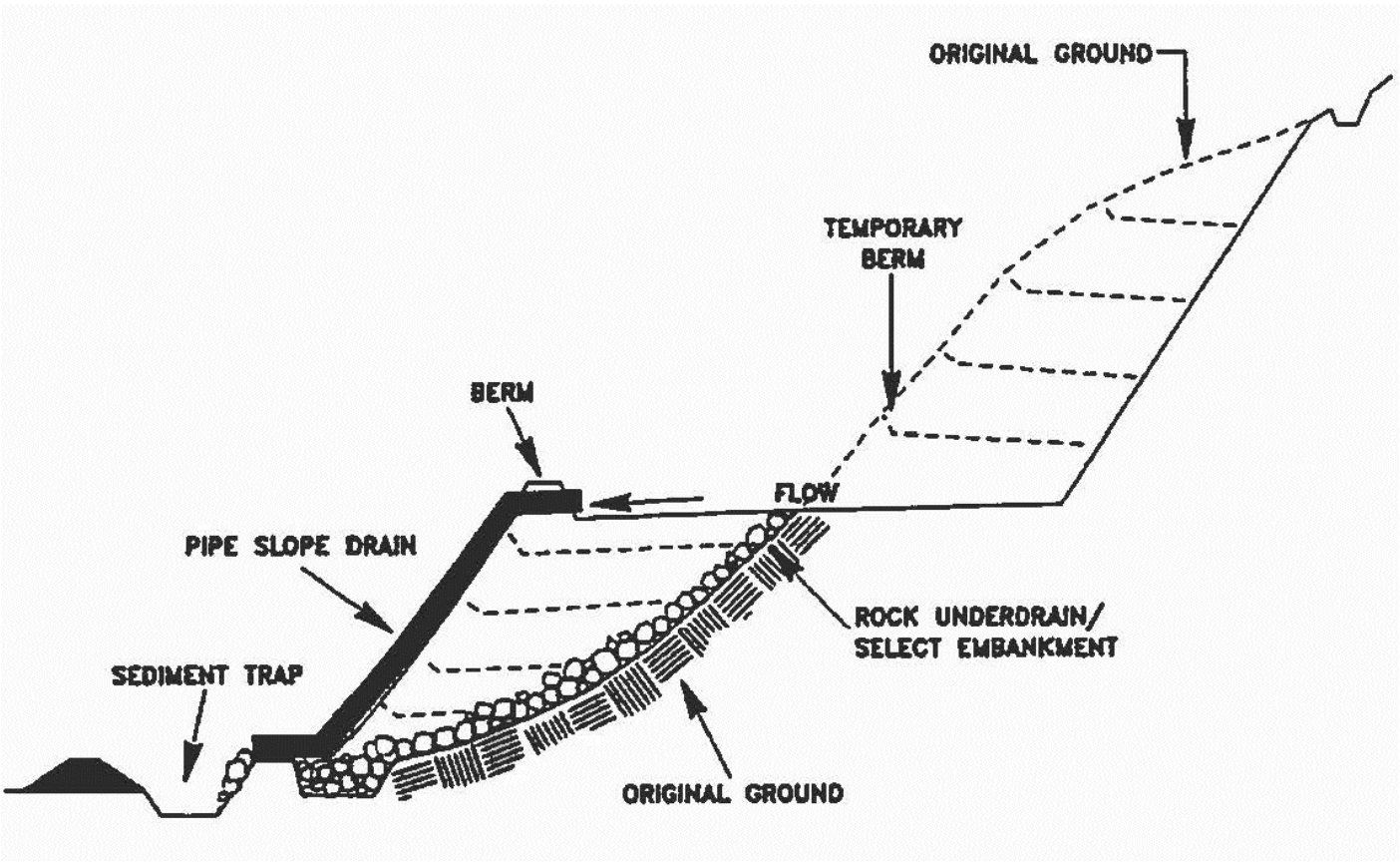
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
CUT AND FILL CONSTRUCTION

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2P

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

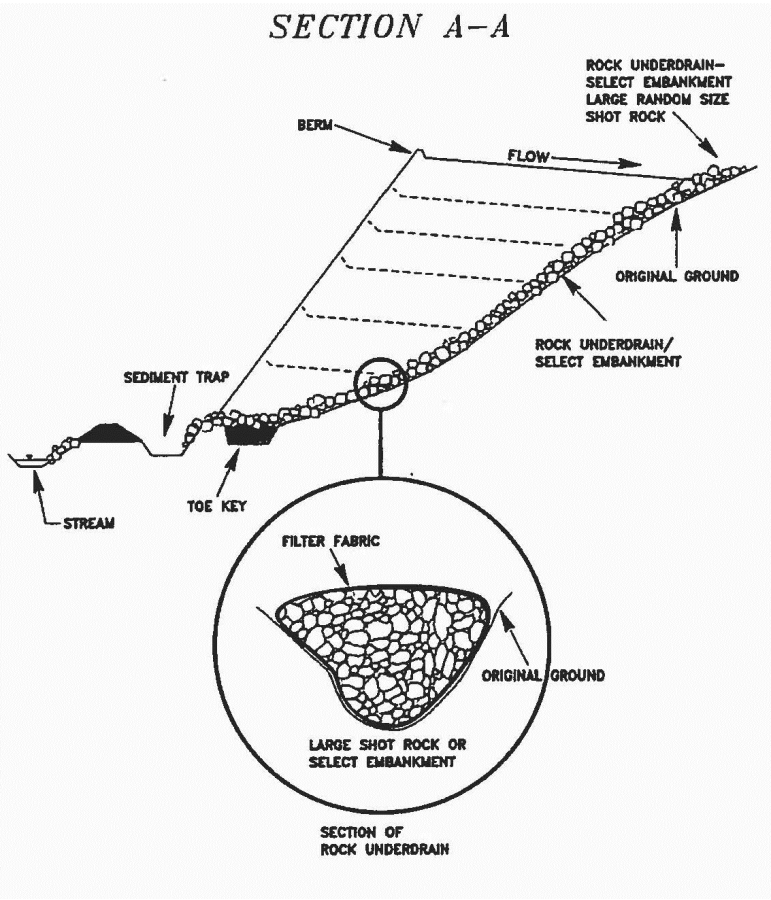
CONSULTANT
Golder Associates

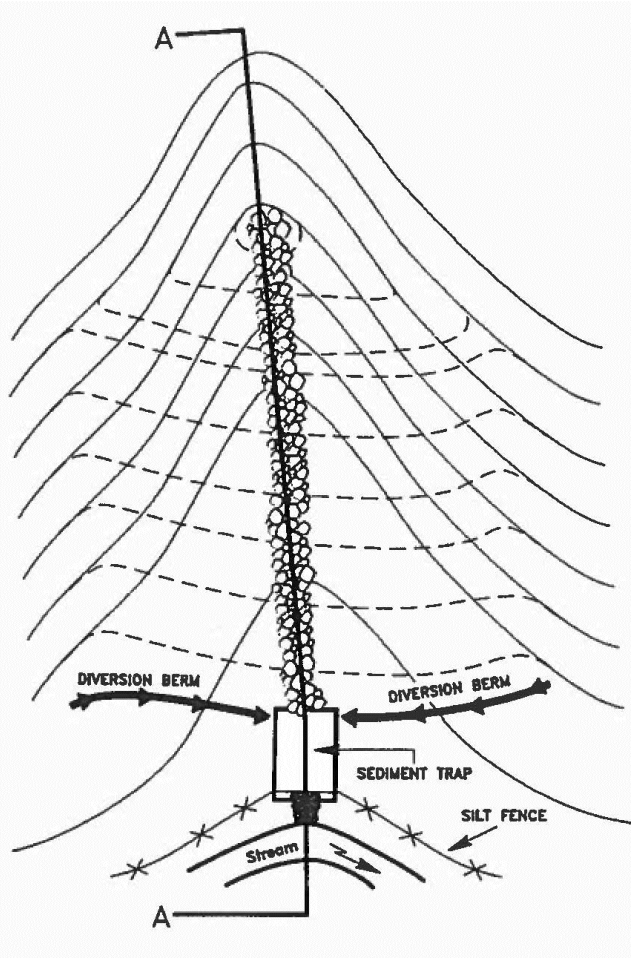
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP SIDE HILL CUT AND FILL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2Q

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in





CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

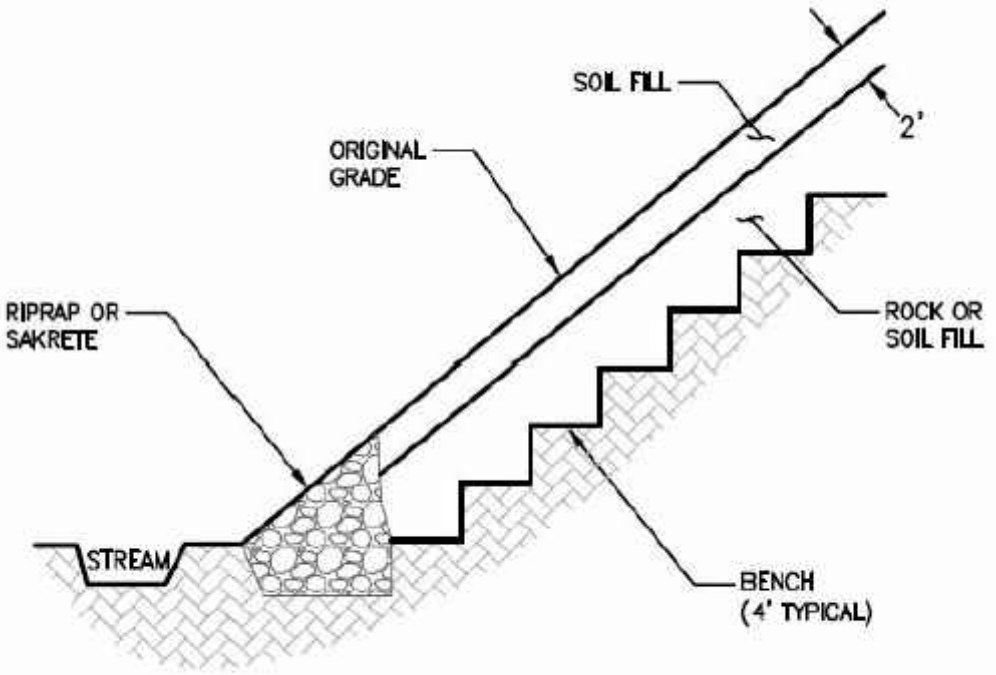
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

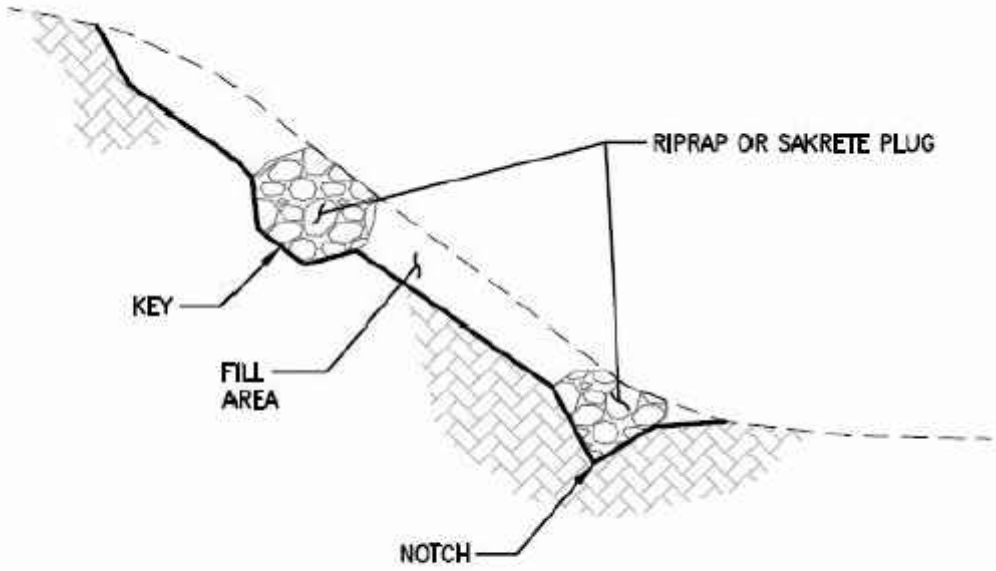
TITLE
TYP FILL WITH ROCK UNDER DRAIN

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2R

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



BENCH AND REGRADE TYPICAL
N.T.S.



KEYING TYPICAL
N.T.S.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

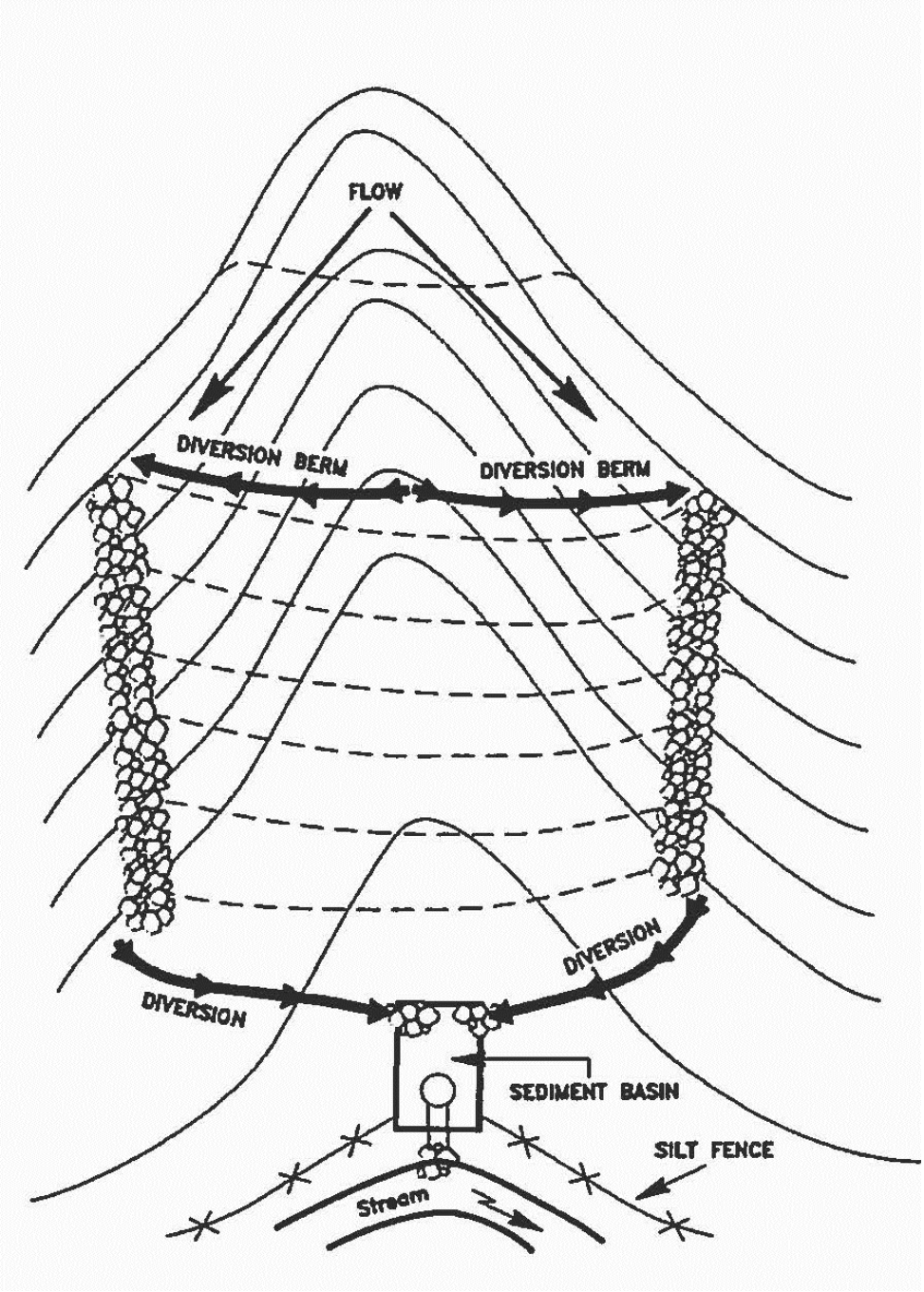
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP BENCH AND REGRADE BACKFILL WITH ROCK OR SACKCRETE KEYS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2S

0 1in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

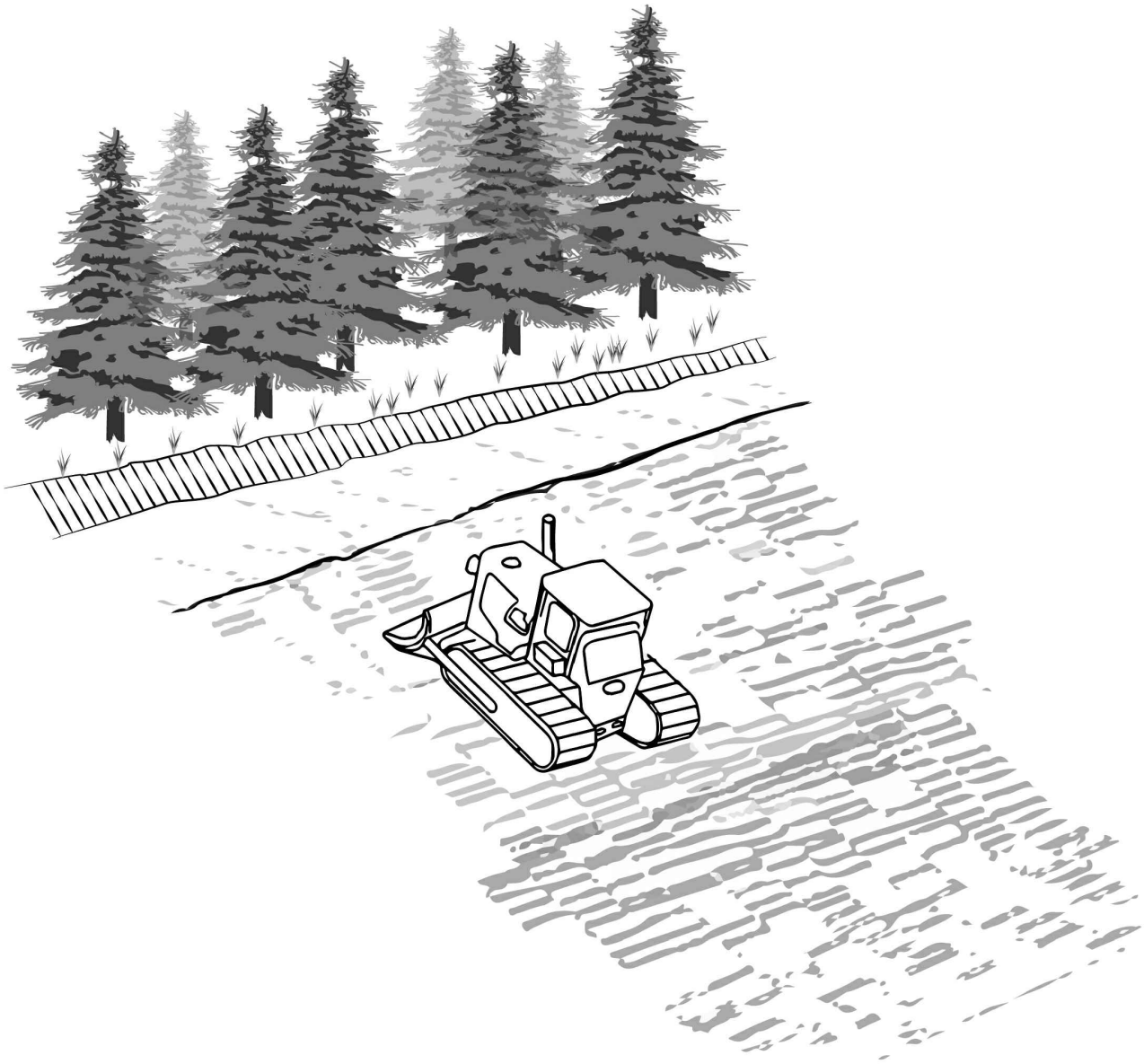
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP FILL WITH MULTIPLE ROCK CHANNELS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	2T

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. TRACKING SLOPES IS DONE BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PERPENDICULAR TO THE SLOPE.
3. IF A BULLDOZER IS USED, THE BLADE MUST BE UP.
4. CARE SHOULD BE EXERCISED ON SOILS HAVING HIGH CLAY CONTENT TO AVOID OVER COMPACTION.

NOT TO SCALE

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TRACK DISTURBED SLOPES

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3A

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. RE-VEGETATE DISTURBED SLOPES WITH NATIVE GRASS SEED MIX PER REGULATORY AND PERMIT REQUIREMENTS.
3. FINAL SEED MIX TO BE REVIEWED AND APPROVED BY ENGINEER PRIOR TO INSTALLATION.
4. GENERAL APPROACH CONSISTS OF, MAY INCLUDE, BUT IS NOT LIMITED TO, TEMPORARY SEEDING FOLLOWED BY PERMANENT SEEDING.
5. TEMPORARY SEEDING CONSISTS OF SEEDING AND MULCHING, OR MATTING USED TO PRODUCE A QUICK GROUND COVER TO REDUCE EROSION ON EXPOSED AND/OR DISTURBED SOIL THAT MAY BE REDISTURBED OR PERMANENTLY STABILIZED AT A LATER DATE. SELECT PLANTS APPROPRIATE TO THE SEASON AND SITE CONDITIONS, PER DOMINION SPECIFICATIONS AND CONTRACT REQUIREMENTS.
6. PERMANENT SEEDING ESTABLISHES PERENNIAL VEGETATION COVER ON EXPOSED AND/OR DISTURBED SOILS TO REDUCE EROSION AND DECREASE SEDIMENT YIELD FROM DISTURBED AREAS. SELECT PLANTS APPROPRIATE TO THE SEASON AND SITE CONDITIONS, PER DOMINION SPECIFICATIONS AND CONTRACT REQUIREMENTS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

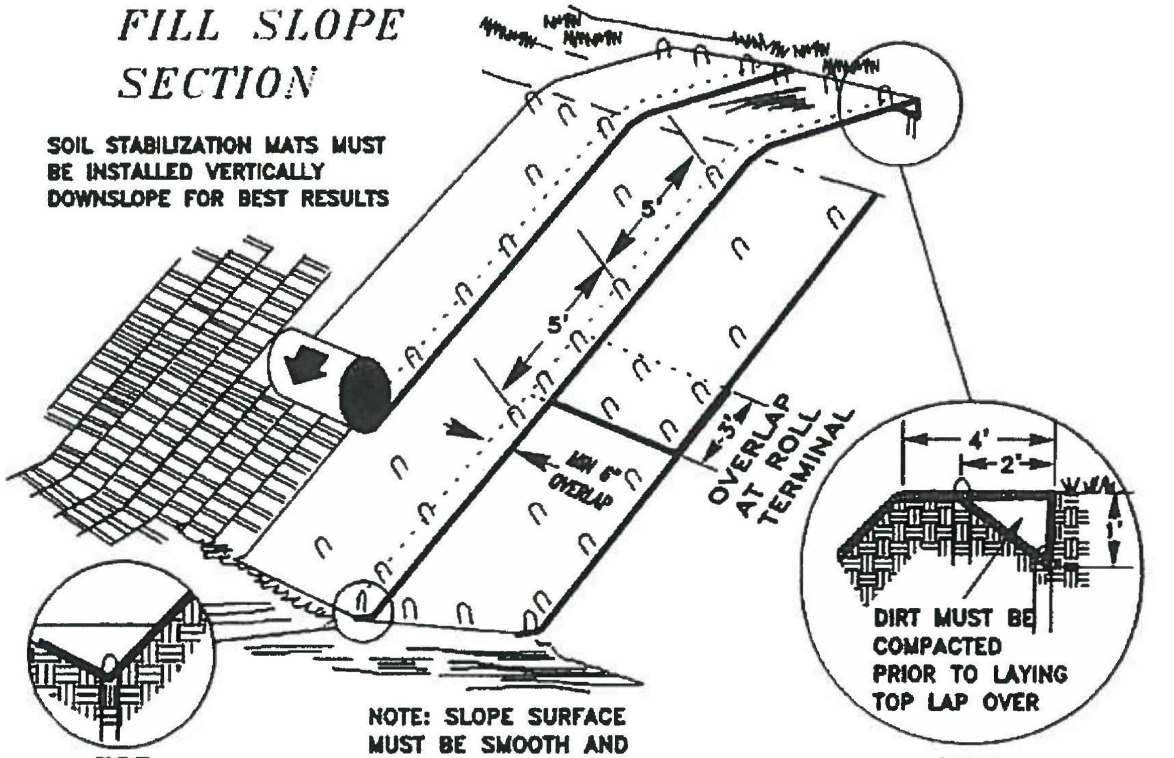
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
RE-VEGETATE DISTURBED SLOPES

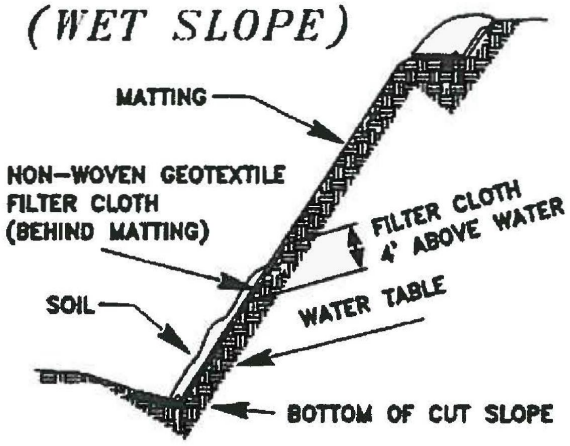
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3B

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

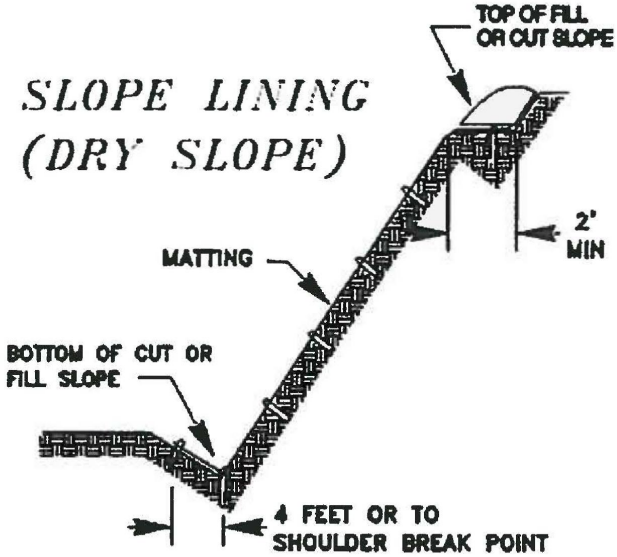
FILL SLOPE SECTION



SLOPE LINING (WET SLOPE)



SLOPE LINING (DRY SLOPE)



SOURCE: VDOT STANDARDS AND VIRGINIA DCR-DSWC

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

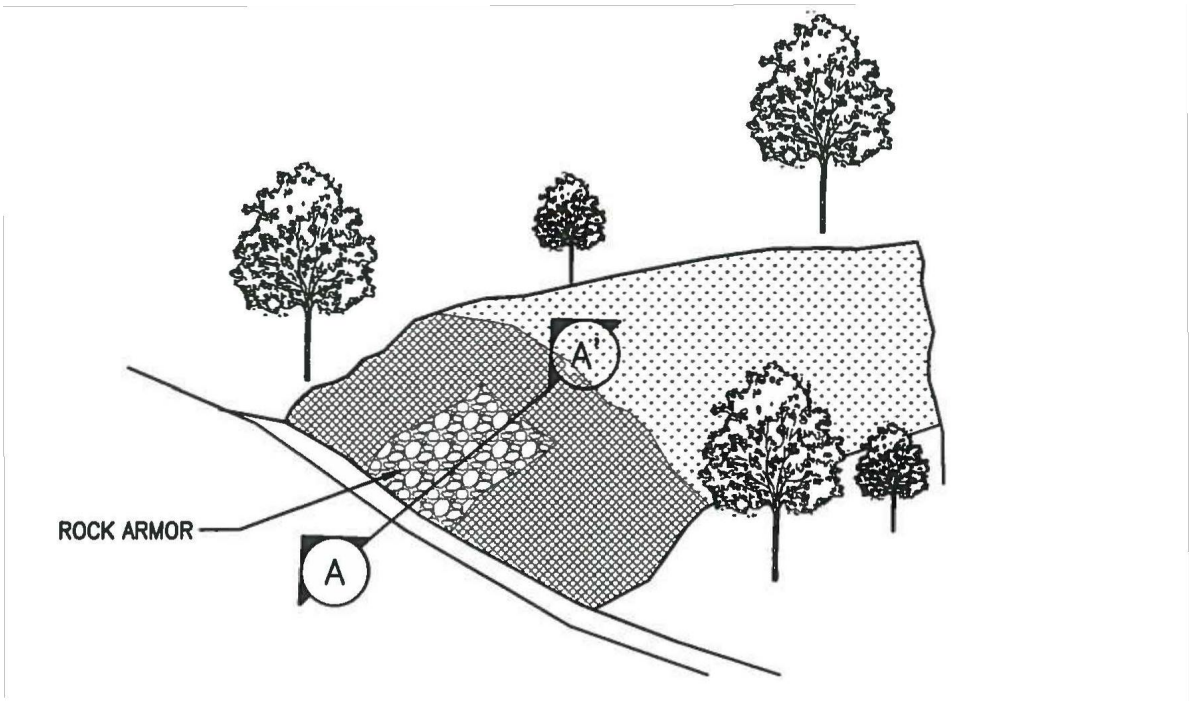
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

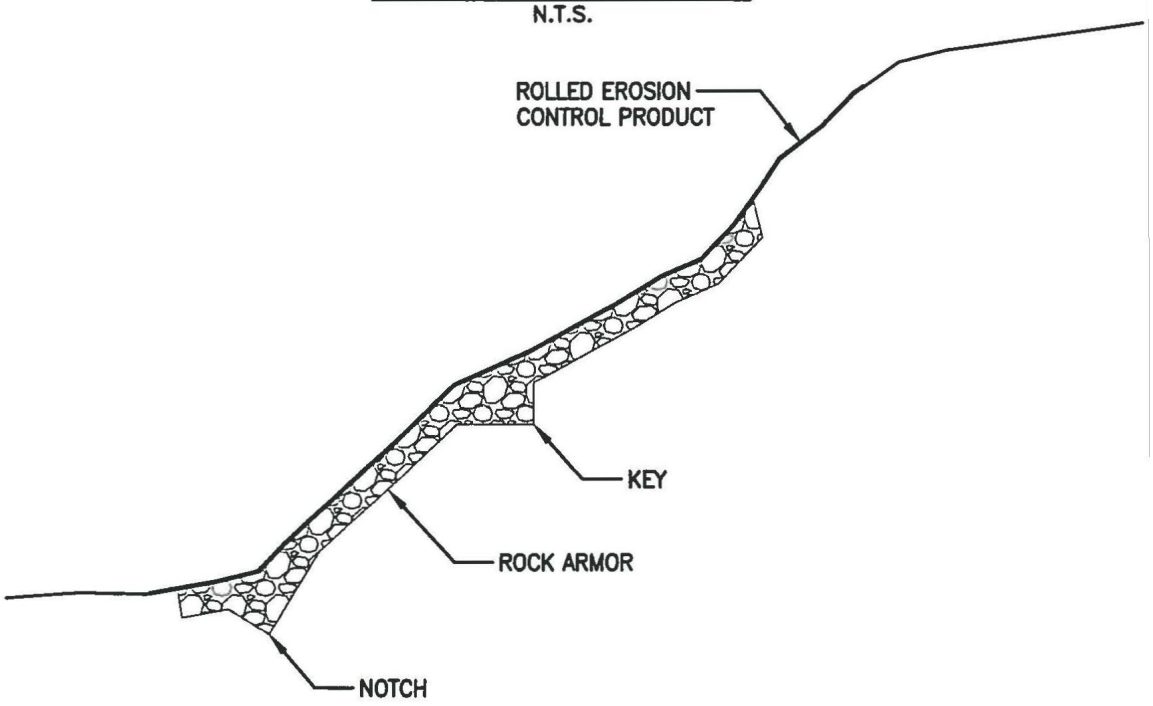
TITLE
COIR CLOTH ON DISTRUBED SLOPES

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3C

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PERSPECTIVE VIEW
N.T.S.



A–A' ROCK ARMOR ON STEEP SLOPE
N.T.S.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

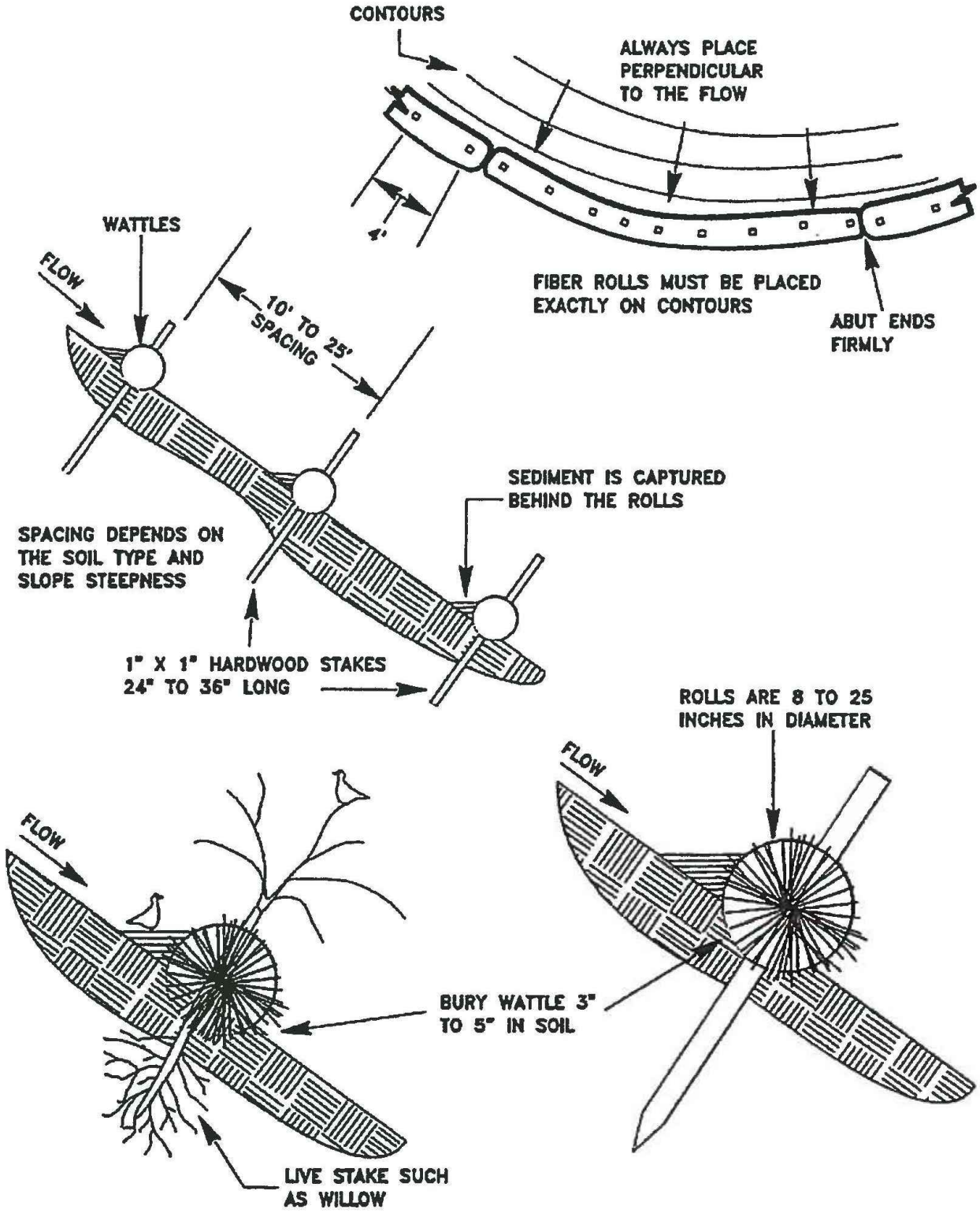
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ROCK ARMORING ON DISTRUBED SLOPES

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

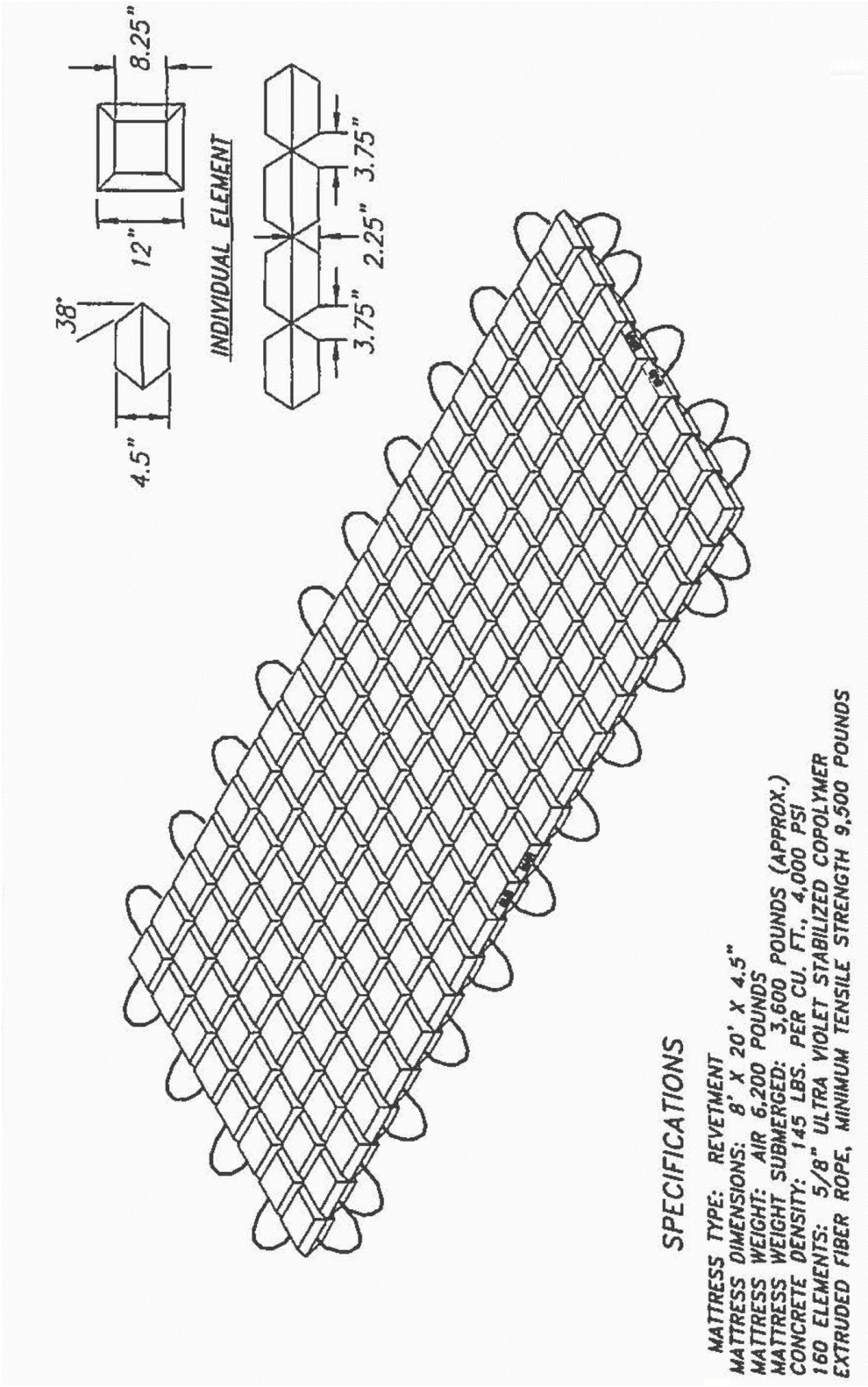
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
COIR LOGS ON DISTURBED SLOPES

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3E

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
0



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

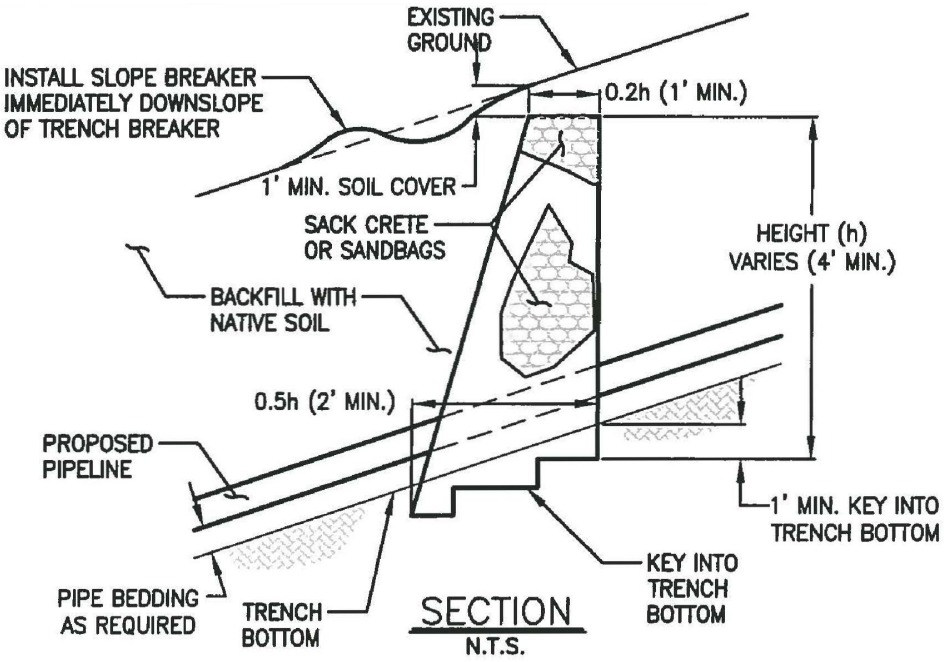
Golder Associates

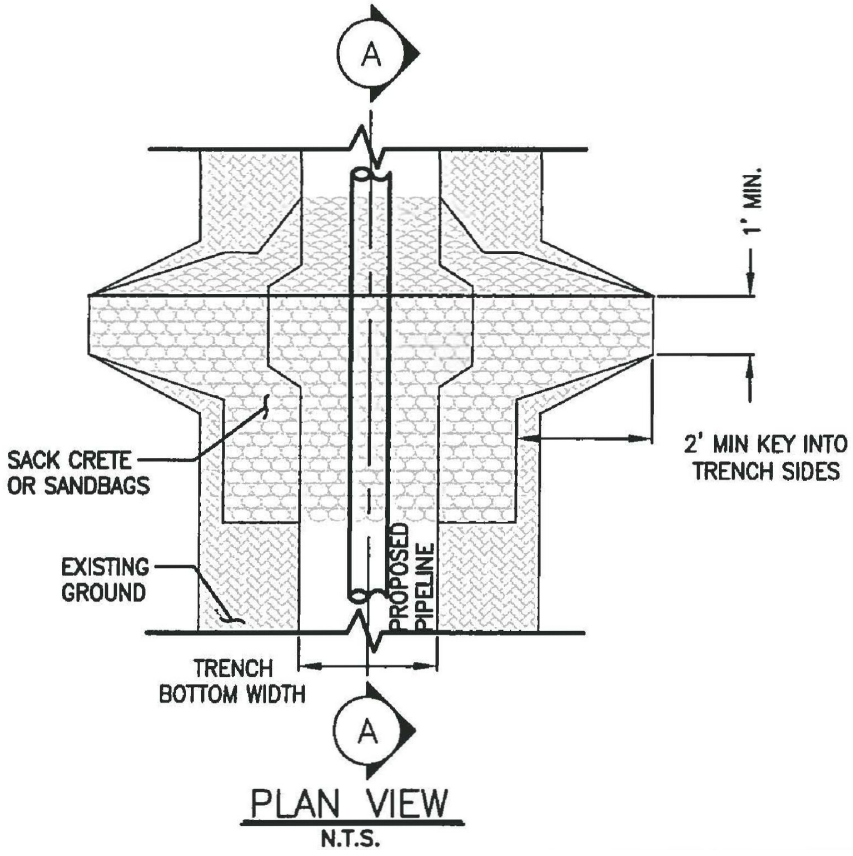
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SUBMAR MATTS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	3F

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A





CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

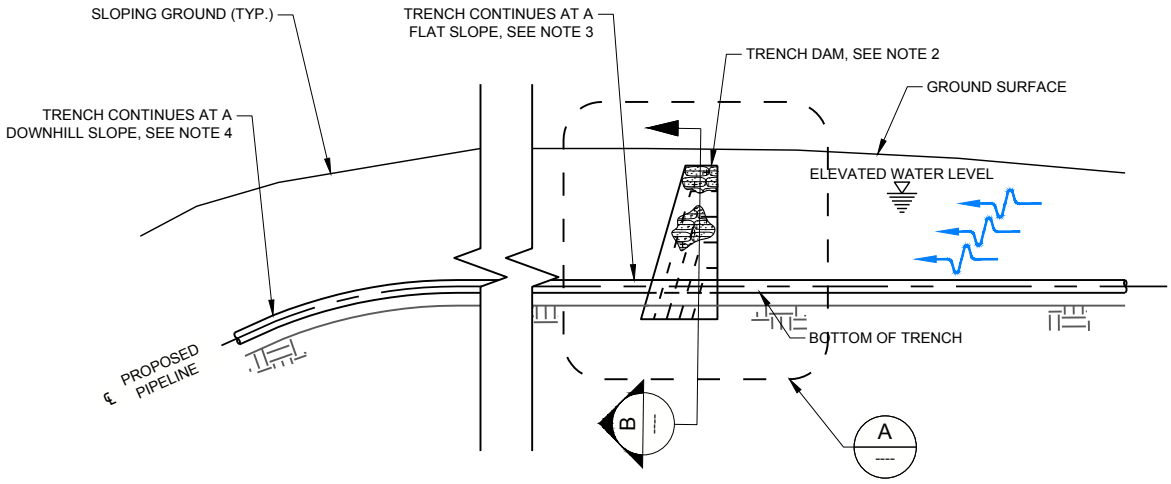
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

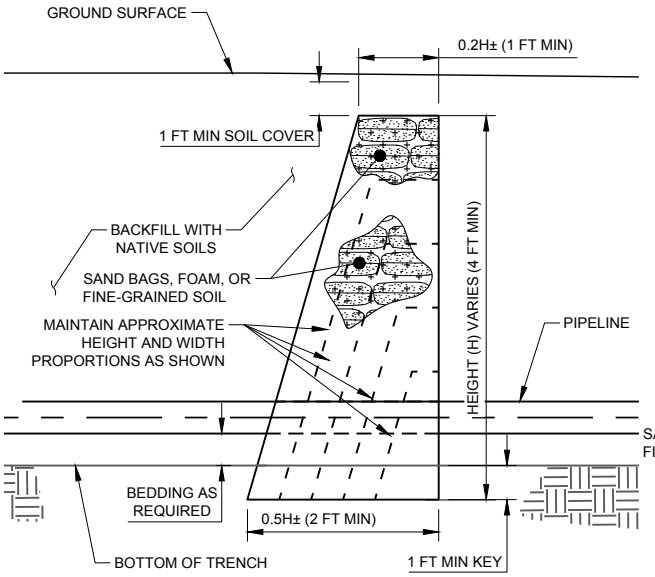
TITLE
TRENCH BREAKERS (FOAM AND SANDBAGS)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4A

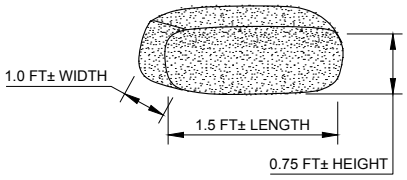
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



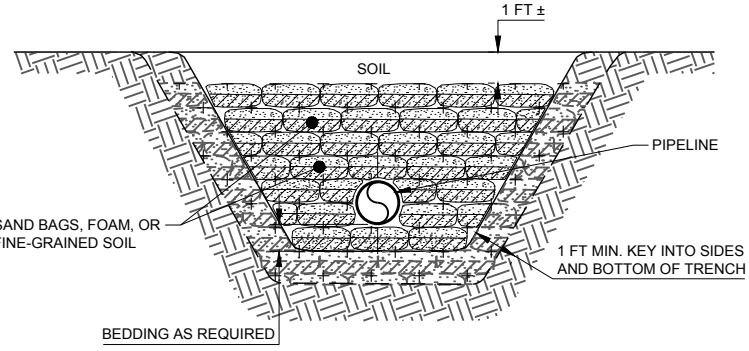
TRENCH DAM CONFIGURATION
N.T.S.



N.T.S A TRENCH DAM DETAIL



SAND BAG DETAIL
N.T.S.



N.T.S B SECTION

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. THE PURPOSE AND INTENT OF TRENCH DAMS IS TO STOP THE FLOW OF WATER IN THE TRENCH WHERE ELEVATED WATER SURFACES MAY EXIST (SUCH AS STREAM CROSSINGS OR PONDED AREAS).
3. INSTALL TRENCH DAM IN LOW / FLAT TERRAIN AREAS THAT MAY HAVE ELEVATED WATER LEVELS. THE PURPOSE OF THE TRENCH DAM IS TO STOP FLOW OF WATER FROM RUNNING DOWN THE FLAT TRENCH.
4. INSTALL TRENCH DAM AT THE TOP OF SLOPES AT AREAS THAT MAY HAVE ELEVATED WATER LEVELS. THE PURPOSE OF THE TRENCH DAM IS TO STOP FLOW OF WATER FROM RUNNING DOWN THE TRENCH ON THE HILL SLOPE.
5. AT LOCATIONS WHERE DAMS ARE SPECIFIED ON DETAILS, PLANS OR AS DIRECTED BY COMPANY REPRESENTATIVE, SOFT PLUGS (UNEXCAVATED SECTIONS ALONG TRENCH-LINE) MAY BE LEFT IN PLACE TO PERFORM FUNCTION OF PERMANENT DAMS PRIOR TO PIPE PLACEMENT.
6. THE TRENCH SHALL BE DEWATERED THROUGH A SEDIMENT TRAP, FILTER BAG, OR DEWATERING STRUCTURE.
7. PERMANENT TRENCH DAMS SHALL BE INSTALLED BEFORE THE TRENCH IS BACKFILLED.
8. TRENCH PLUGS SHALL BE INSTALLED AT THE BANKS OF ALL PERENNIAL STREAM CROSSINGS IMMEDIATELY AFTER TRENCH EXCAVATION. THE PLUGS MAY BE TEMPORARILY REMOVED DURING PIPE PLACEMENT, BUT THEN REPLACED.
9. THE TRENCH SHALL BE DEWATERED THROUGH A SEDIMENT TRAP, FILTER BAG, OR DEWATERING STRUCTURE REFER TO TRENCH DEWATERING DETAIL (TWD).
10. PERMANENT TRENCH DAMS SHALL BE INSTALLED BEFORE THE TRENCH IS BACKFILLED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

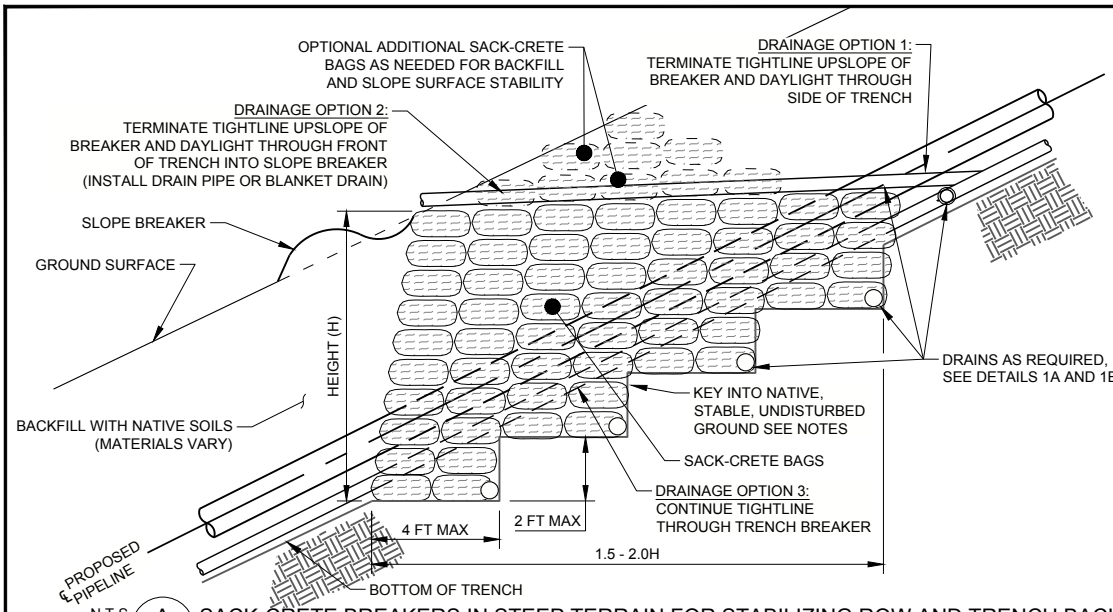
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

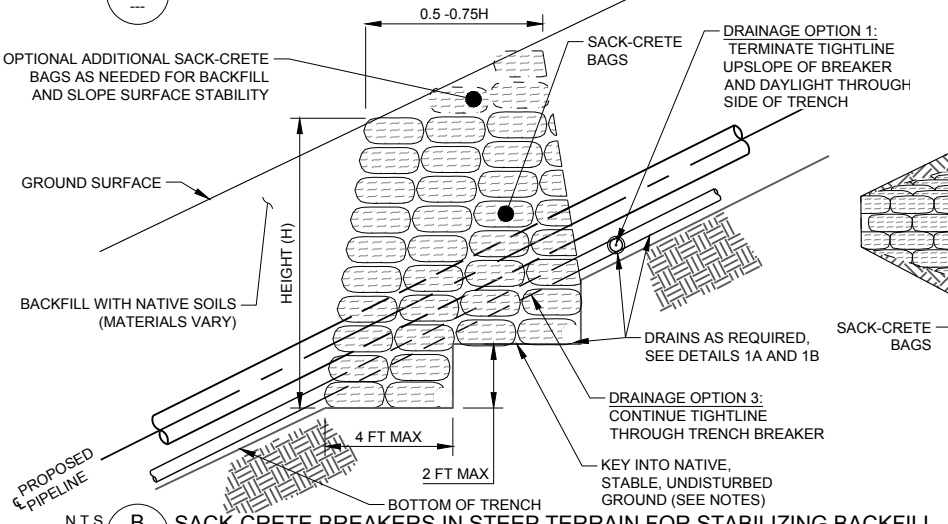
TITLE
TRENCH DAMS (FOAM, BAGS, OR FINE GRAINED SOILS)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4B

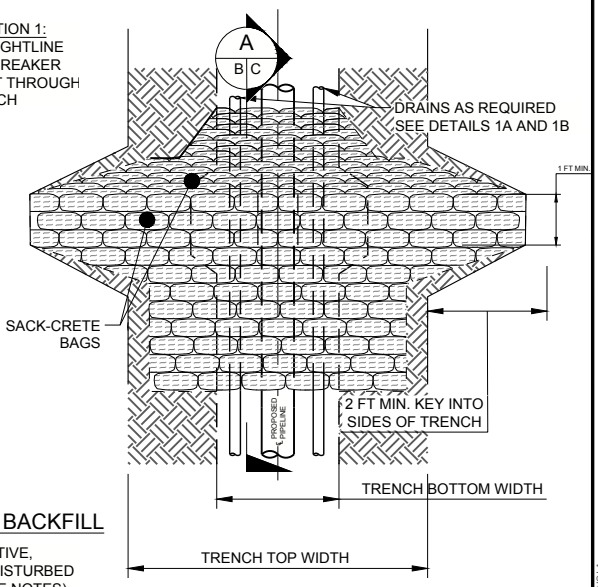
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in 1 cm



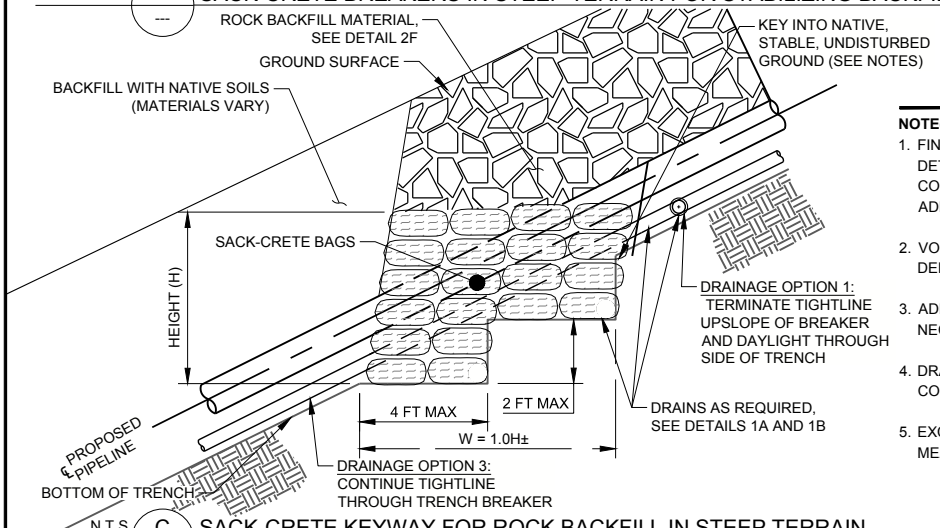
N.T.S A SACK-CRETE BREAKERS IN STEEP TERRAIN FOR STABILIZING ROW AND TRENCH BACKFILL



N.T.S B SACK-CRETE BREAKERS IN STEEP TERRAIN FOR STABILIZING BACKFILL



PLAN VIEW
N.T.S.



N.T.S C SACK-CRETE KEYWAY FOR ROCK BACKFILL IN STEEP TERRAIN

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. ADD OR EXTEND KEYS OR PLACE ADDITIONAL SACK-CRETE BAGS AS NECESSARY TO MAINTAIN STABILITY.
4. DRAINAGE OPTION TO BE SELECTED AT THE TIME OF CONSTRUCTION BASED ON CONDITIONS ENCOUNTERED.
5. EXCAVATE KEY WITH OUTBOARD SLOPE, AND INCLUDE DRAINAGE MEASURES THAT EVACUATE ACCUMULATED SEEPAGE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

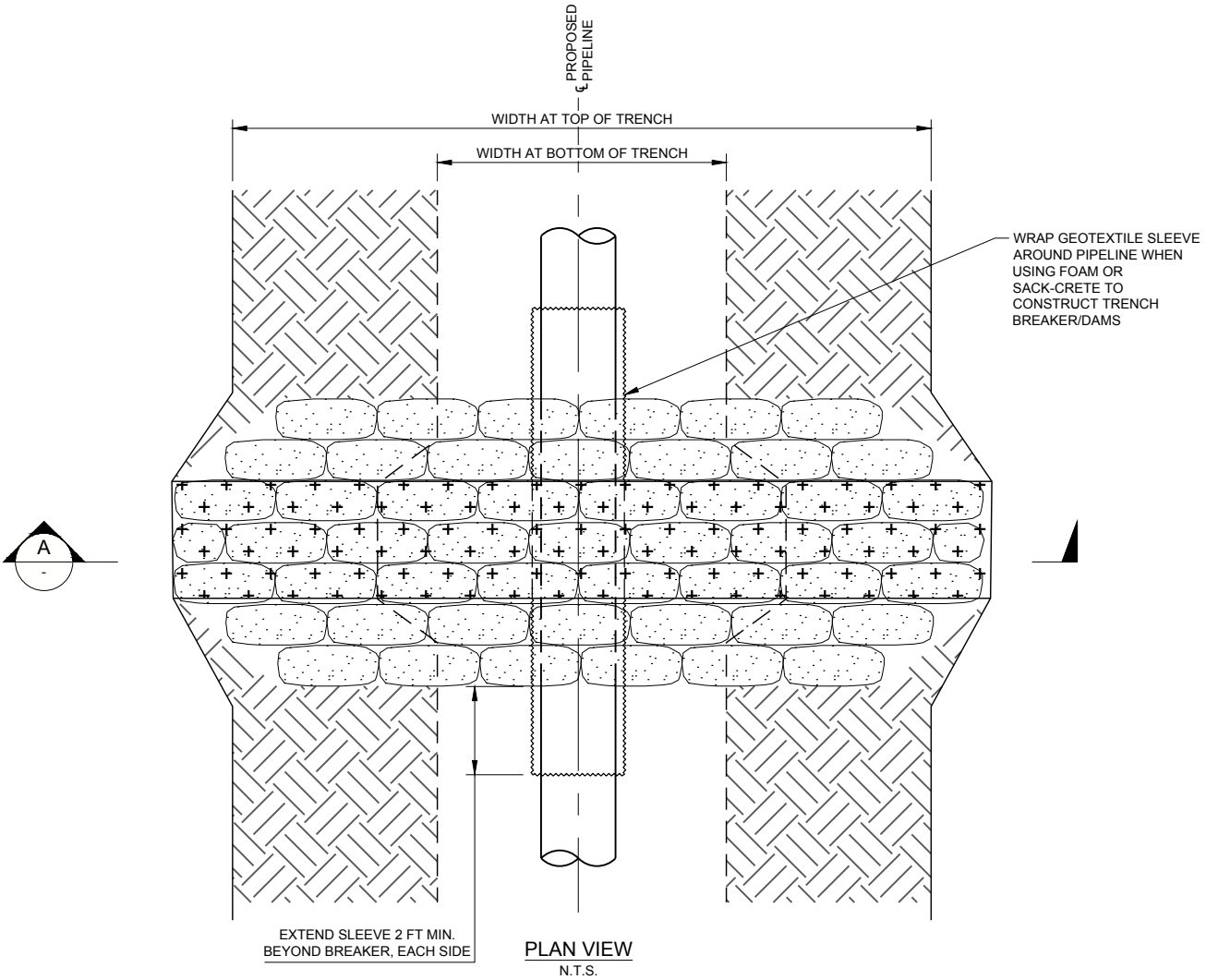
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

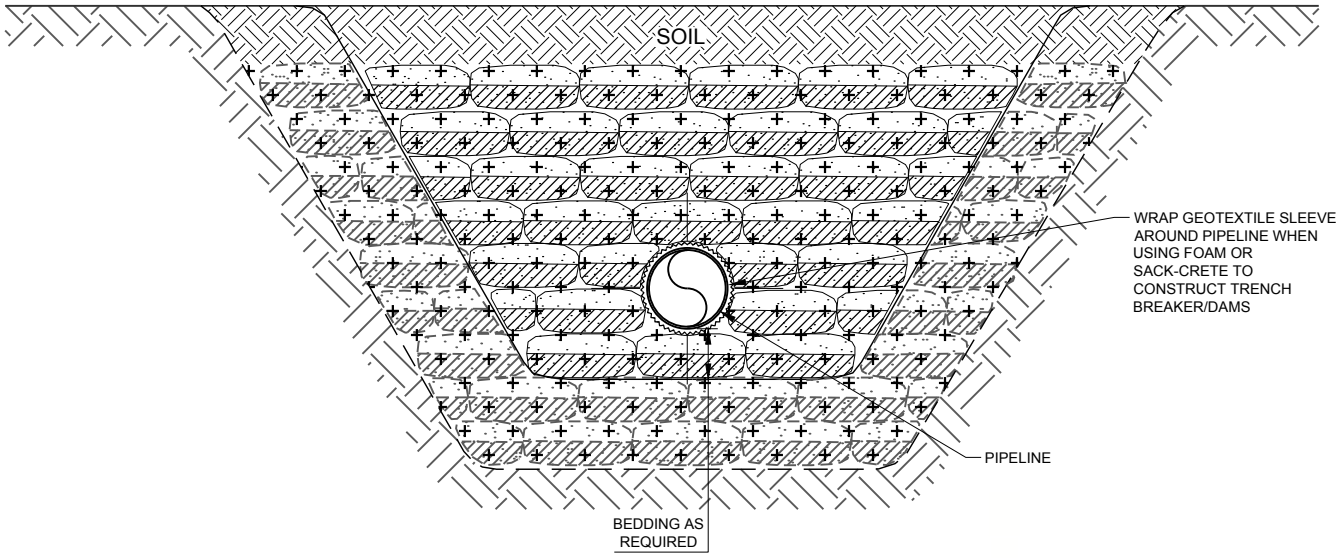
TITLE
SACK-CRETE BREAKERS (STRUCTURAL BREAKER)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4C

0 1 cm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PLAN VIEW
N.T.S.



N.T.S A --- ELEVATION

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

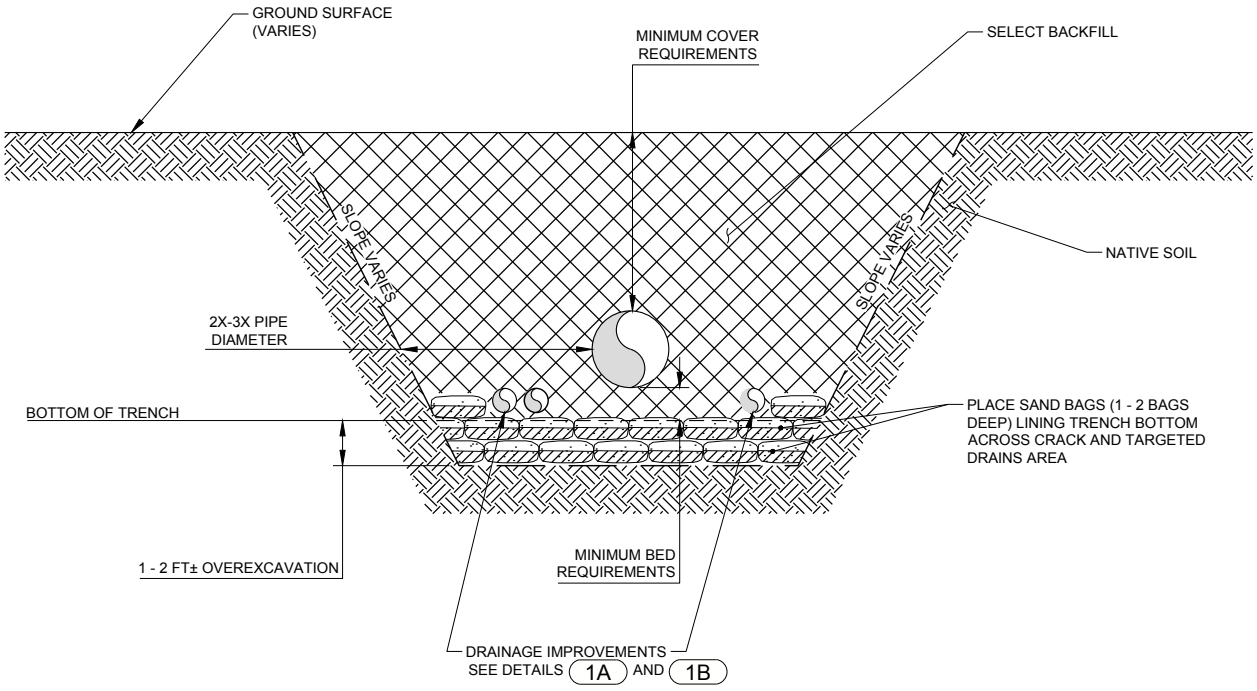
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLEEVE INTERFACE BETWEEN PIPELINE AND BREAKER

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



TYPICAL TRENCH SECTION WITH SEALED BOTTOM

SCALE: N.T.S.

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. MAINTAIN POSITIVE DRAINAGE IN TRENCH ACROSS AREAS SEALED WITH SANDBAGS, DRAINS SHOULD BE PLACED OVER THE SEAL. WATER SHOULD NOT POND BEHIND SEAL.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

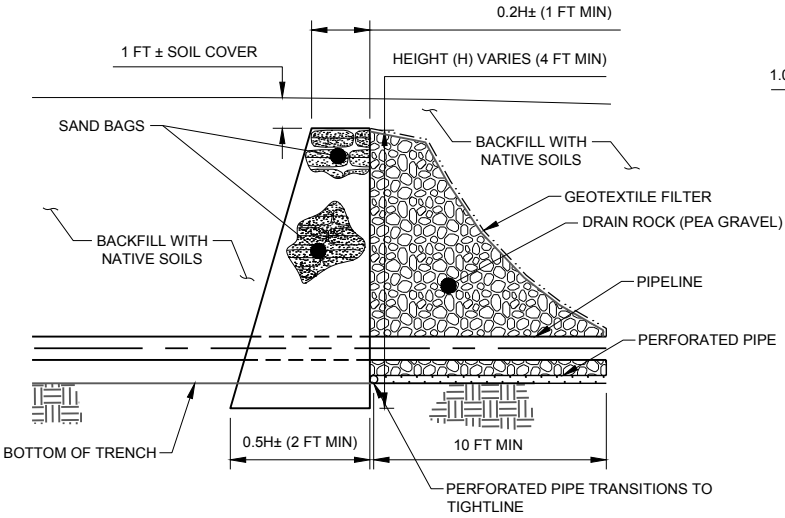
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SEAL BOTTOM OF TRENCH WITH SANDBAGS

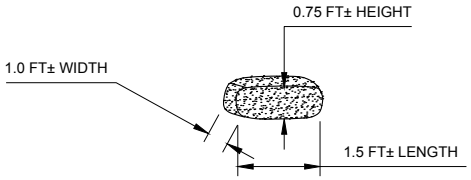
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4E

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



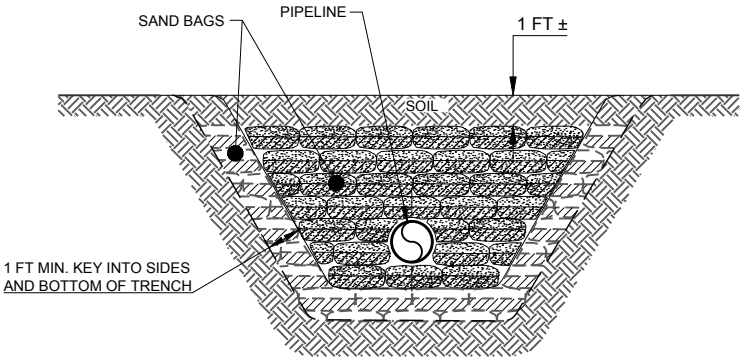
TRENCH BREAKER PROFILE VIEW

SCALE: N.T.S.



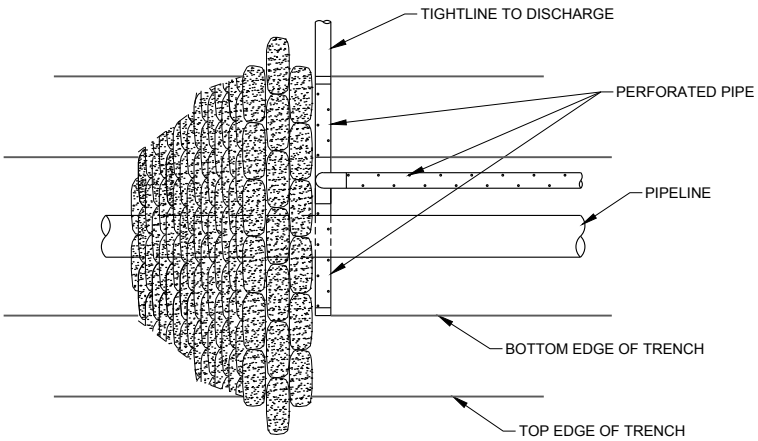
SAND BAG DETAIL

SCALE: N.T.S.



TRENCH BREAKER SECTION VIEW

SCALE: N.T.S.



TRENCH BREAKER PLAN VIEW

SCALE: N.T.S.

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

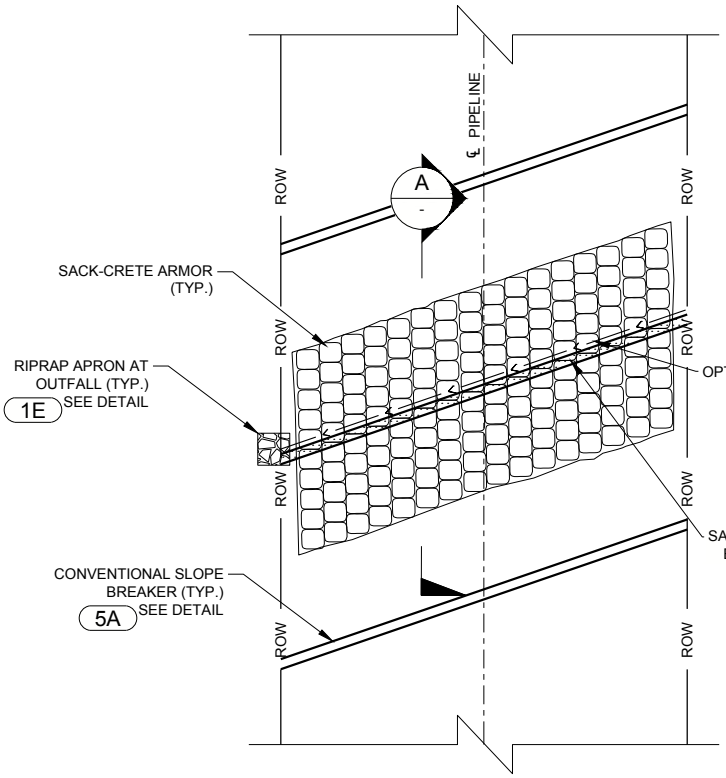
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

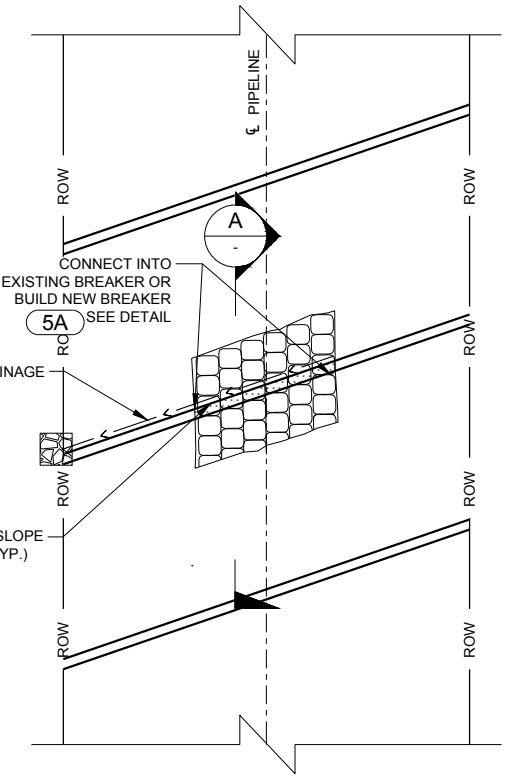
TITLE
TRENCH BREAKER WITH DRAINAGE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4F

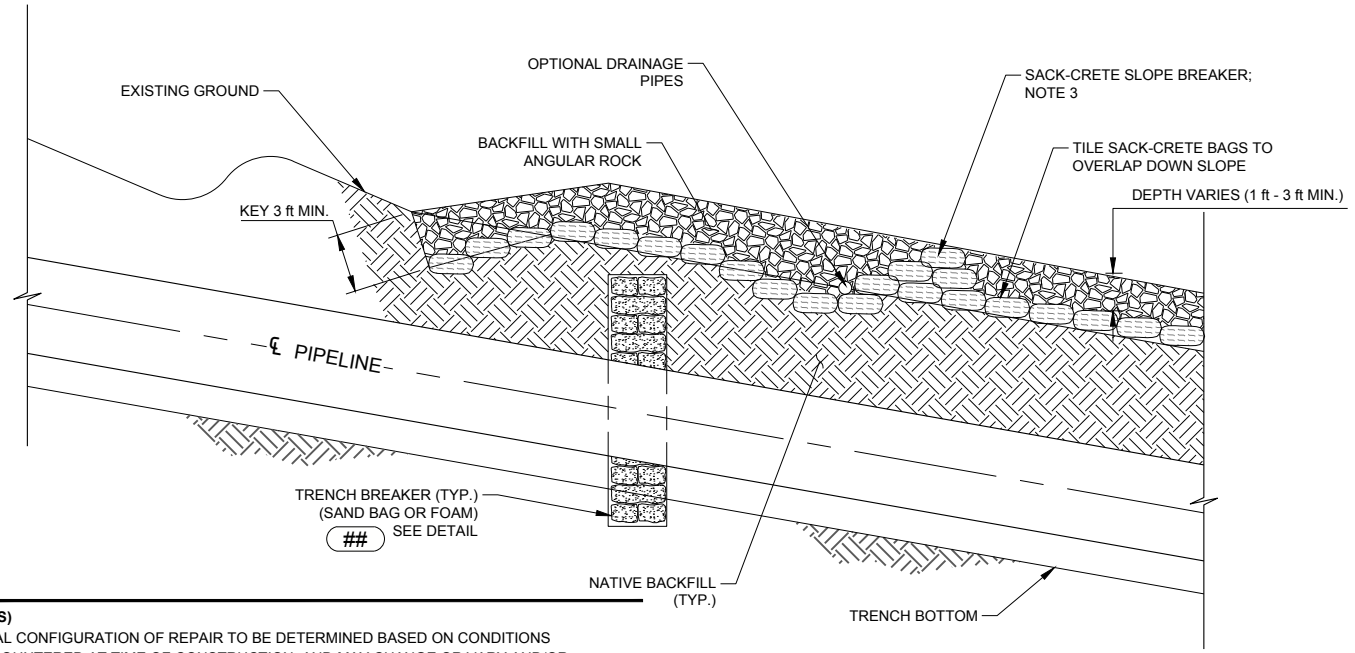
0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



OPTION A - EXTEND FULL WIDTH OF ROW



OPTION B - TARGETED REPAIR AREA



A -- SECTION

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. CONSTRUCT SLOPE BREAKER USING SACK-CRETE BAGS (1-4 HIGH) AND SLOPE ALONG ROW TO CONNECT TO EXISTING BREAKERS OR BUILD NEW BREAKERS TO INTERCEPT AND/OR DIVERT SURFACE RUNOFF TO TARGETED LOCATIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SACK-CRETE ARMOR WITH BREAKERS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4G

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. FLOWABLE FILL IS A SELF-COMPACTING LOW STRENGTH MATERIAL WITH FLOWABLE CONSISTENCY THAT IS USED AS AN FILL OR BACKFILL MATERIAL AS AN ALTERNATIVE TO COMPACTED GRANULAR FILL (ACI 229R, AMERICAN CONCRETE INSTITUTE). FLOWABLE FILL IS NOT INTENDED AS A CONCRETE MATERIAL, HENCE THE LOW STRENGTH PARAMETERS.

3. REFER TO MANUFACTURER SPECIFICATIONS FOR DESIGN AND PLACEMENT, EXAMPLE TECHNICAL REFERENCES INCLUDE, BUT ARE NOT LIMITED TO: "RECOMMENDED GUIDE SPECIFICATION FOR CLSM (FLOWABLE FILL)", NRMCA 2PFFGS, NATIONAL READY MIXED CONCRETE ASSOCIATION; ASTM BOOK OF STANDARDS, VOLUMES 04.09 AND 04.02, AMERICAN SOCIETY FOR TESTING AND MATERIALS; "CONTROLLED LOW STRENGTH MATERIALS", ACP SP-150, "THE DESIGN AND APPLICATION OF CONTROLLED LOW STRENGTH MATERIALS (FLOWABLE FILL)", ASTM STP 1331, "CONTROLLED LOW-STRENGTH MATERIALS", AMERICAN CONCRETE INSTITUTE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

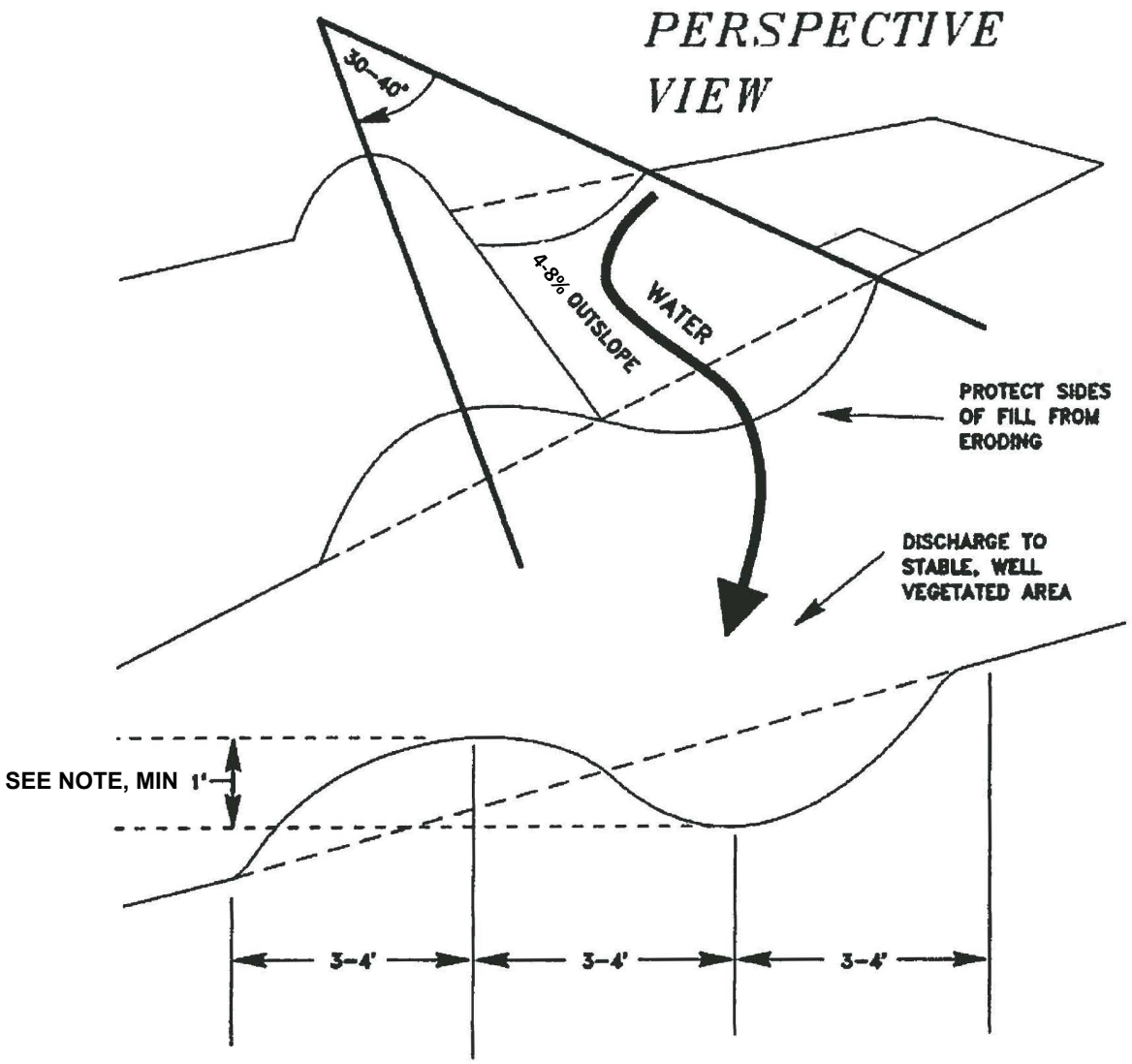
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
FLOWABLE FILL FOR TRENCH BACKFILL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	4H

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



INCREASE THE DISTANCE BETWEEN THE BOTTOM OF THE DIP AND TOP OF THE BERM FOR IMPROVE DRIVEABILITY

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION.
2. DEPTH BETWEEN BOTTOM OF DIP AND TOP OF BERM MAY INCREASE, AS DIRECTED BY DOMINION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

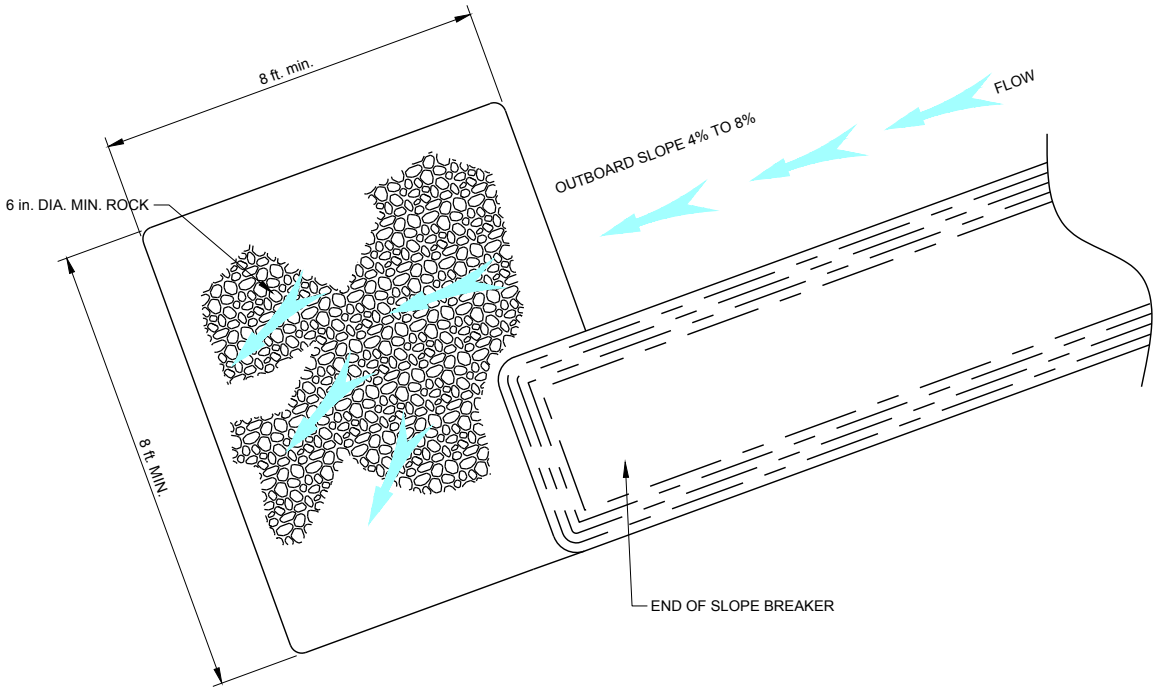
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLOPE BREAKERS (TEMP AND PERMANENT)

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

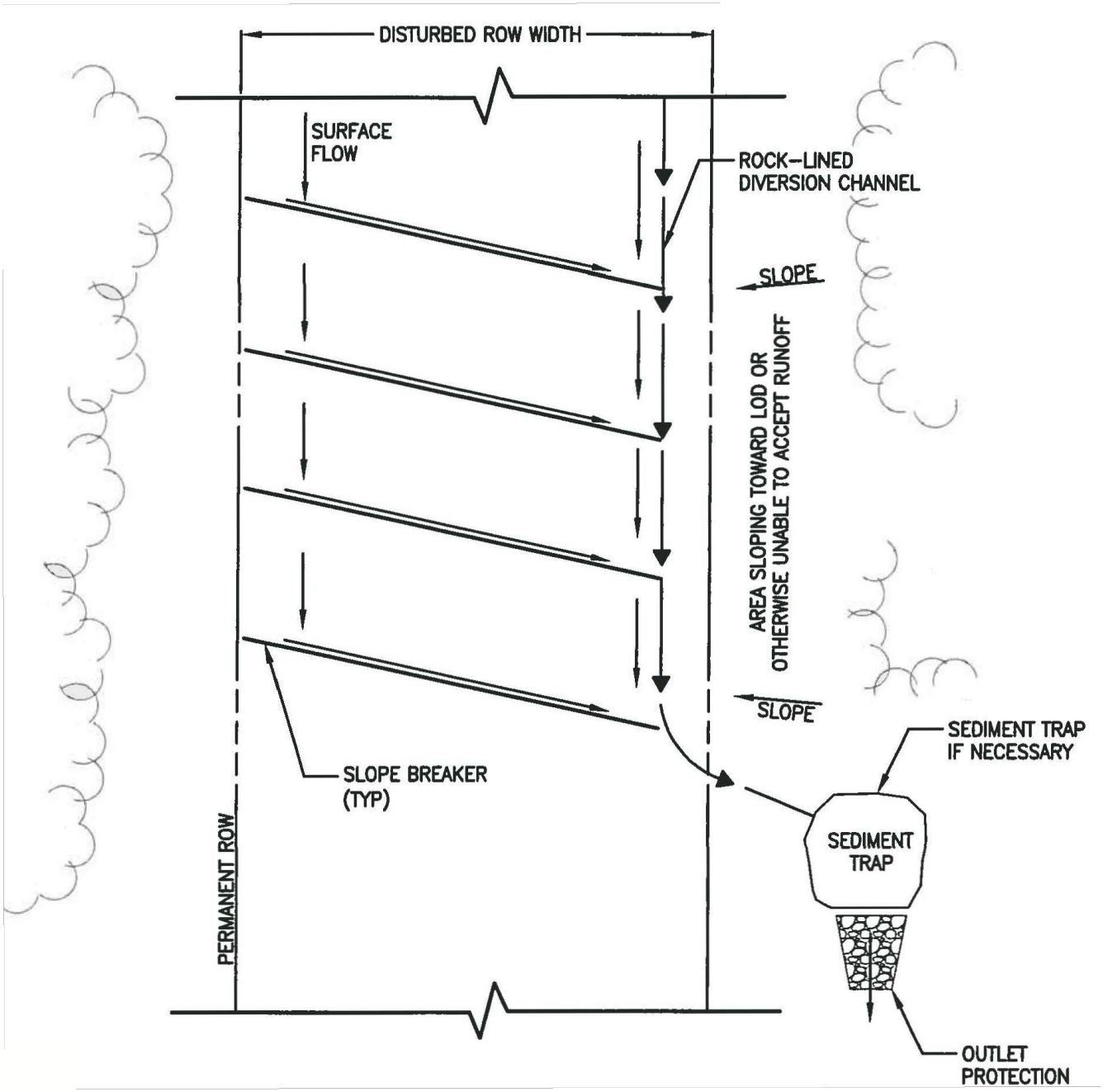
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLOPE BREAKER ARMORED OUTLET

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. CHANNEL(S) MAY REQUIRE STONE CHECK DAMS, EROSION CONTROL CLOTH, OR OTHER SITE SPECIFIC MITIGATION MEASURES, TO FIT SITE CONDITIONS.
3. SEDIMENT TRAP AND OUTLET PROTECTION REQUIRES SIZING.
4. DRAINS MAY BE ADDED TO THE UPSLOPE SIDE OF SLOPE BREAKERS (SEE BIC 1A) TO IMPROVE COLLECTION/CONVEYANCE OF FLOWS.
5. DIVERSION CHANNEL MAY BE ROCK LINED, EROSION CONTROL CLOTH LINED, OR VEGETATED TO FIT SITE CONDITIONS, AND MAY INCLUDE DRAINAGE PIPES TO IMPROVE COLLECTION/CONVEYANCE OF FLOWS (SEE BIC 1F OR 1H).

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLOPE BREAKERS WITH DIVERSION CHANNELS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5C

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SPECIAL CARE AND CONSIDERATION IS REQUIRED TO CONSTRUCT DRAINAGE MEASURES FOR EXISTING, PERMANENT, AND TEMPORARY ACCESS ROADS ON A SITE-SPECIFIC BASIS. ACCESS ROADS MAY COLLECT RUNOFF FROM UPSLOPE AREAS AND DELIVER WATER TO THE ROW, PIPE TRENCH, OR TO OTHER GEOTECHNICAL, GEOLOGIC, OR HYDROTECHNICAL AREAS OF CONCERN. RECOMMENDED DRAINAGE MEASURES FOR ACCESS ROADS INCLUDE THE FOLLOWING:

A. DRAINAGE MEASURE MAY REQUIRE SITE SPECIFIC DESIGN WITH REGARD FOR SLOPE, DRAINAGE AREA, EROSION PROTECTION , DISCHARGE ARMORED PAD, CHECK DAMS, ETC.
B. INSTALL WATER BARS (I.E. SLOPE BREAKERS) EVERY 100-200 FEET ALONG THE ACCESS ROAD, PROVIDED THAT WATER IS NOT DISCHARGED ONTO OR ABOVE GEOTECHNICALLY SENSITIVE AREAS (LANDSLIDES, AREAS OF FILL, POTENTIALLY UNSTABLE SLOPES, ETC.) OR THE ROW.
C. INSTALL INBOARD SLOPES WITH BAR DITCH (LINED OR ARMORED AS NECESSARY) UPSLOPE OF GEOTECHNICALLY SENSITIVE AREAS AND/OR THE ROW TO CONVEY WATER TO A STABLE DISCHARGE POINT.
D. INSTALL FRENCH DRAINS AS NEEDED TO COLLECT WATER IN AREAS WHERE WATER BARS AND BAR DITCHES CAN NOT BE USED OR WOULD RESULT IN DIRECTING WATER INTO THE ROW OR PIPE TRENCH. FRENCH DRAINS SHOULD CONVEY COLLECTED WATER IN A TIGHTLINE (SOLID WALL PIPE) TO A STABLE DISCHARGE POINT.
E. INSTALL EROSION PROTECTION FOR CONCENTRATED FLOWS AND DISCHARGE POINTS/OUTLETS AS NECESSARY (I.E. CHANNEL LINING, RIPRAP APRON, ETC.).
F. DO NOT ALLOW WATER DELIVERED FROM ACCESS ROADS TO CROSS OR ENTER THE PIPE TRENCH.
G. SPECIAL STUDY MAY BE REQUIRED FOR COMPLEX SITES OR AREAS OF CONCERN.

3. CHANGES IN THE FINAL GRADING MAY BE NEEDED TO ADDRESS SPECIFIC TARGETED GEOTECHNICAL OR HYDROTECHNICAL OR GEOLOGIC ENGINEERING ISSUES (I.E. CORRECT DRAINAGE PROBLEMS, MINIMIZE DELIVERY OF WATER TO LANDSLIDE SITES, ETC.)

4. FINAL GRADING TO BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO COMPLETION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

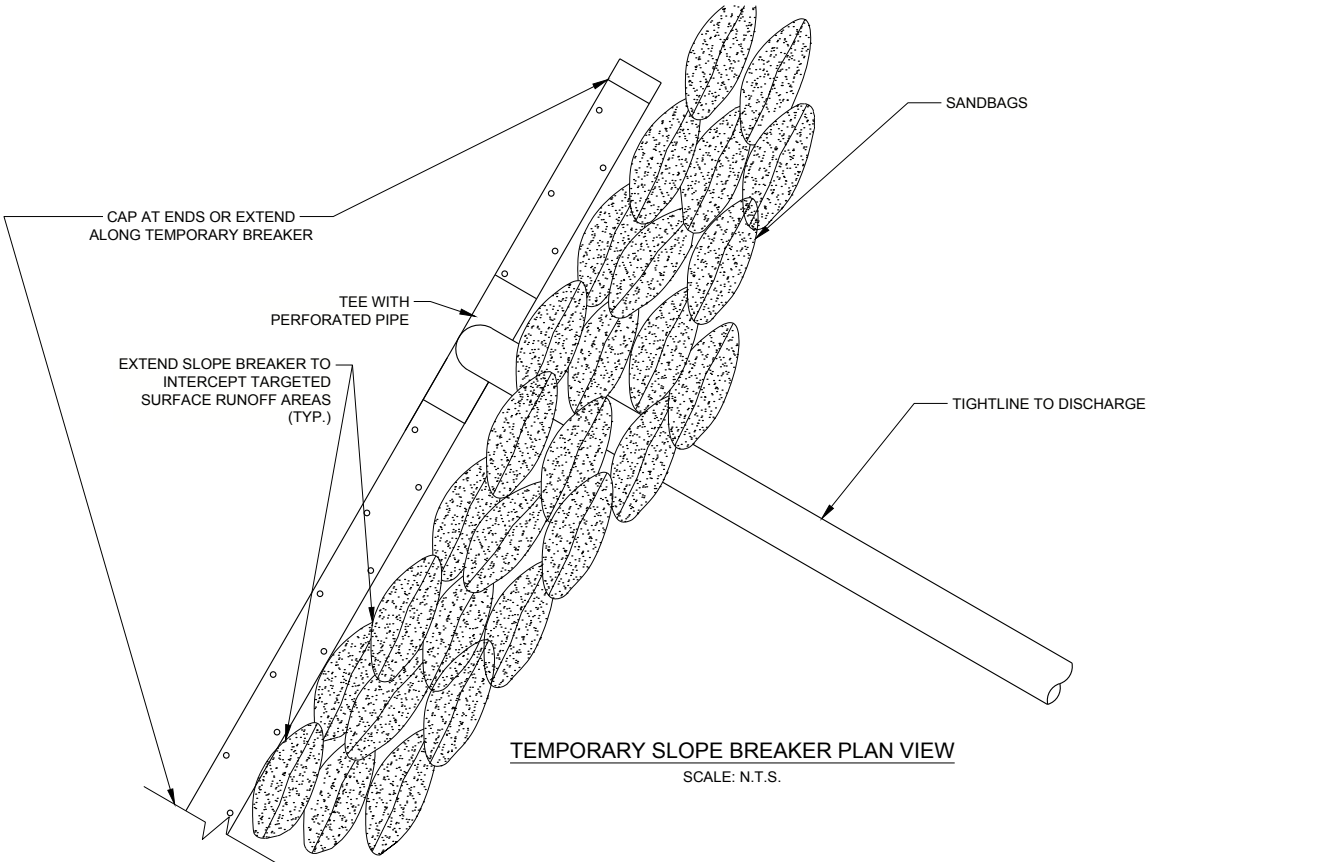
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ACCESS ROADS

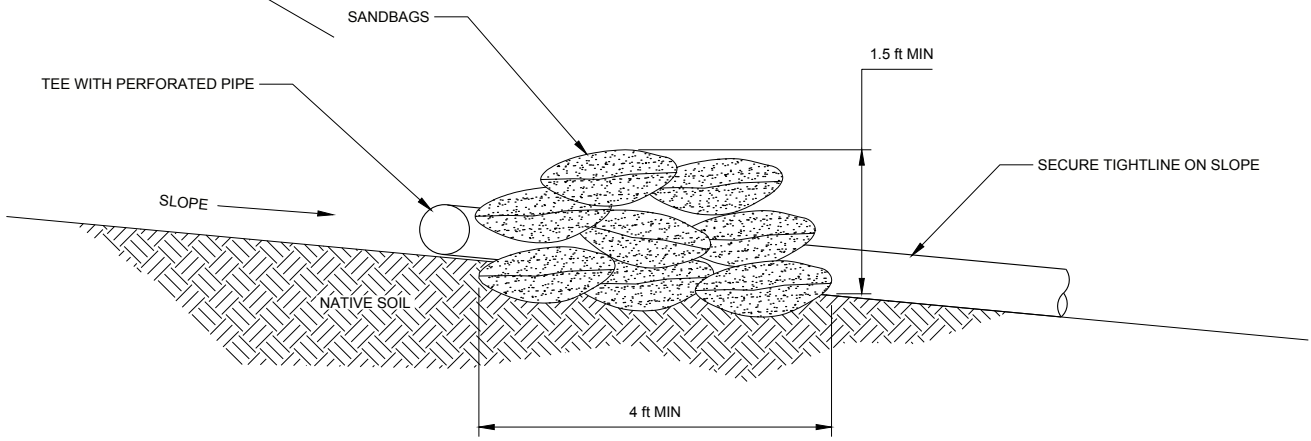
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



TEMPORARY SLOPE BREAKER PLAN VIEW

SCALE: N.T.S.



TEMPORARY SLOPE BREAKER PROFILE VIEW

SCALE: N.T.S.

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

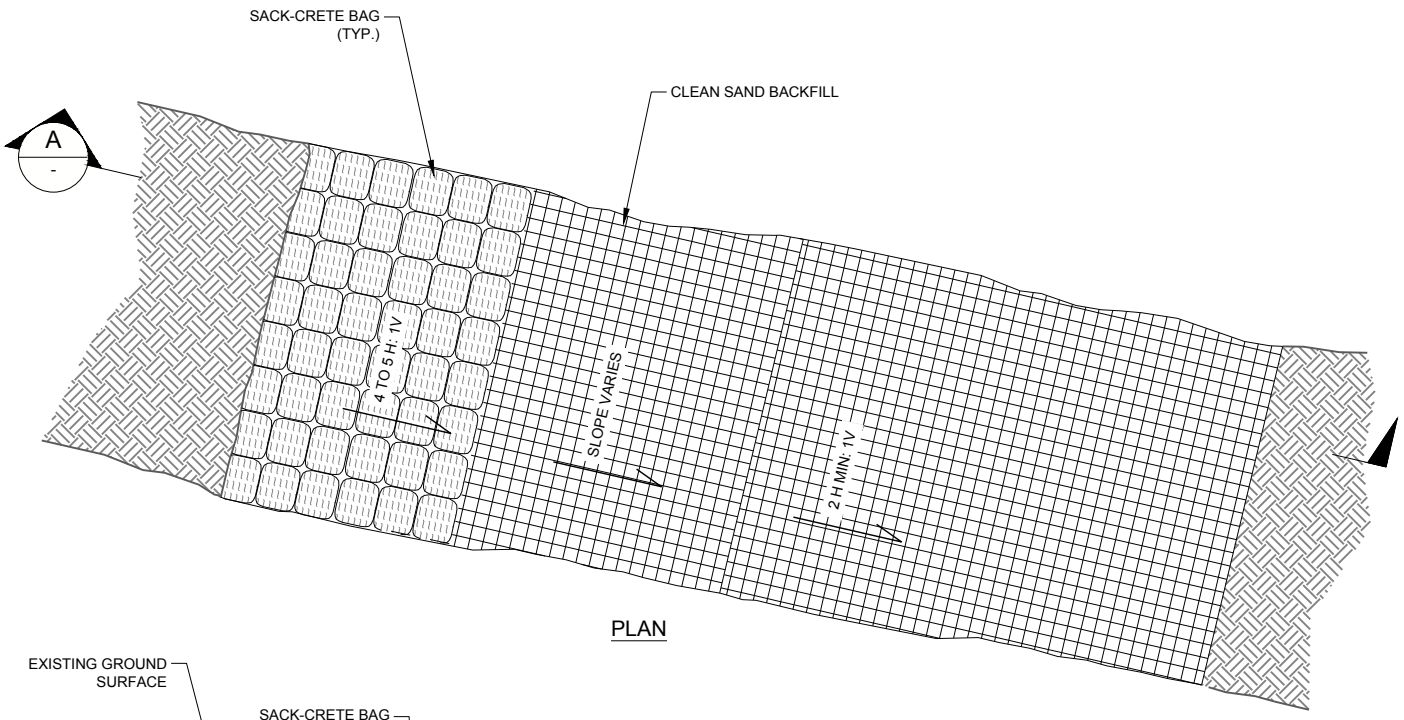
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

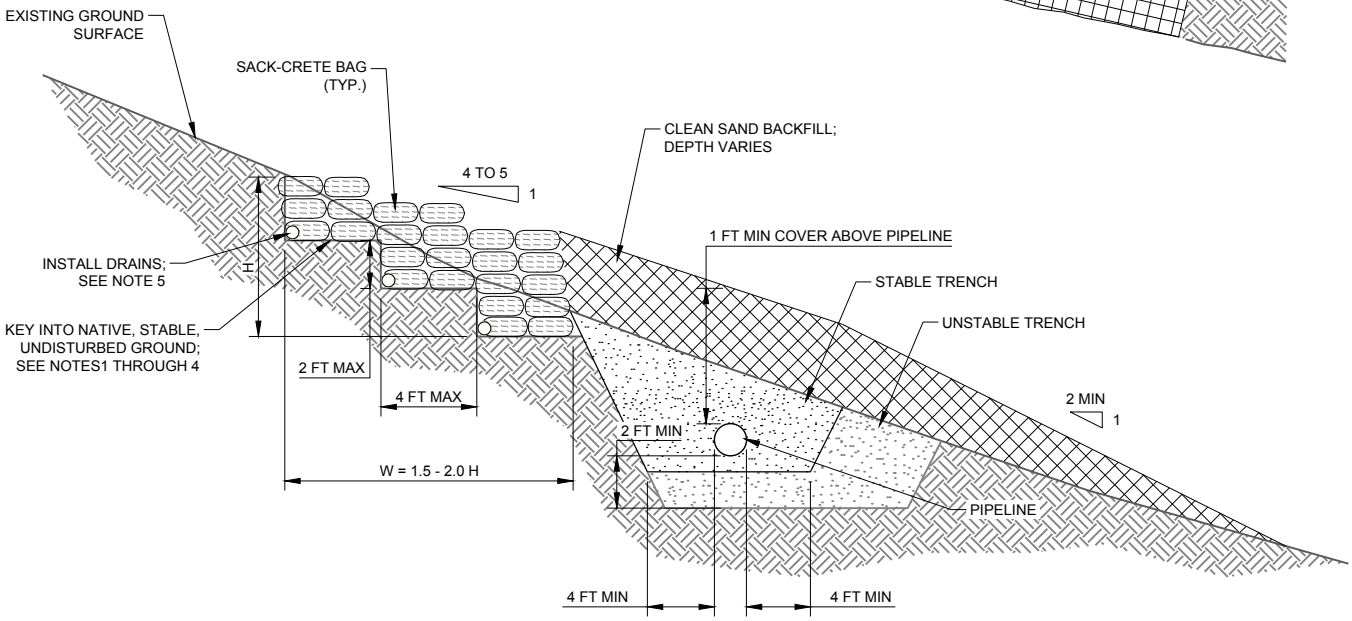
TITLE
TEMPORARY SLOPE BREAKER WITH DRAIN PIPE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5E

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in



PLAN



A -- SECTION

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.
2. VOLUMES, GRADES, ELEVATIONS AND QUANTITIES, WILL VARY DEPENDING ON SITE CONDITIONS ENCOUNTERED.
3. ADD OR EXTEND KEYS OR PLACE ADDITIONAL SACK-CRETE BAGS AS NECESSARY TO MAINTAIN STABILITY.
4. EXCAVATE KEY WITH OUTBOARD SLOPE, AND INCLUDE DRAINAGE MEASURES THAT EVACUATE ACCUMULATED SEEPAGE.
5. DRAINAGE OPTION AND CONFIGURATION TO BE SELECTED AT THE TIME OF CONSTRUCTION BASED ON CONDITIONS ENCOUNTERED. CONSTRUCT DISCHARGE OUTFALL AT A LOCATION THAT DOES NOT IMPACT SITE CONDITIONS (LOCATION WITH POSITIVE DRAINAGE FROM THE ROW AND LANDSLIDE / POTENTIALLY UNSTABLE AREAS).

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SACK-CRETE WEDGE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5F

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in

NOTE(S)

1. FINAL CONFIGURATION OF REPAIR TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. NO WOOD CHIPS OR GROUND-UP WOODY/ORGANIC DEBRIS, OR SIMILAR IS ALLOWED TO BE PLACED OR SPREAD ON THE ROW, UNLESS DIRECTED BY DOMINION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

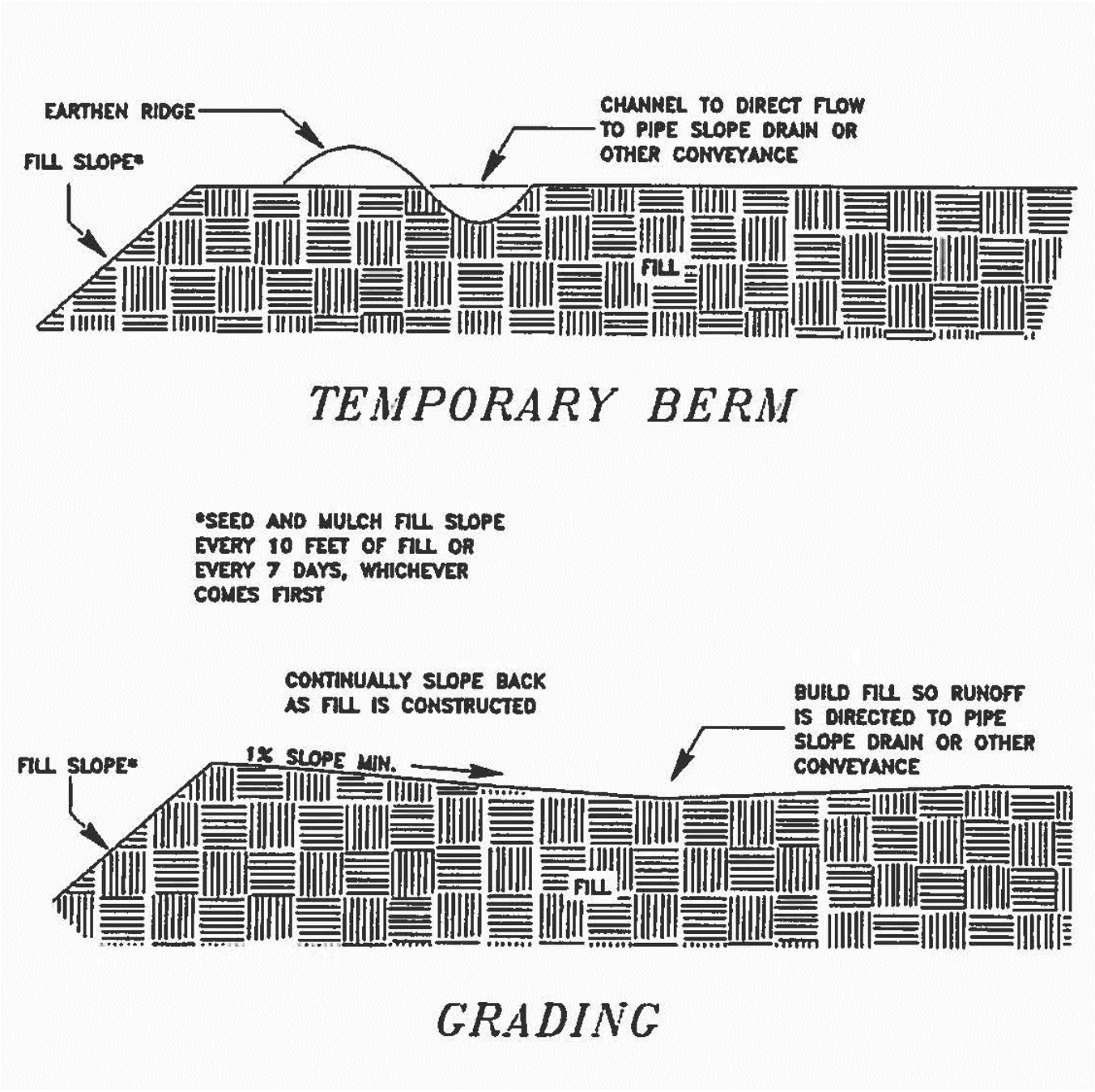
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
NO WOOD CHIPS IN ROW

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5G

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

0 1 in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

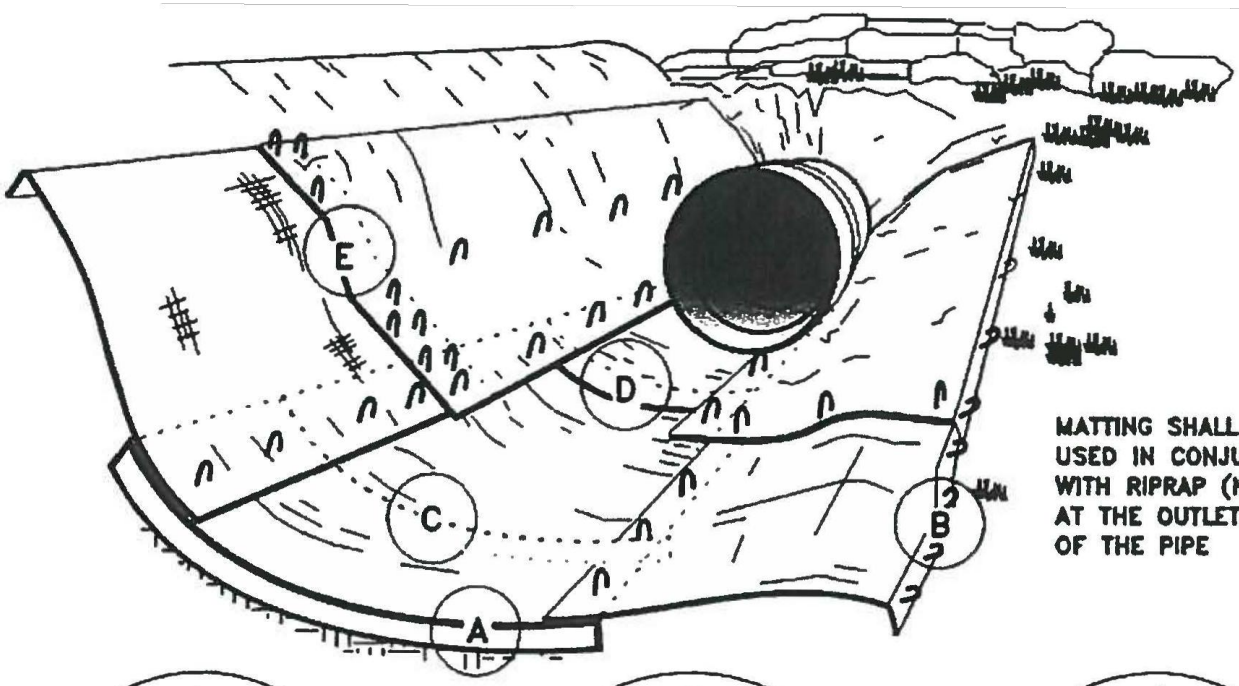
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

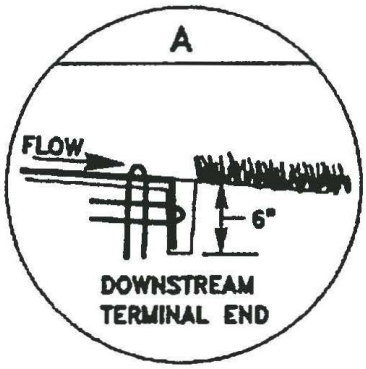
TITLE
SURFACE WATER DIVERSIONS

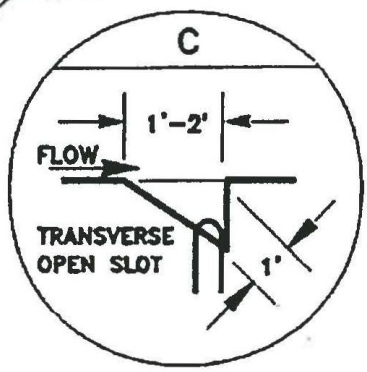
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	5H

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

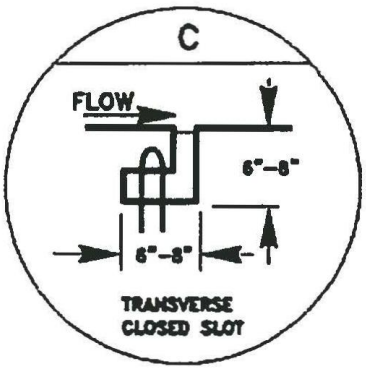


MATTING SHALL BE USED IN CONJUNCTION WITH RIPRAP (NOT SHOWN) AT THE OUTLET END OF THE PIPE

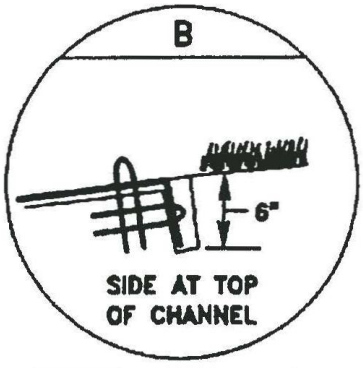


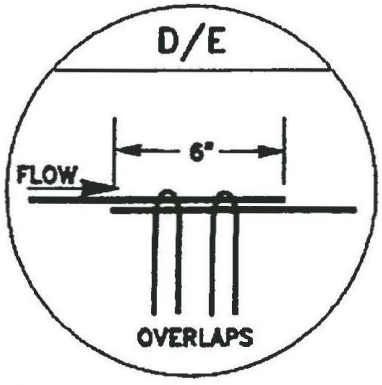


OR



THESE CONFIGURATIONS ARE EXAMPLES ONLY
ALWAYS INSTALL PER MANUFACTURER'S RECOMMENDATIONS





CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

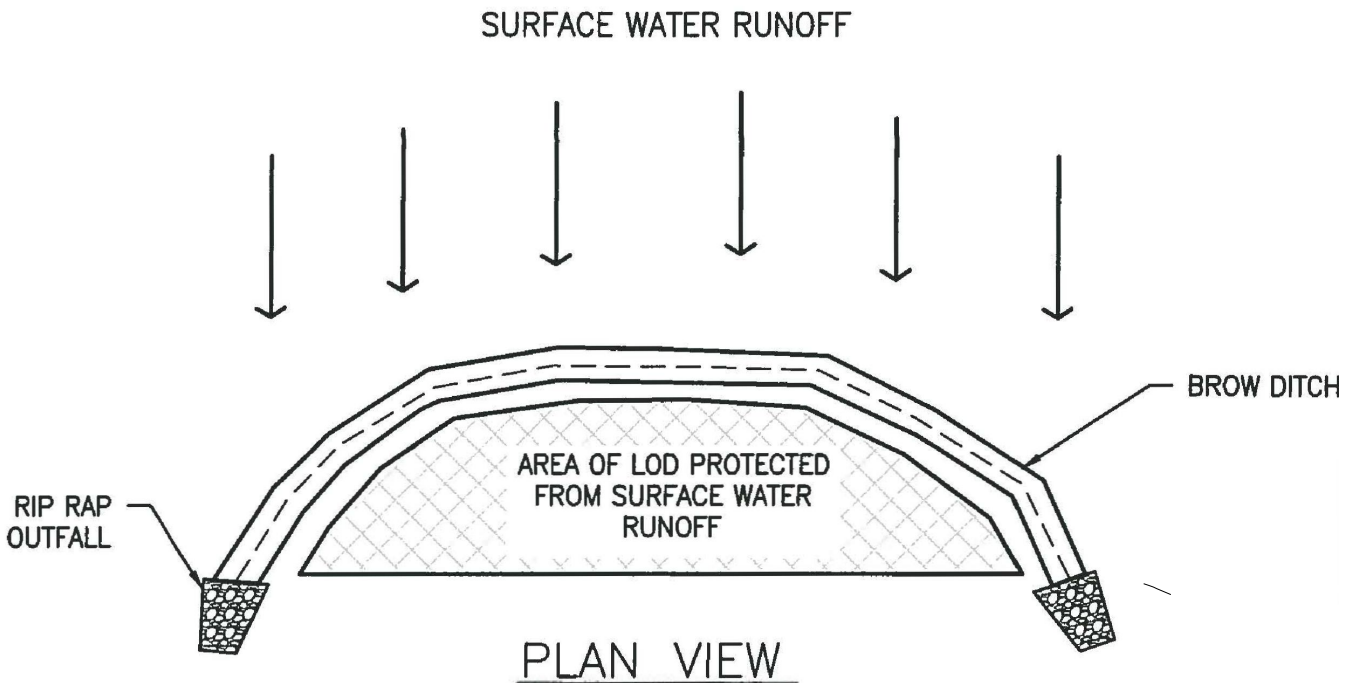
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

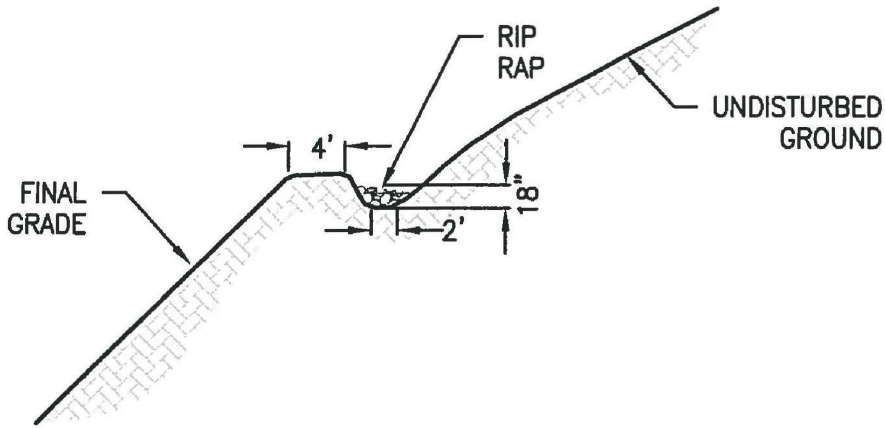
TITLE
COIR-LINED VEGETATED DIVERSION CHANNEL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6A

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PLAN VIEW
N.T.S.



SECTION
N.T.S.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

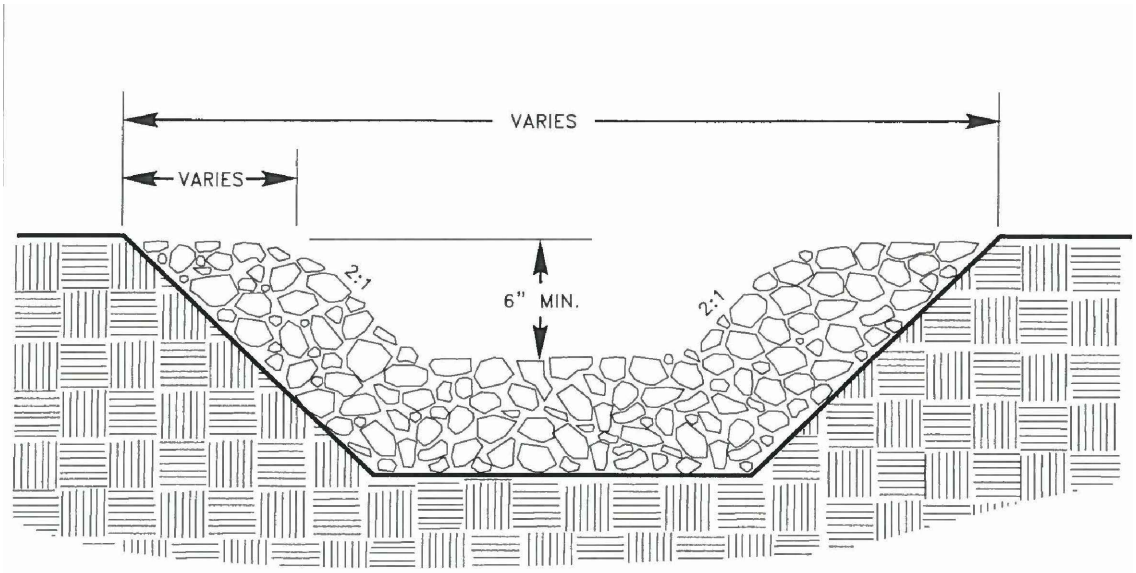
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

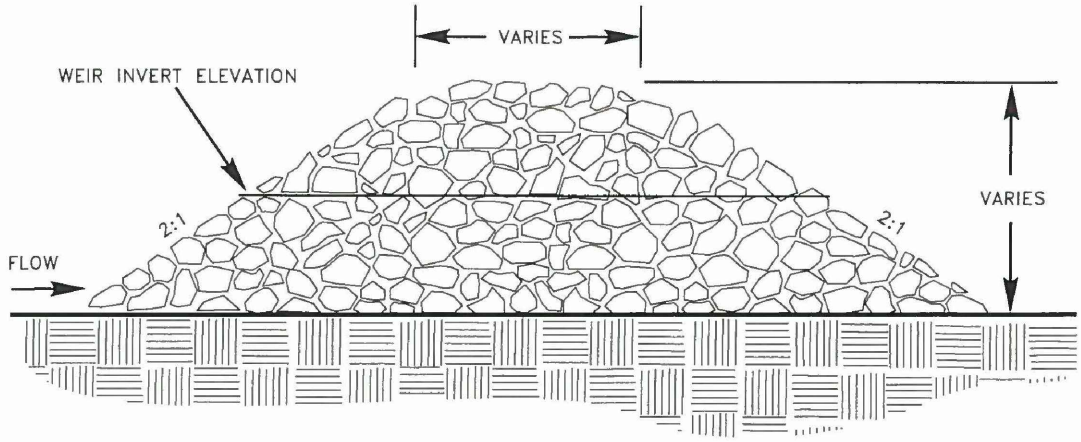
TITLE
BROW DITCH

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



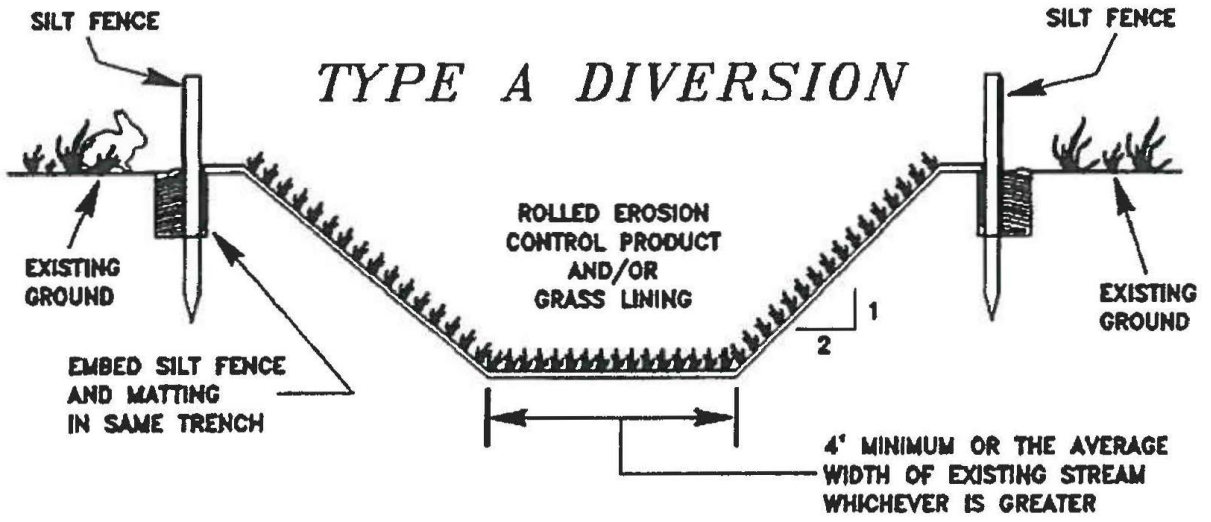
ELEVATION

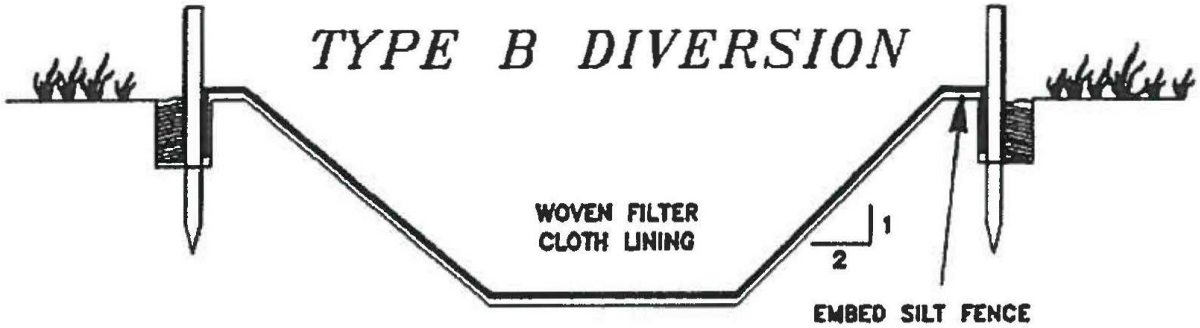


CROSS SECTION

CLIENT	DOMINION
PROJECT	BIC/INCREMENTAL CONTROLS
CONSULTANT	Golder Associates
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK
TITLE	**ROCK FILTER IN TRENCH**
PROJECT No.	1535050
PHASE	500
Rev.	F
FIGURE	6C

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in





CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

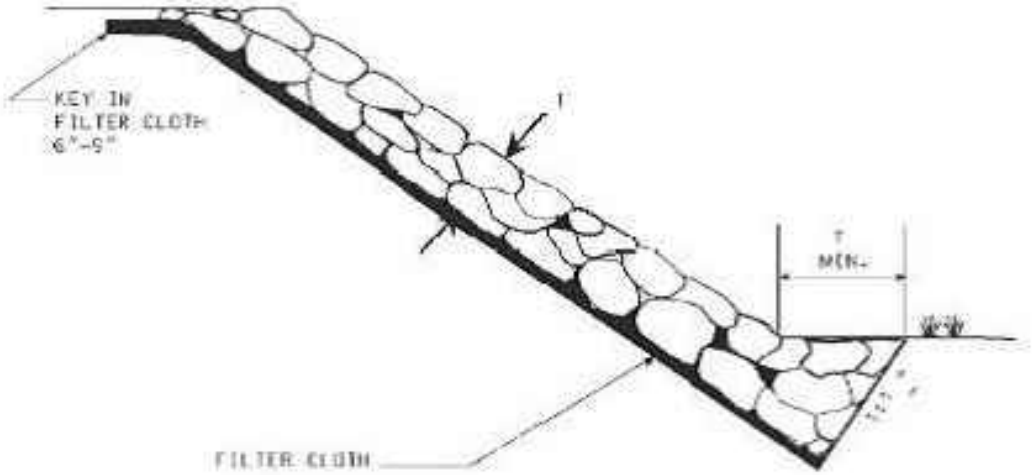
TITLE
ARMORED CHANNEL

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6D

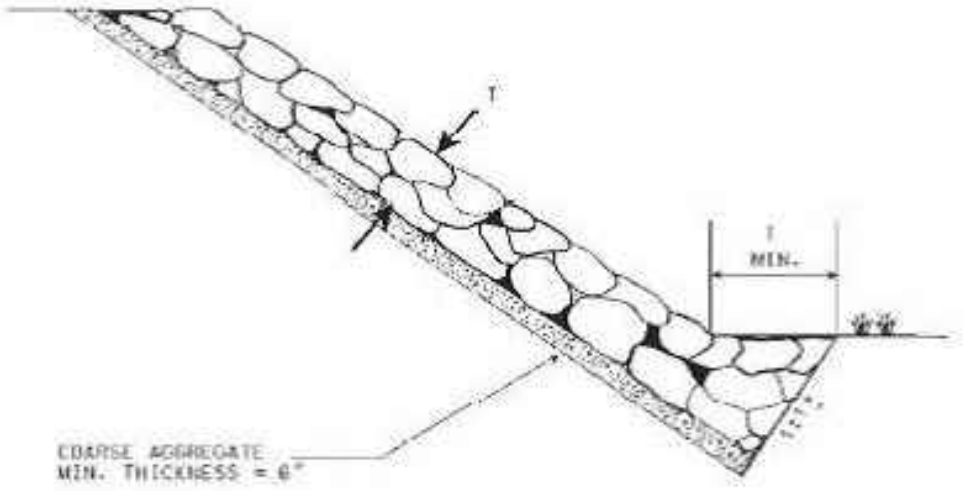
0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

FILTER CLOTH UNDERLINER

(PREFERRED)



GRANULAR FILTER



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP BANK ARMORING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6E

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. REFER TO THE FOLLOWING FOR EXAMPLE RIPRAP SPECIFICATIONS:

NSA No.	GRADING ROCK SIZE (INCHES)			FILTER BLANKET REQUIEMENTS		VMAX (ft./SEC.)
	MAX.	d_{50}	MIN.	SIZE NSA NO.	PLACEMENT THICKNESS	
R-1	1.5	0.75	NO.8	FS-1	N/A	2.5
R-2	3	1.5	NO.1	FS-1	N/A	4.5
R-3	6	3	NO.2	FS-1	3	6.5
R-4	12	6	NO.3	FS-2	4	9
R-5	18	9	NO.5	FS-2	6	11.5
R-6	24	12	NO.7	FS-3	8	13
R-7	30	15	NO.12	FS-3	10	14.5

3. FINAL RIPRAP SPECIFICATIONS AS DIRECTED BY DOMINION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

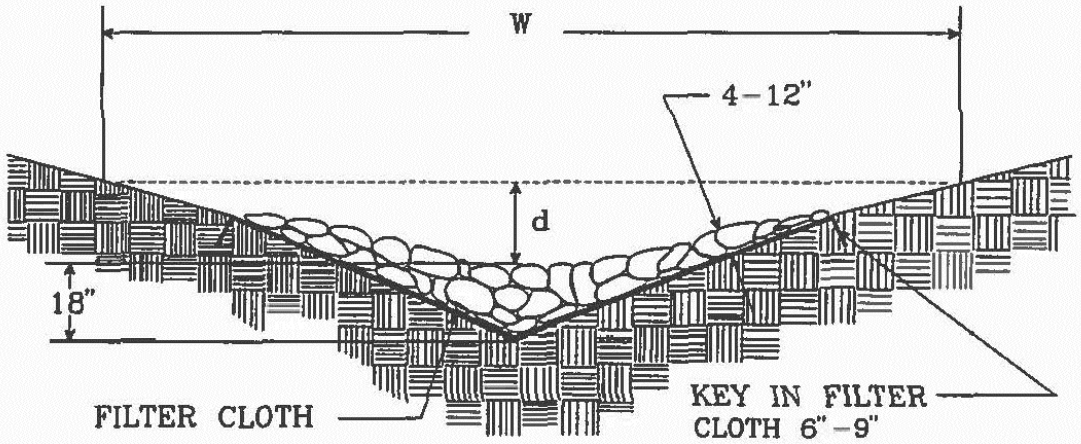
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
RIPRAP GRADATIONS

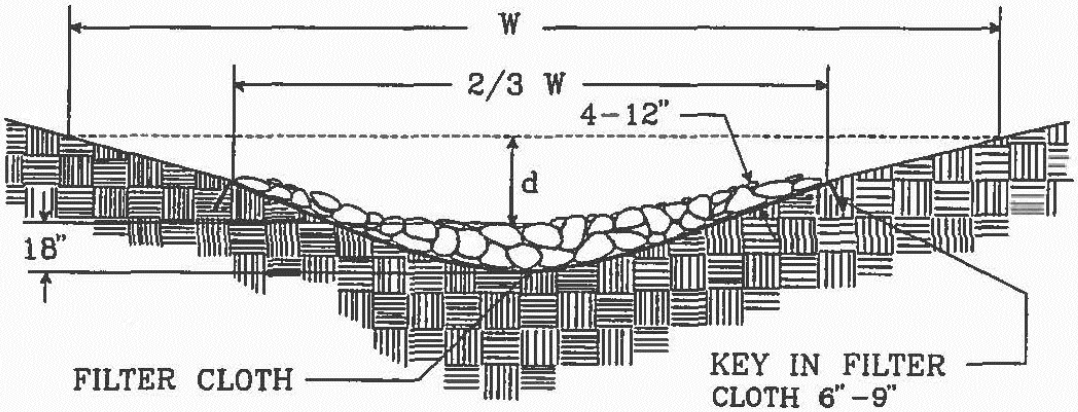
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6F

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



V–SHAPED WATERWAY WITH STONE CENTER DRAIN

NOTE: A GRANULAR FILTER MAY BE SUBSTITUTED FOR FILTER CLOTH.



PARABOLIC WATERWAY WITH STONE CENTER DRAIN

NOTE: A GRANULAR FILTER MAY BE SUBSTITUTED FOR FILTER CLOTH.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

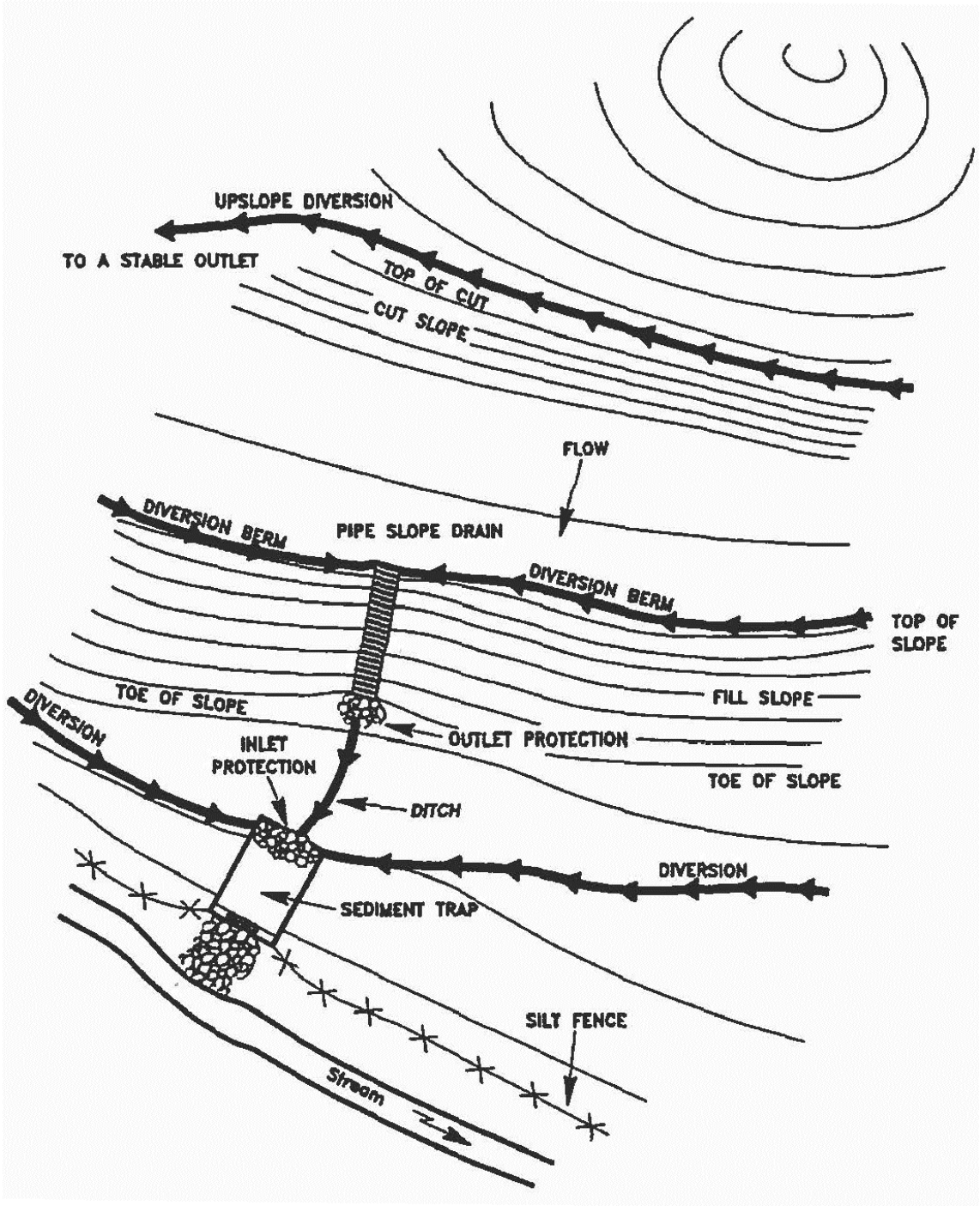
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ARMORED V-SHAPED AND U-SHAPED CHANNELS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6G

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

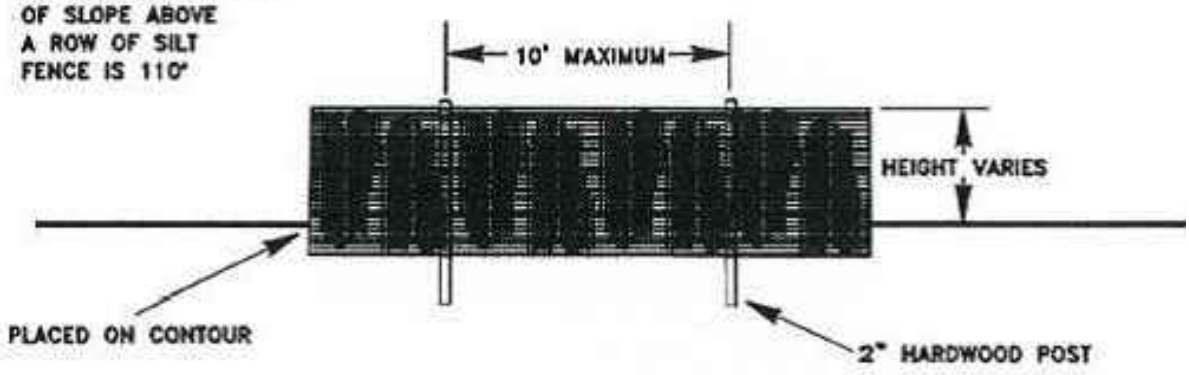
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP SURFACE WATER CONTROL LAYOUT

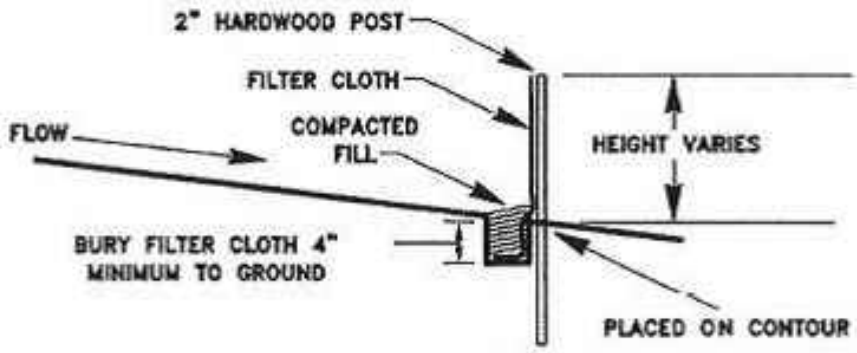
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	6H

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE:
THE MAXIMUM LENGTH
OF SLOPE ABOVE
A ROW OF SILT
FENCE IS 110'



FRONT ELEVATION



SIDE ELEVATION

TOP VIEW

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

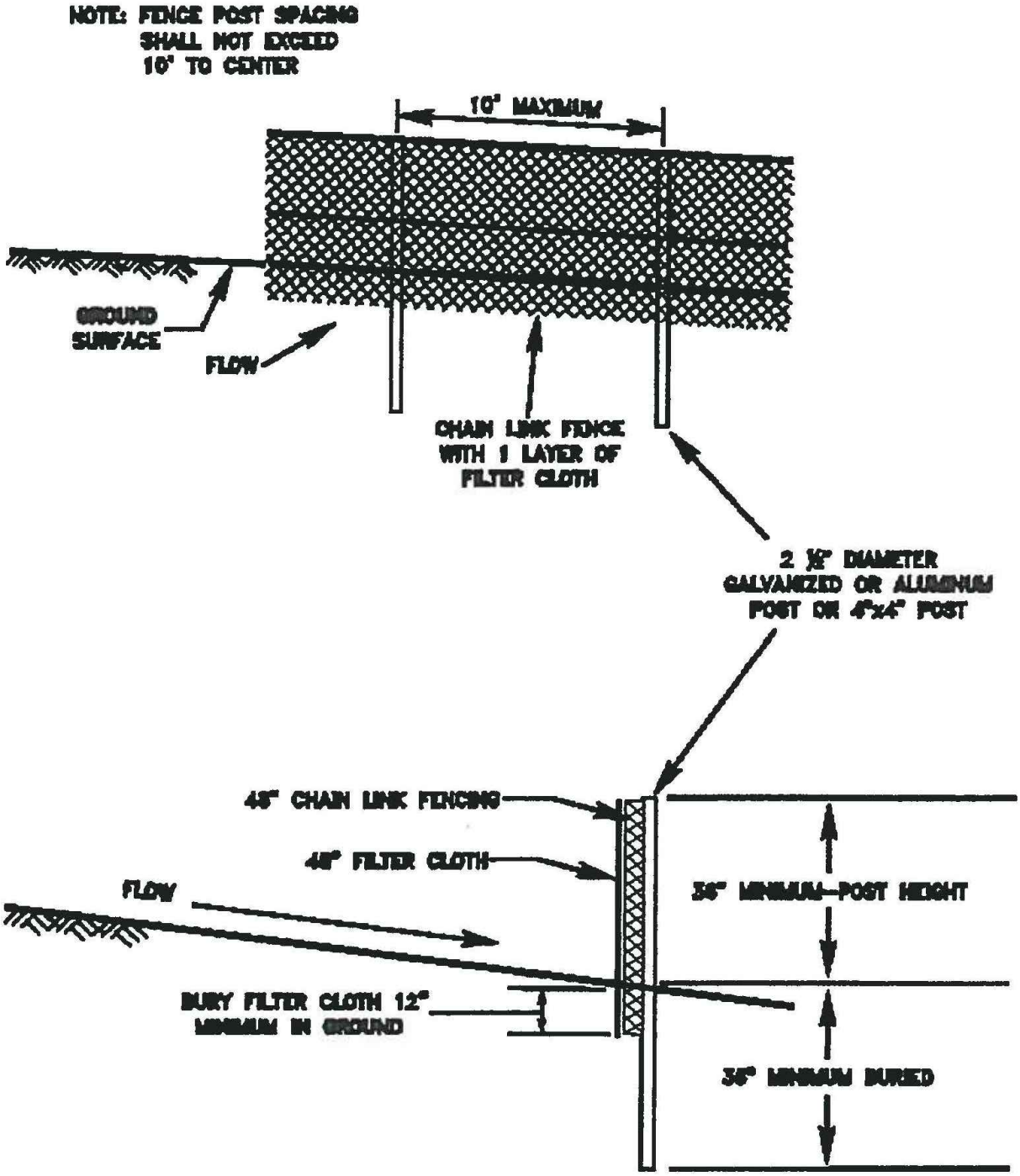
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SILT FENCE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	7A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

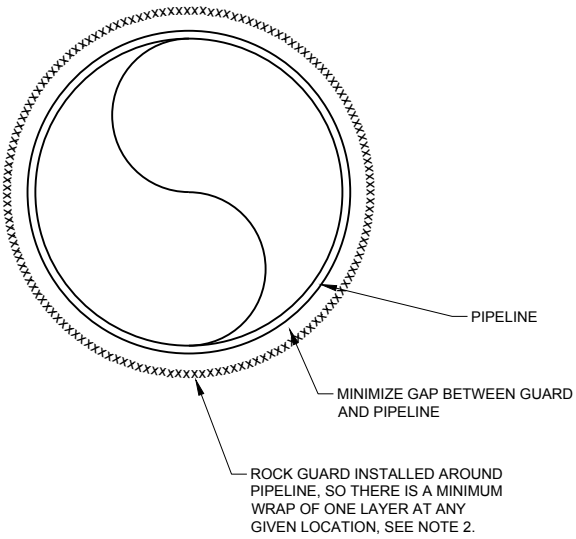
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SUPER SILT FENCE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	7B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SECURE ROCK GUARD PER MANUFACTURER SPECIFICATIONS , OR AS DIRECTED BY THE ENGINEER.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ROCK GUARD ON PIPELINE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	8A

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. OPTIONS FOR BUOYANCY CONTROL INCLUDE THE USE OF CONCRETE COATING, SET-ON CONCRETE WEIGHTS, SET-ON BAGS FILLED ROCK MATERIALS, ANCHORS WITH BANDING OVER THE PIPELINE, OR DEEP BURIAL.

3. FINAL SELECTION OF BUOYANCY CONTROL SHALL BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO IMPLEMENTATION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

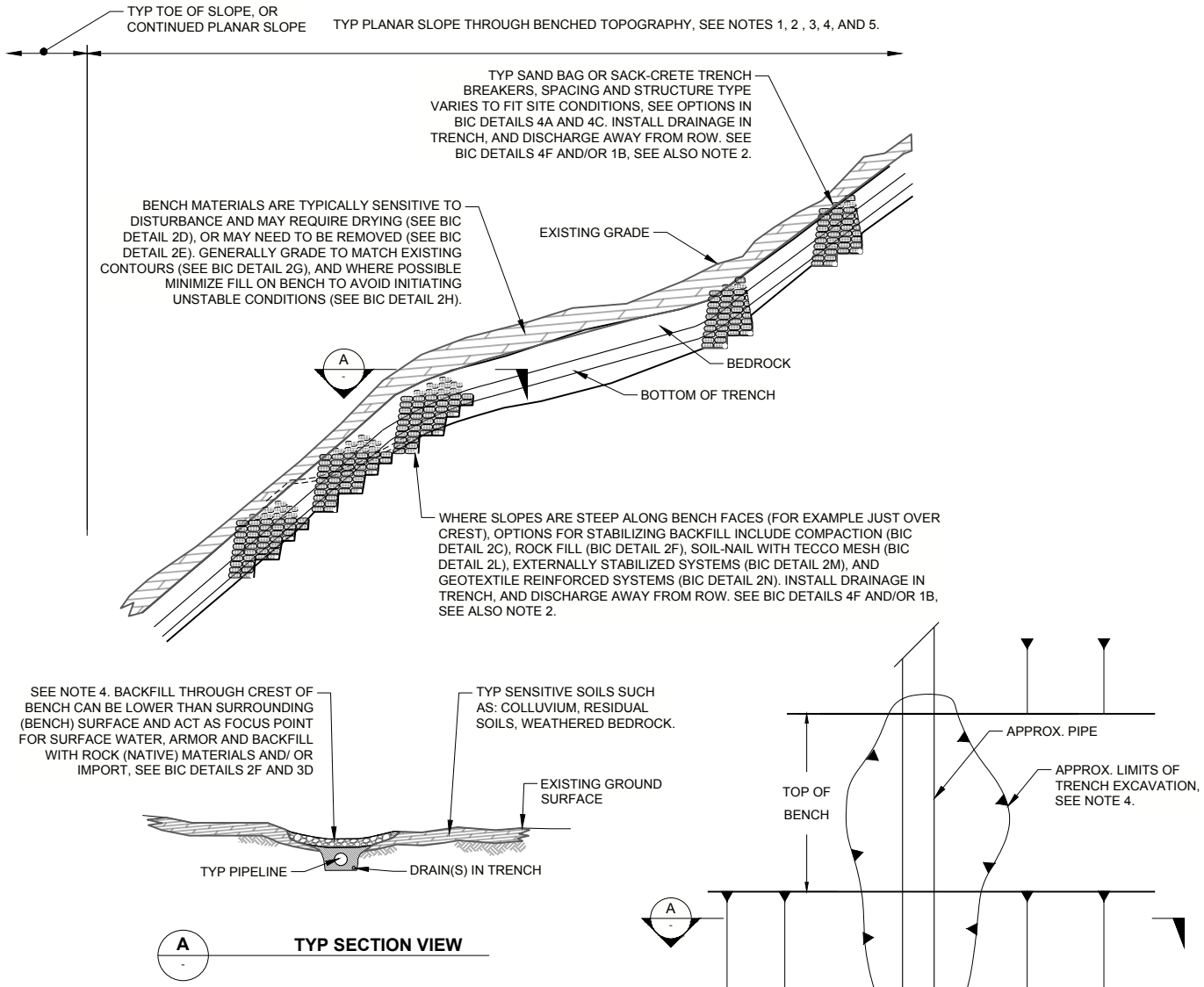
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
BUOYANCY MITIGATION

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	9A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. TRENCH EXCAVATIONS INTO SHALLOW BEDROCK IN AREAS MAY RESULT IN INSUFFICIENT AMOUNTS OF BACKFILL AND PADDING/BEDDING DUE TO LARGER, ANGULAR SPOIL MATERIAL. ROCK GUARD MATERIALS MAY BE NEEDED TO PROTECT THE PIPELINE, SEE BIC DETAIL 8A.

2. TRENCH EXCAVATIONS INTO BEDROCK IN STEEPLY SLOPED TERRAIN (PLANAR SLOPES & INCLINED RIDGES) MAY REQUIRE TRENCH BREAKERS WITH SUFFICIENT MASS AND GEOTECHNICAL PERFORMANCE TO RETAIN BACKFILL SOILS AND/OR ROCK MATERIALS. USE OF FOAM BREAKERS IN THESE CONDITIONS IS NOT RECOMMENDED.

3. ALTERNATING LAYERS OF WEAKER BEDROCK AND STRONGER BEDROCK MATERIALS OFTEN CREATES A "BENCHED" OR "STAIR-STEPPED" APPEARANCE TO EXISTING HILL SLOPES. MAINTAIN POSITIVE DRAINAGE ACROSS BENCHES WHEN RESTORING OR MODIFYING ROW CONTOURS TO ALLOW POSITIVE DRAINAGE AND TO AVOID ACCUMULATION OF WATER ON BENCH SURFACES (WHICH CAN INFILTRATE AND SATURATE LOCAL SOILS).

4. EXCAVATIONS THROUGH BENCH CREST CREATES WIDER CUT WHERE TRENCH DEPTH INCREASES, REQUIRES RESTORATION OF INCREASED DEPTH EXCAVATIONS; MAY REQUIRE SACK-CRETE BREAKERS TO BUILD AND STABILIZE BACKFILL.

5. SHALLOW BEDROCK MAY REQUIRE BLASTING, HAMMERING, AND/OR CHIPPING TO EXCAVATE ROW AND TRENCH.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

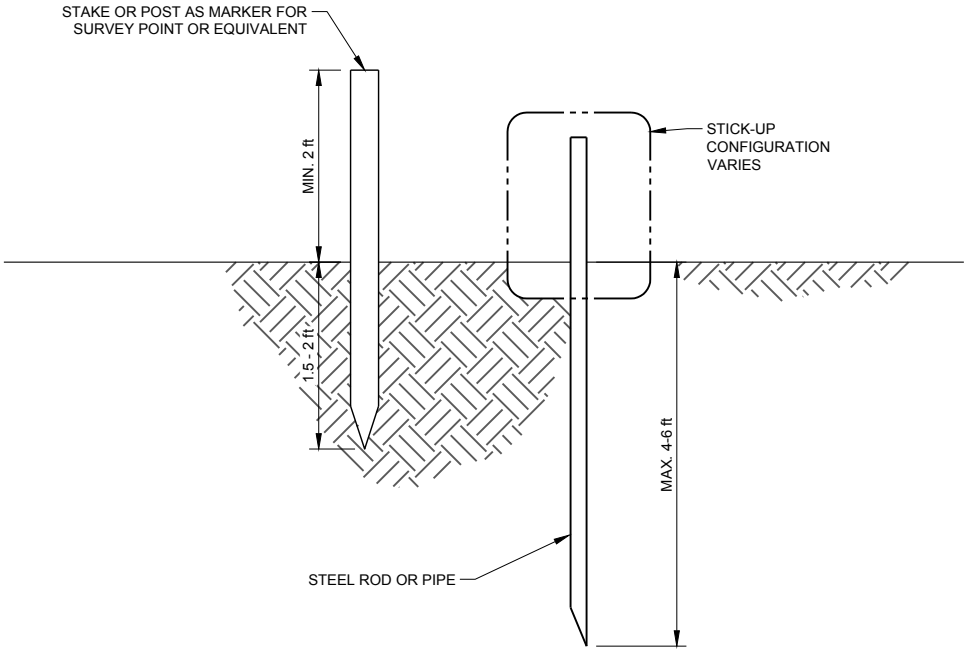
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP BENCH RE-CONSTRUCTION

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	10A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

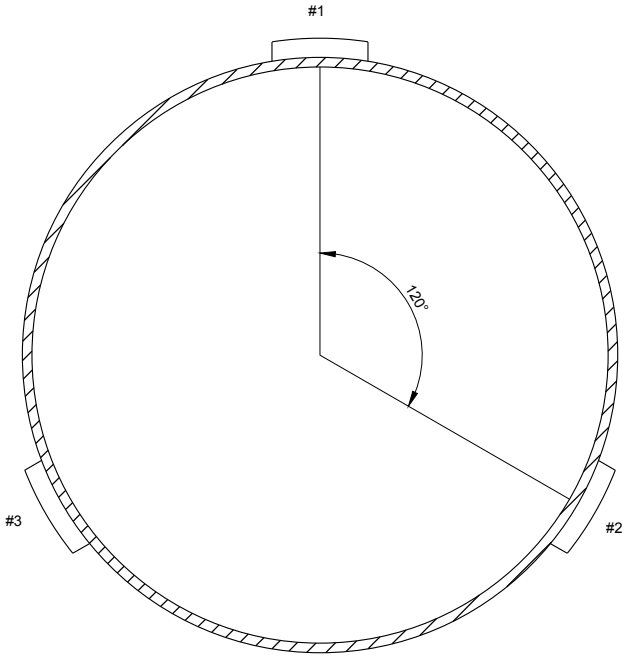
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
GEODETIC MONITORING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in 1 cm



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

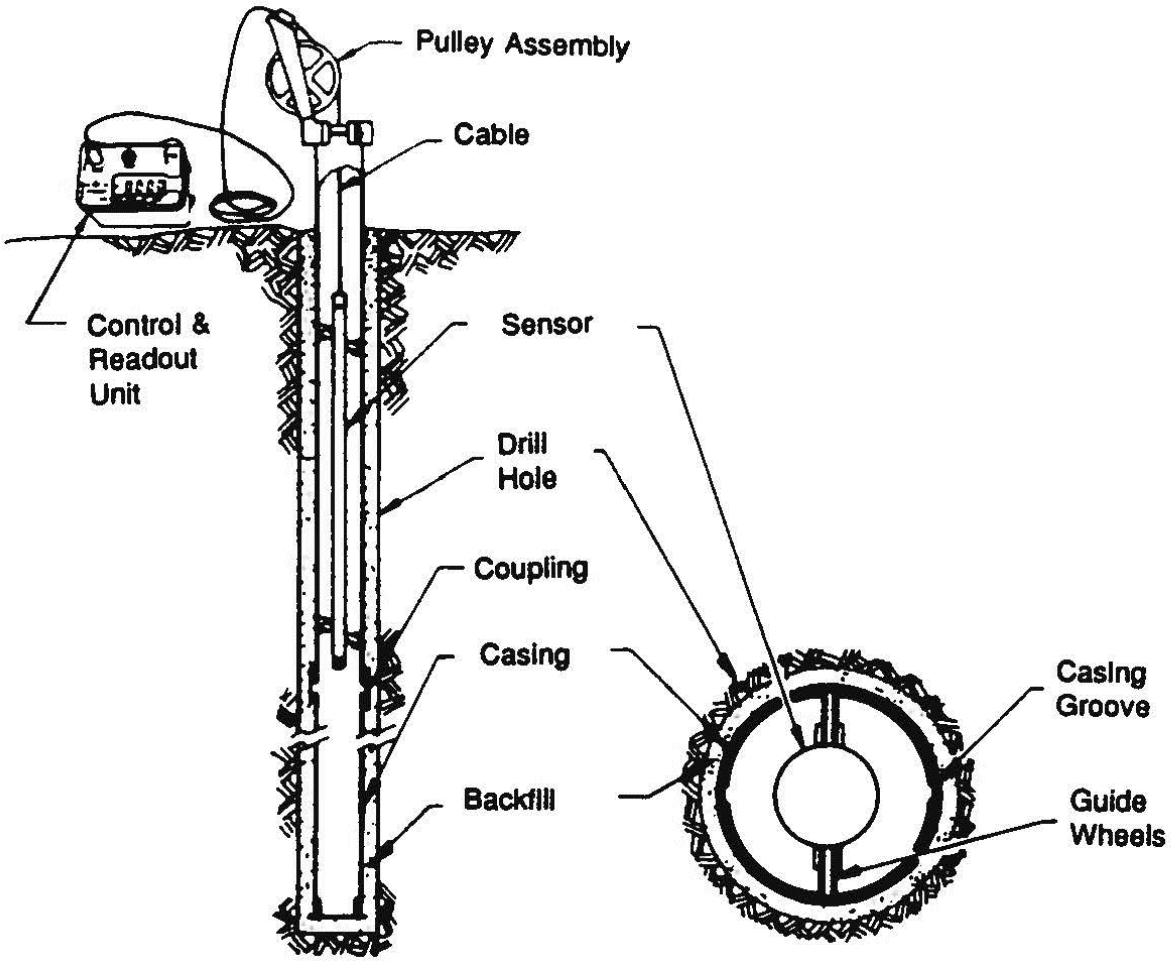
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
STRAIN GAUGE MONITORING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11B

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

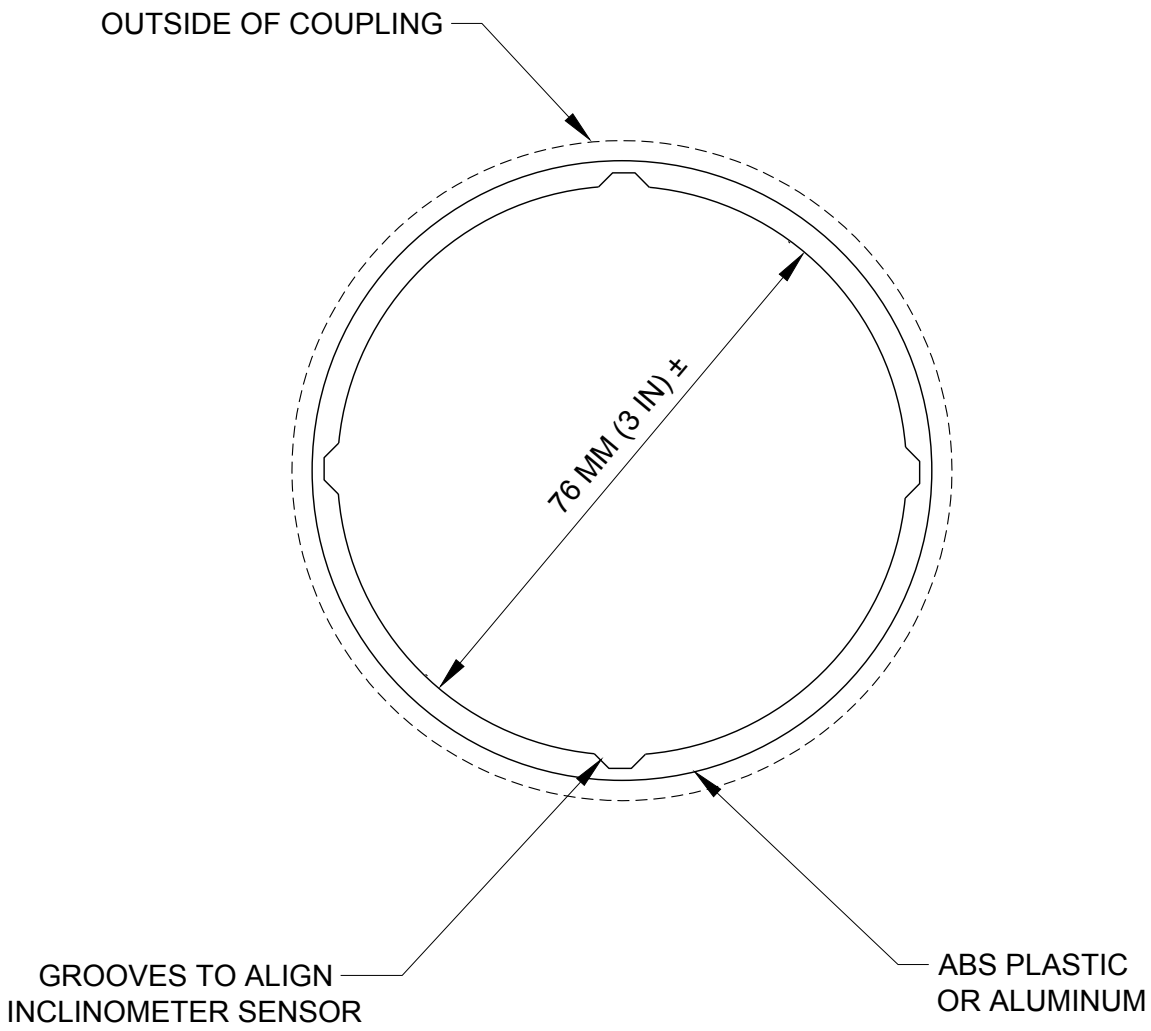
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLOPE INCLINOMETER MONITORING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11C

0 1 IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
1 cm



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

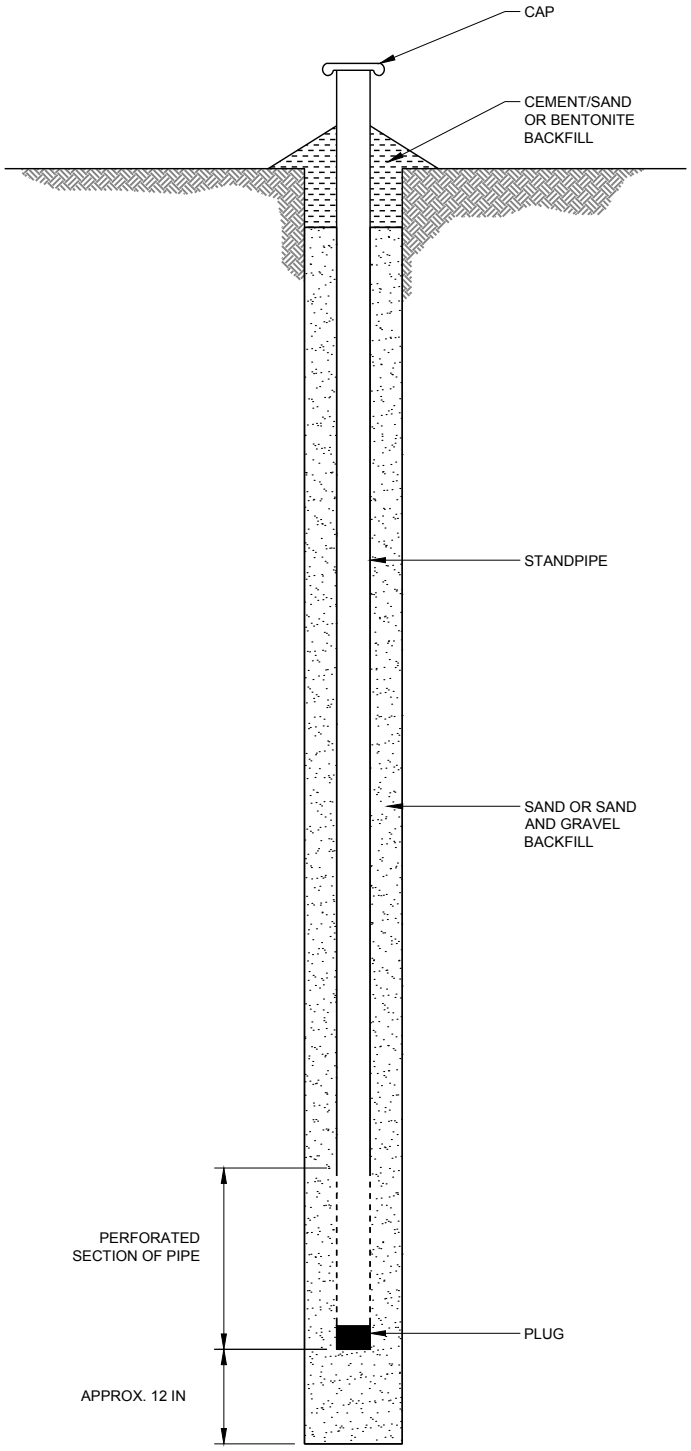
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SLOPE INCLINOMETER CASING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
STANDPIPE PIEZOMETER MONITORING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11E

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. COMPLETE AS-BUILT SURVEY OF INSTALLED TRENCH BREAKERS LOCATIONS, SO THAT SLOPE BREAKERS (WHICH ARE CONSTRUCTED LATER DURING ROW RESTORATION) CAN BE LOCATED TO CORRESPOND TO INSTALLED TRENCH BREAKERS. SLOPE BREAKERS TYPICALLY ARE LOCATED CLOSE TO AND JUST DOWNSLOPE OF TRENCH BREAKERS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

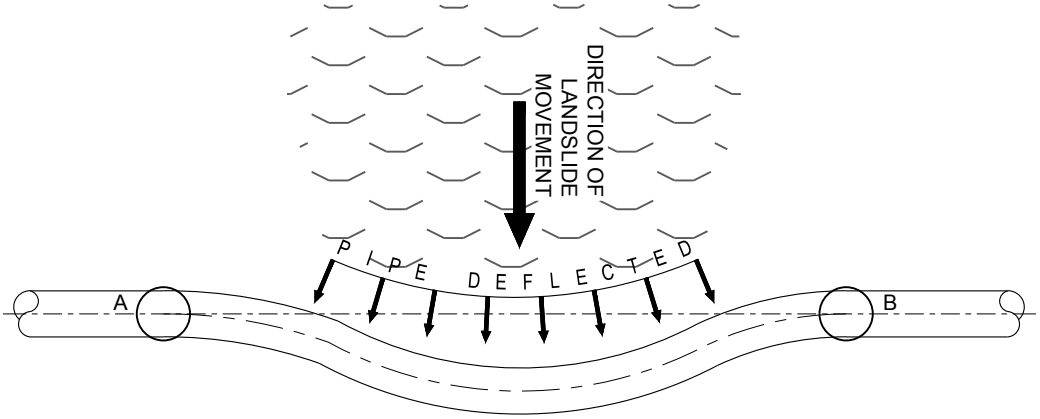
YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
AS-BUILT SURVEY TRENCH AND SLOPE BREAKERS

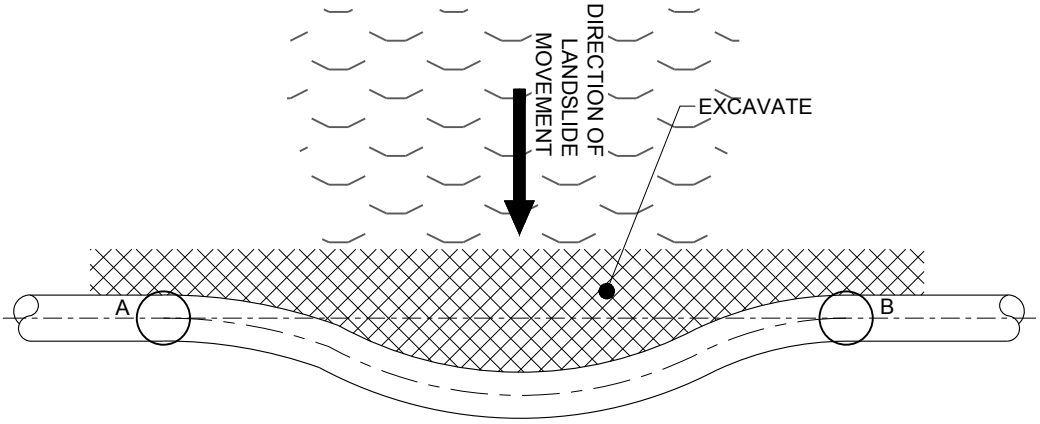
PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	11F

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

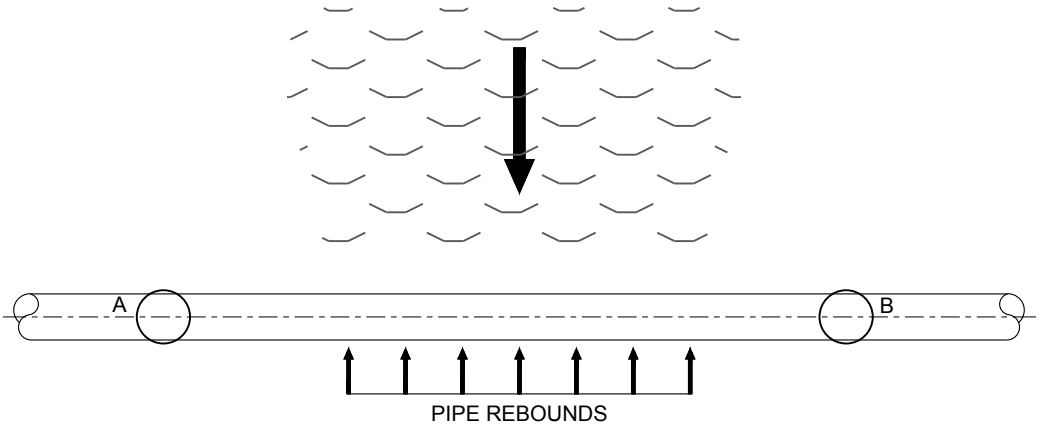
BEFORE STRAIN RELIEF EXCAVATION



DURING STRAIN RELIEF EXCAVATION



AFTER STRAIN RELIEF EXCAVATION



NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

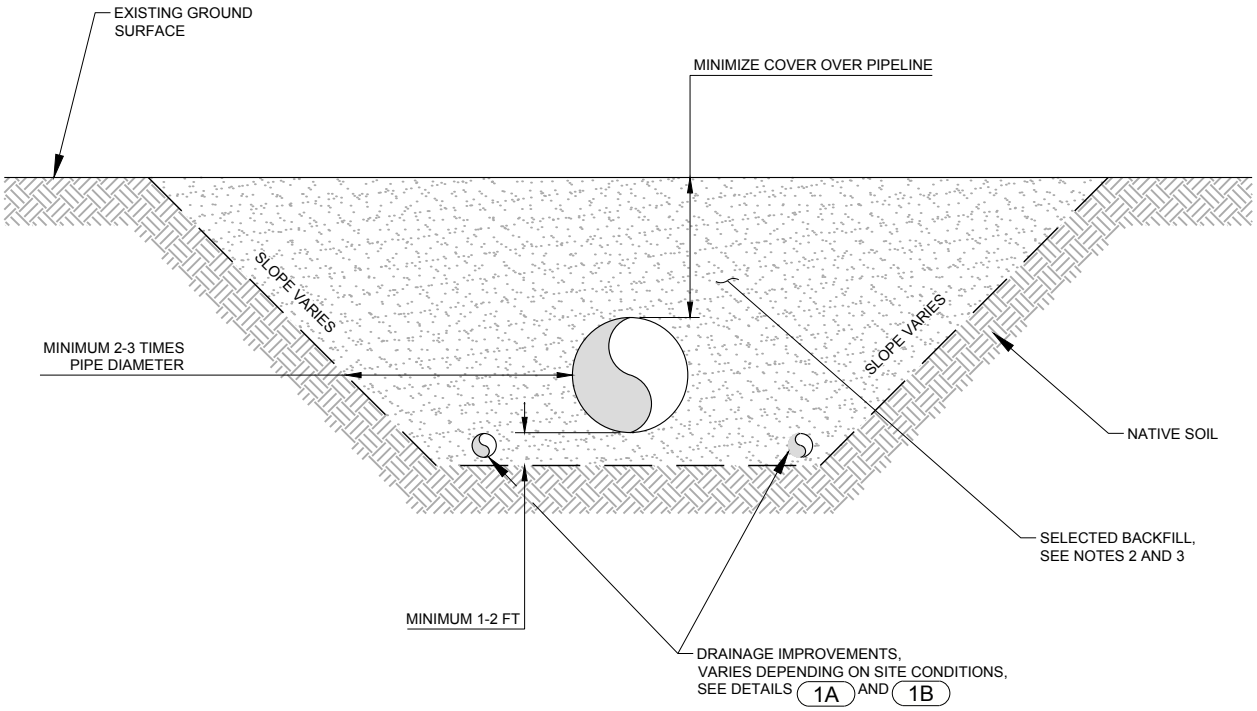
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
STRESS RELIEF EXCAVATIONS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	12A

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



GRAIN SIZE TABLE

PERCENT PASSING	MINIMUM
3/8 INCH	100
U.S. NO. 4	96
8	78
16	60
30	34
50	14
100	2
200	0

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SELECT BACKFILL SHALL CONSIST OF SANDY. INVERT GRANULAR MATERIAL, EITHER NATURALLY OCCURRING OR PROCESSED. IT SHALL BE FREE FROM ORGANICS, SILT CLAY, SWELLING SOILS, GARBAGE, WOOD, OR OTHER EXTRANEOUS OR OBJECTIONABLE MATERIAL.

3. SAND SHALL BE WELL GRADED FROM COARSE TO FINE. THE GRAIN SIZE DISTRIBUTION SHALL CONFORM TO THE FOLLOWING.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

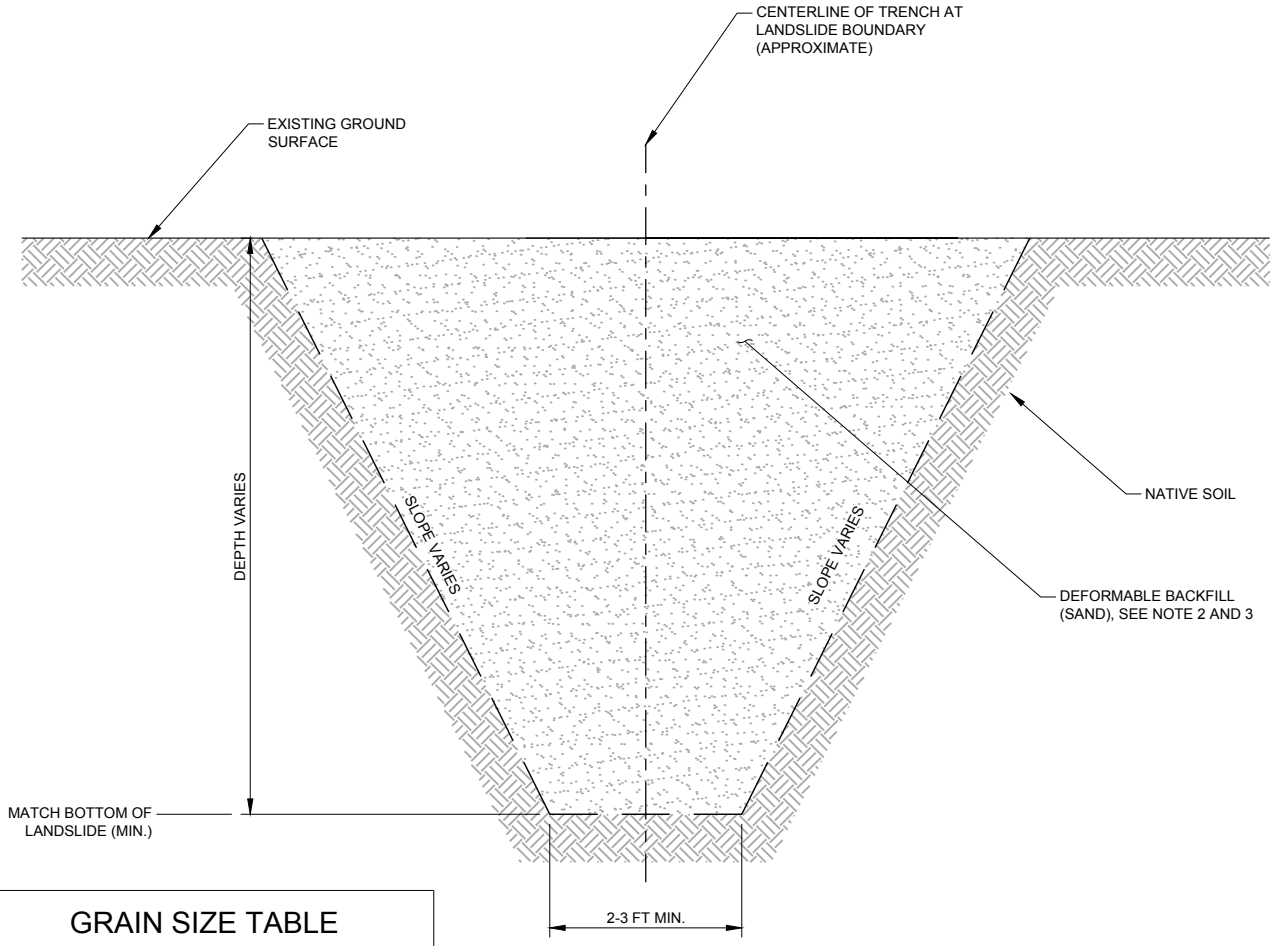
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SELECT (DEFORMABLE) BACKFILL AROUND PIPELINE IN LANDSLIDE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	12B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



GRAIN SIZE TABLE

PERCENT PASSING	MINIMUM
$\frac{3}{8}$ INCH	100
U.S. NO. 4	96
8	78
16	60
30	34
50	14
100	2
200	0

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SELECT BACKFILL SHALL CONSIST OF SANDY. INVERT GRANULAR MATERIAL, EITHER NATURALLY OCCURRING OR PROCESSED. IT SHALL BE FREE FROM ORGANICS, SILT CLAY, SWELLING SOILS, GARBAGE, WOOD, OR OTHER EXTRANEOUS OR OBJECTIONABLE MATERIAL.

3. SAND SHALL BE WELL GRADED FROM COARSE TO FINE. THE GRAIN SIZE DISTRIBUTION SHALL CONFORM TO THE FOLLOWING.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

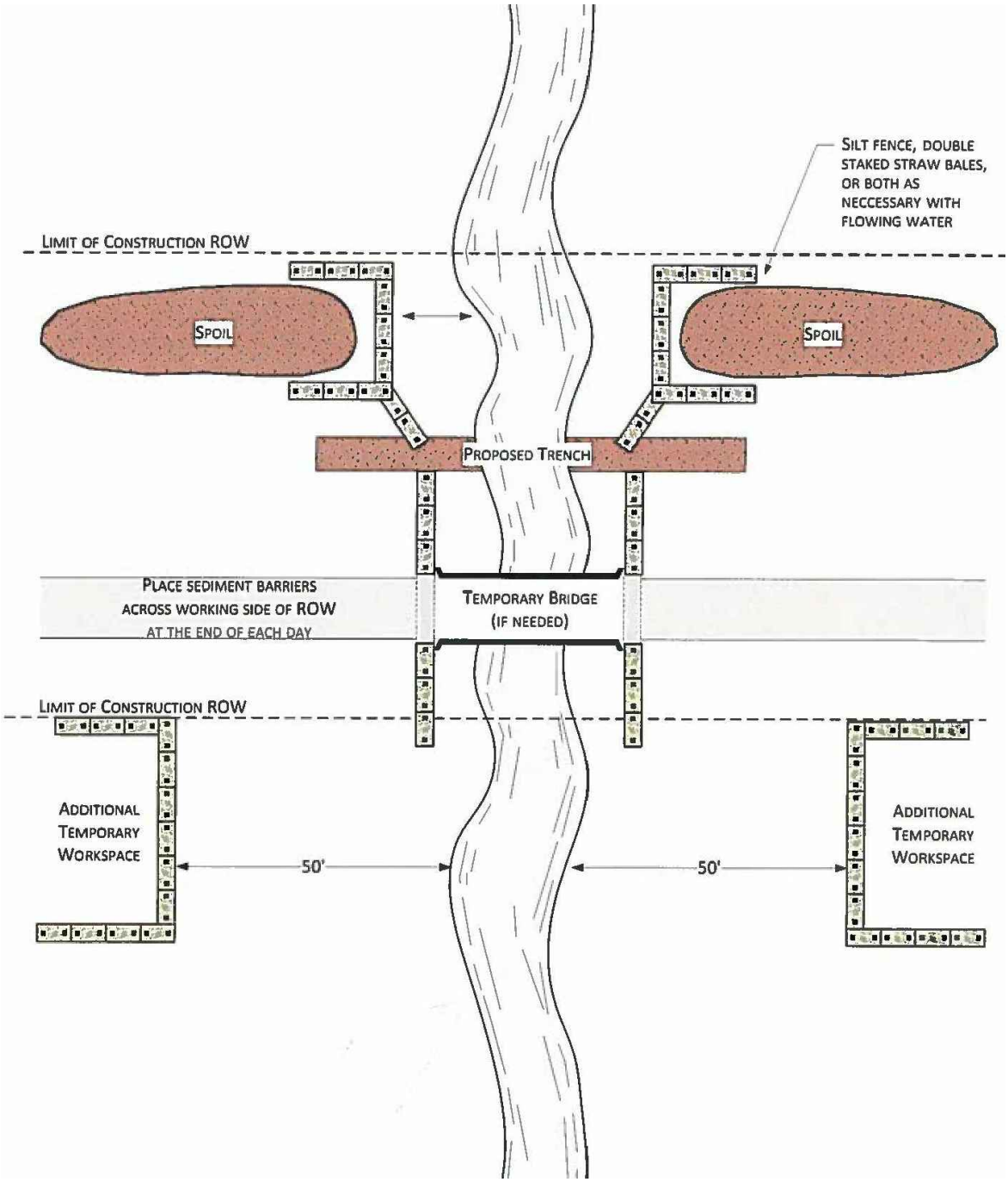
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SHEAR TRENCH

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	12C

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

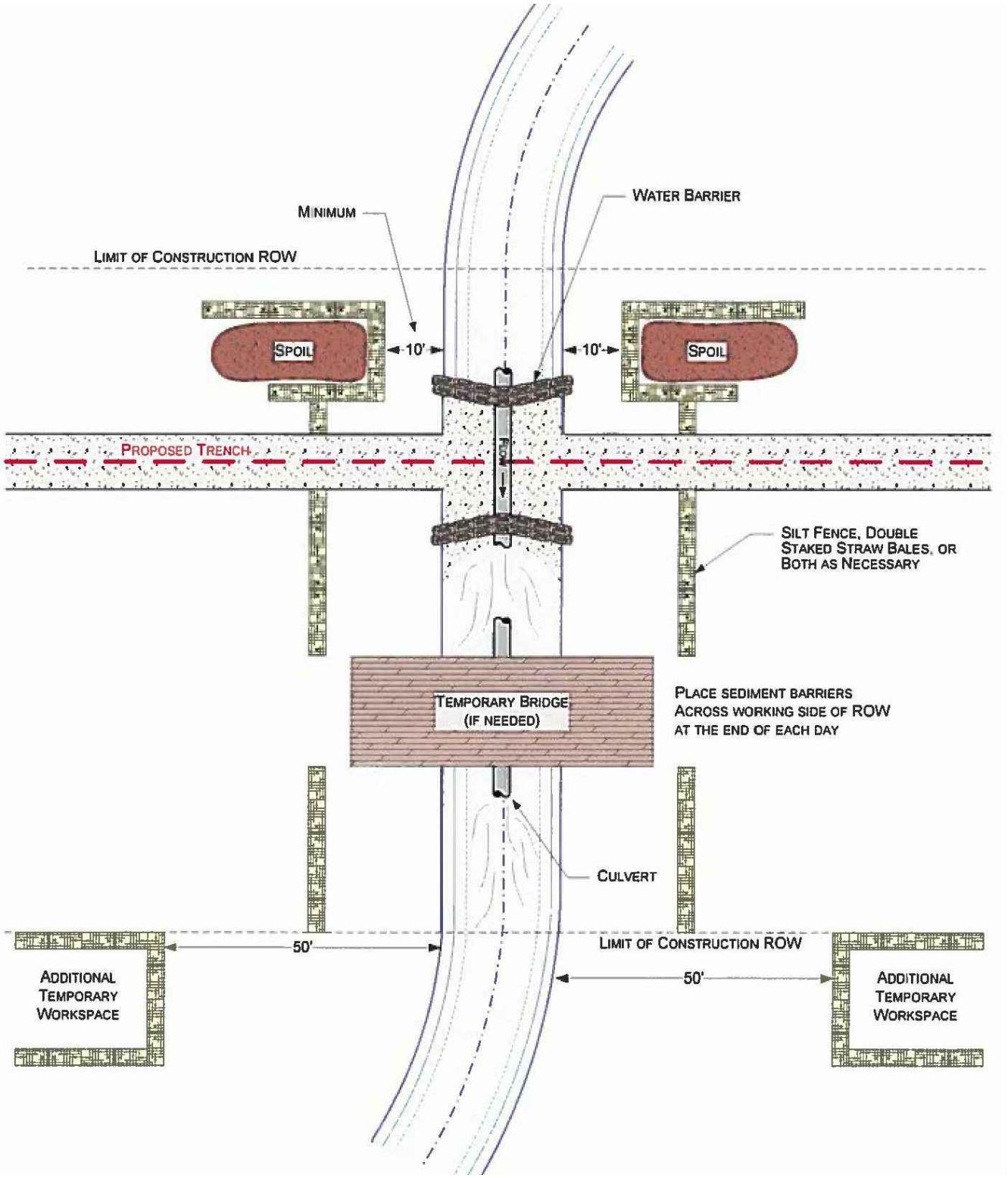
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP WATERBODY OPEN CUT

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

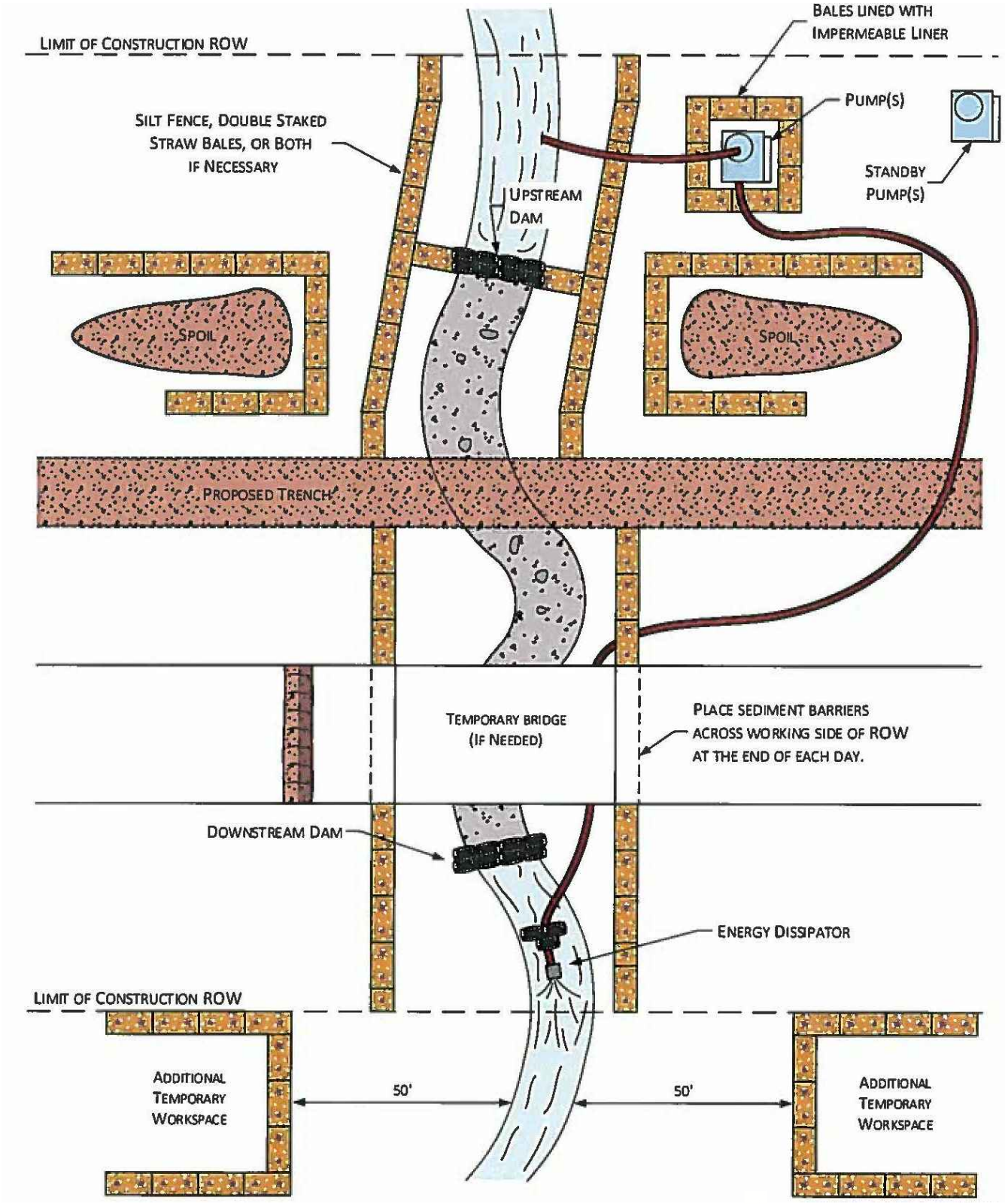
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP WATERBODY FLUME METHOD

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13B

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

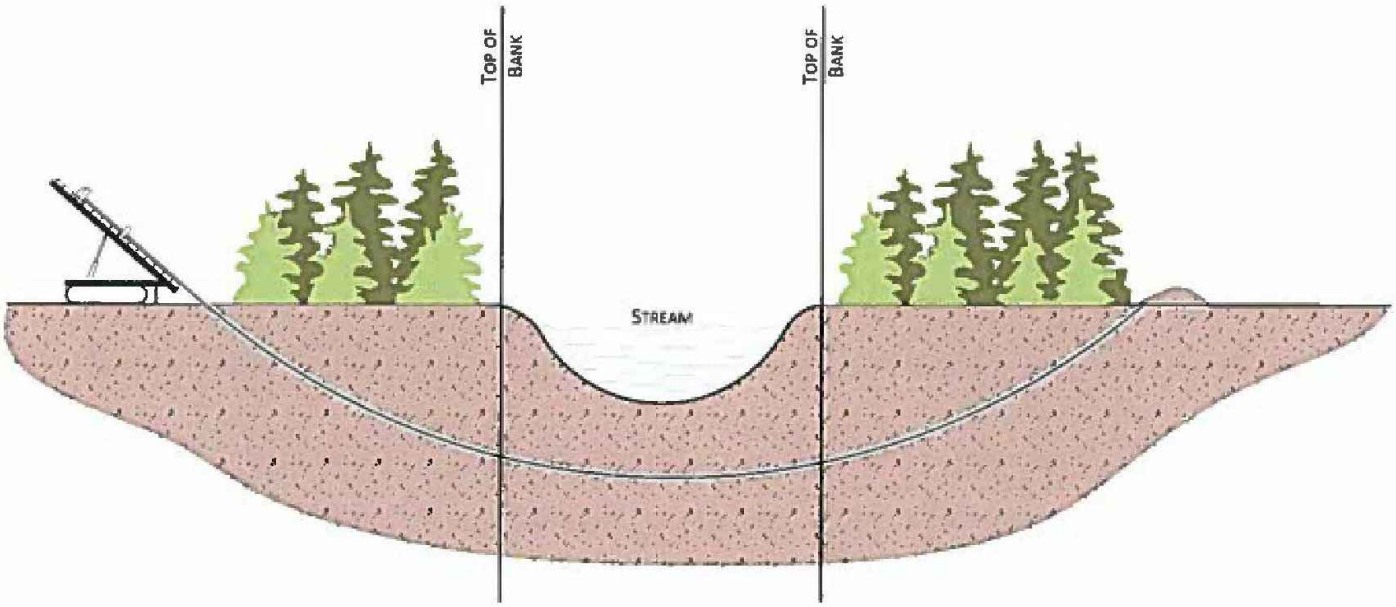
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP WATERBODY DAM AND PUMP

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13C

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

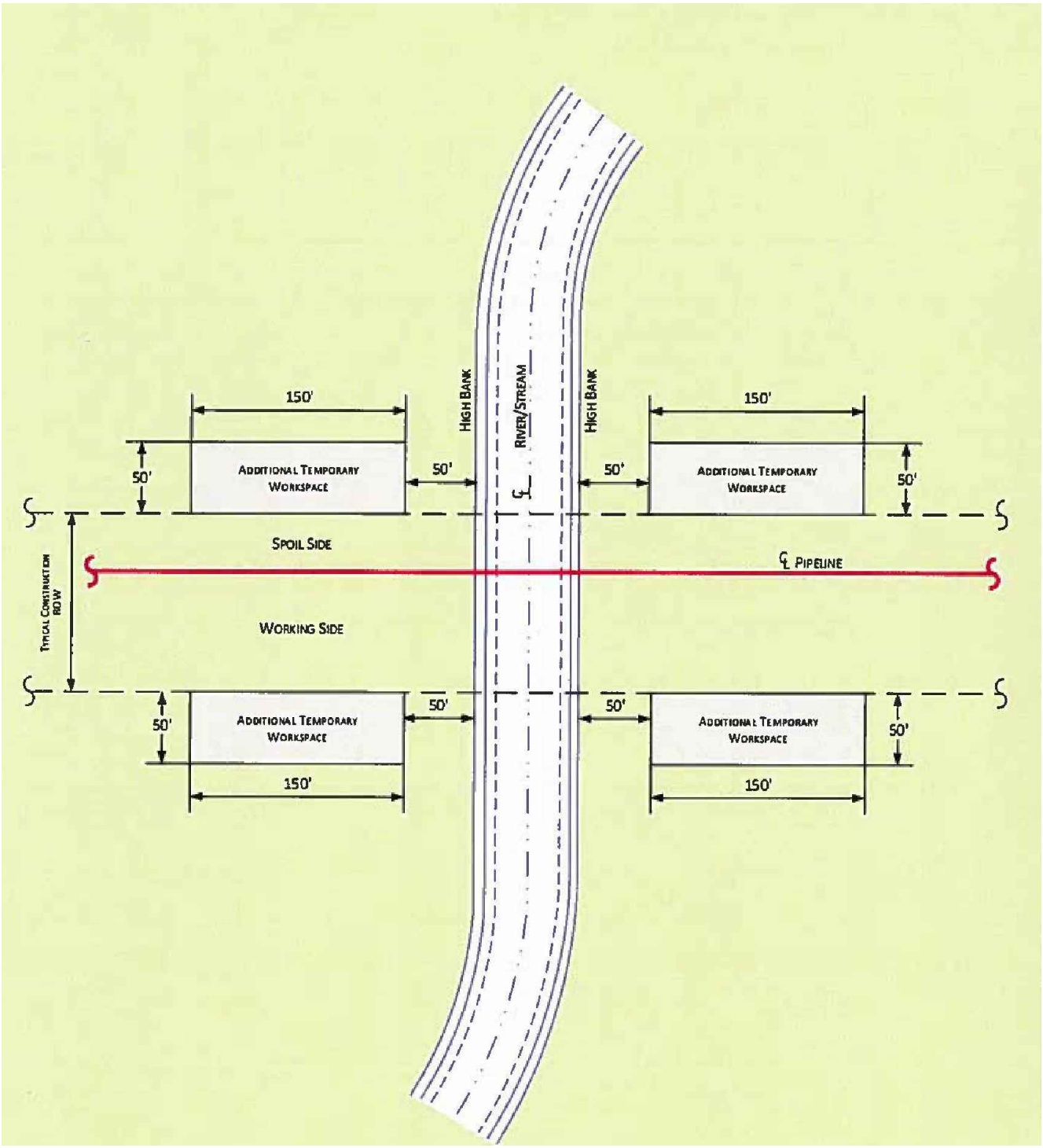
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP WATERBODY HDD METHOD

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13D

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
0



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

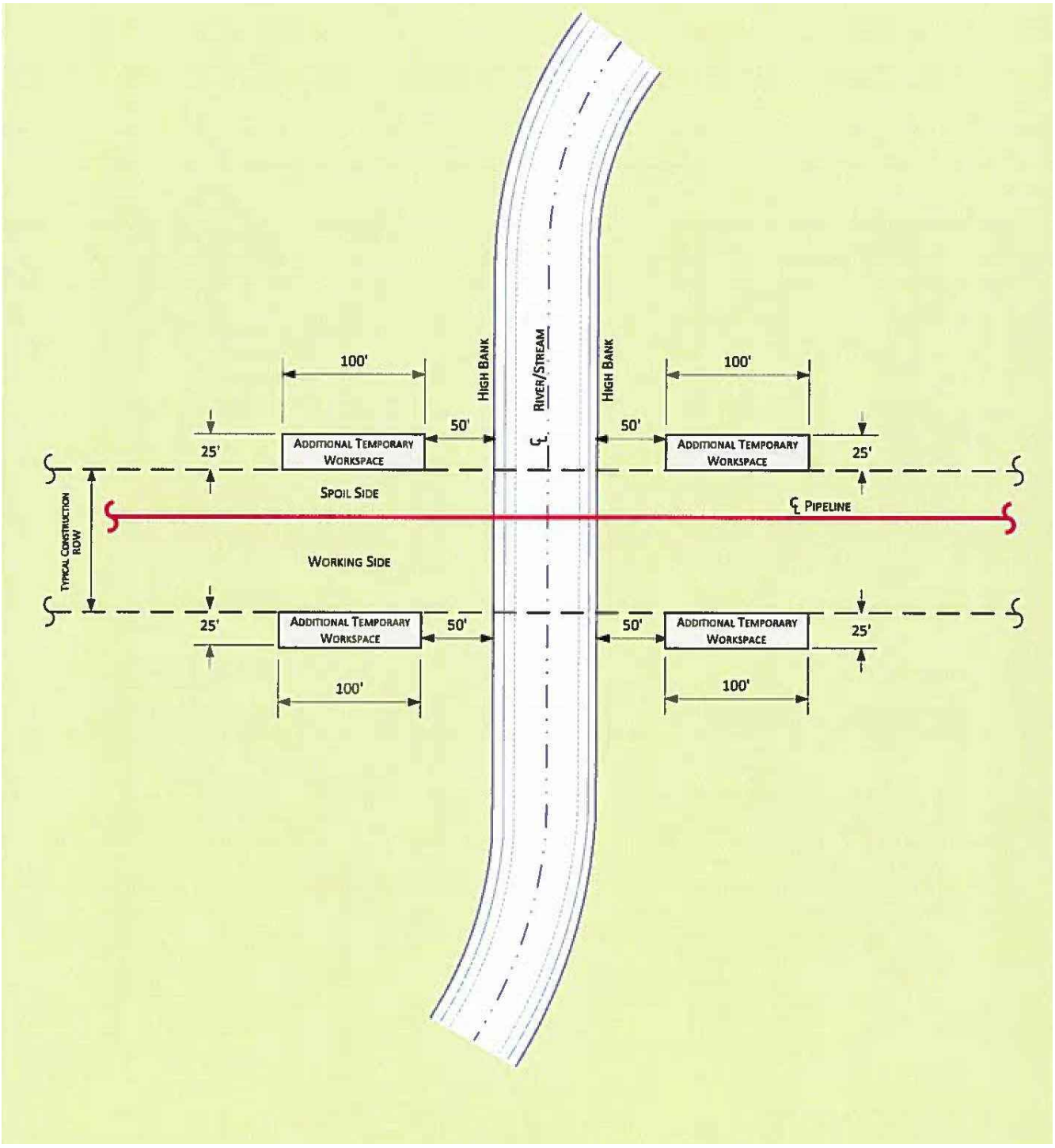
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WATERBODY ACP AP-1

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13E-1

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

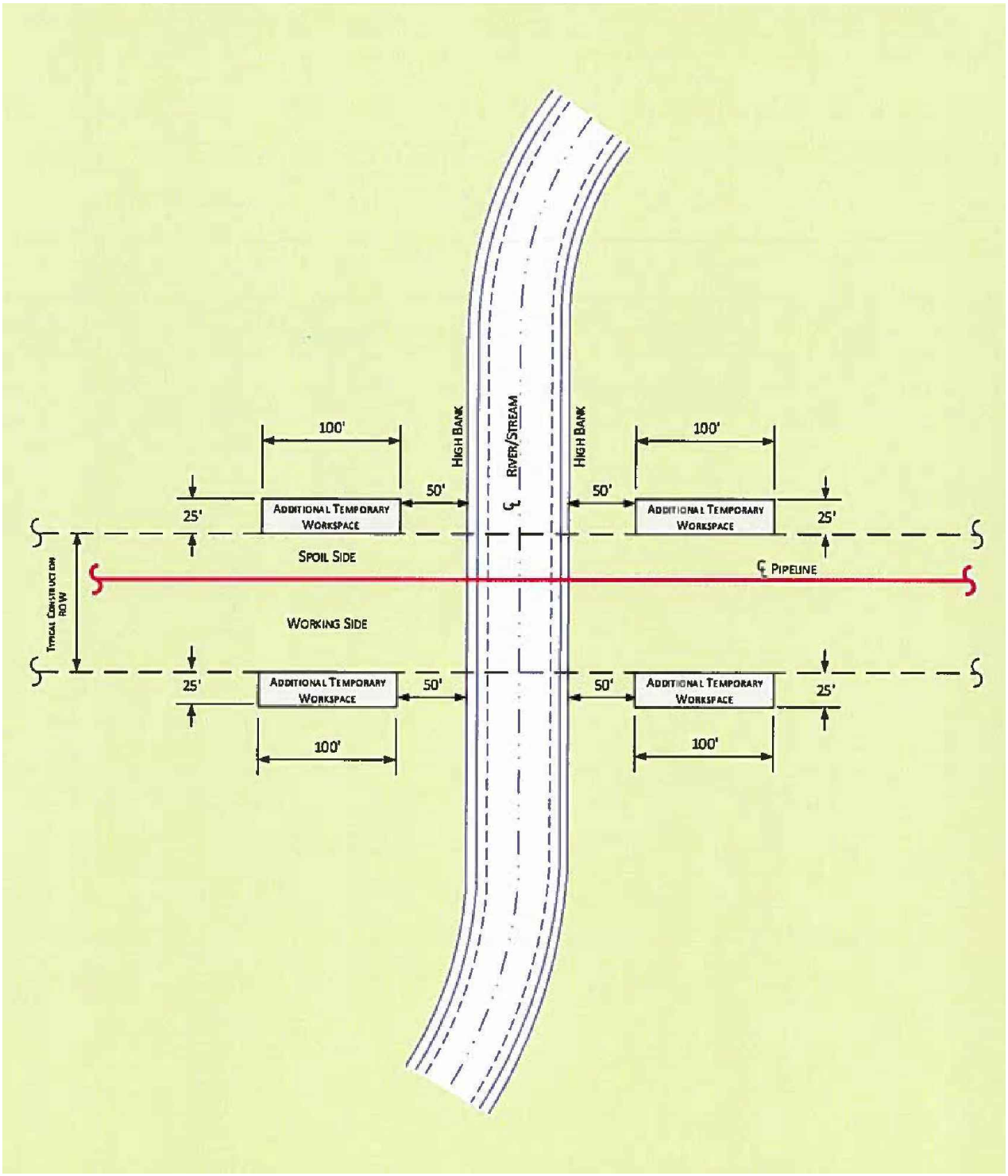
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WATERBODY ACP AP-1 AP-2 AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13E-2

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

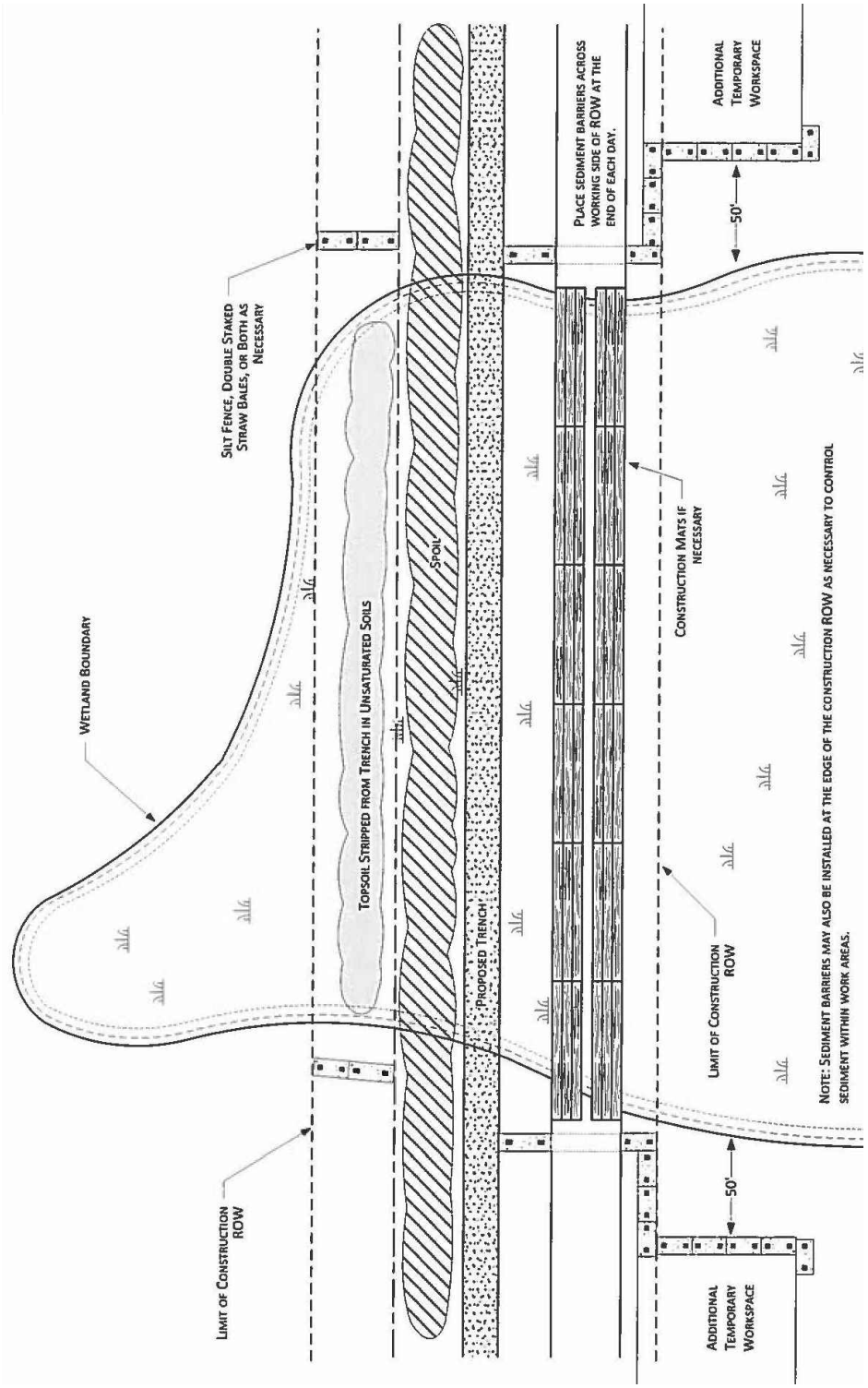
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WATERBODY SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13E-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

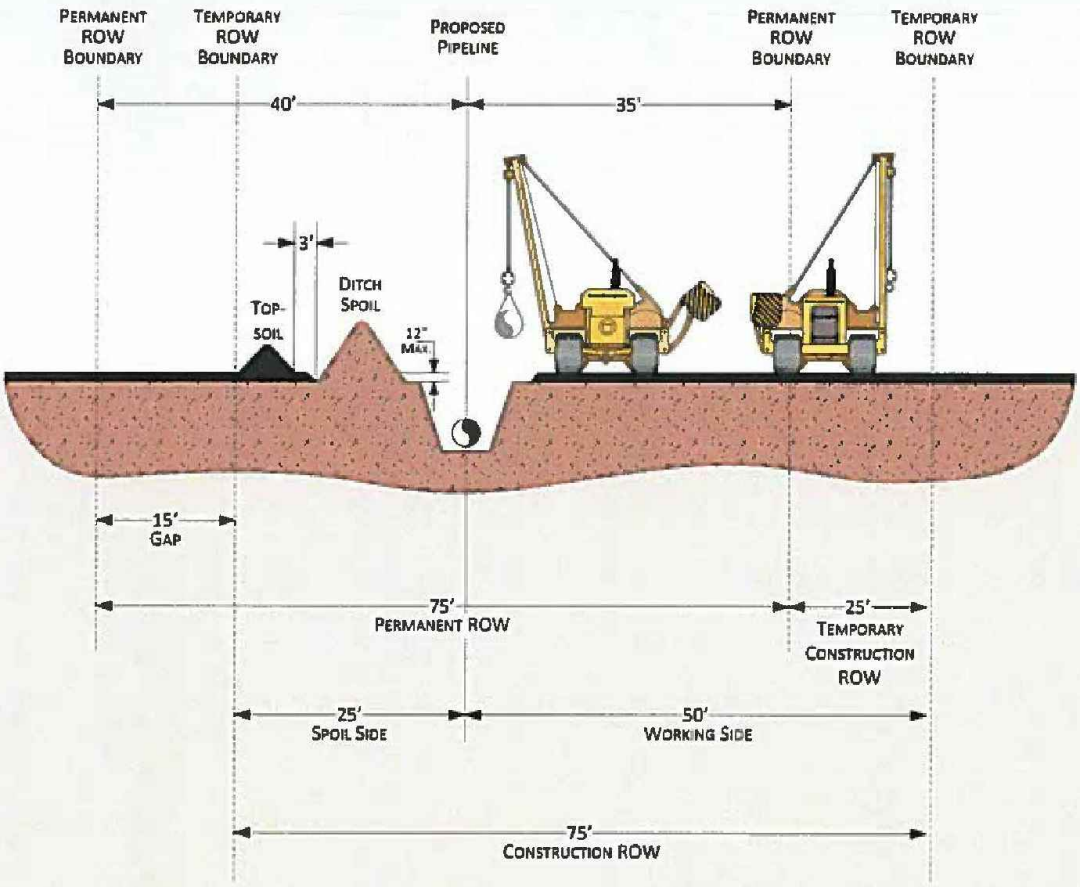
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP WETLAND OPEN CUT METHOD ACP AP-1 AP-2 AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13F

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75' WIDE WITH 25' ON THE SPOIL SIDE AND 50' ON THE WORKING SIDE. THE PERMANENT ROW WILL BE 75' WIDE WITH 40' ON THE SPOIL SIDE AND 35' ON THE WORKING SIDE. THIS WILL LEAVE A 15' GAP BETWEEN THE AREA OF DISTURBANCE DURING CONSTRUCTION AND THE BOUNDARY OF THE PERMANENT ROW. NO IMPACT IS EXPECTED IN THIS AREA.
2. DURING CONSTRUCTION, A WORKING SIDE OF 50 FEET IN WETLANDS WILL BE NECESSARY GIVEN THE DIAMETER OF THE PIPE.
3. DURING OPERATIONS, ATLANTIC PROPOSES A STANDARD PERMANENT EASEMENT IN WETLANDS CONSISTENT WITH OTHER SEGMENTS OF THE PIPELINE. MAINTENANCE ACTIVITIES IN THE PERMANENT EASEMENT WILL BE CONSISTENT WITH THE PROCEDURES.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

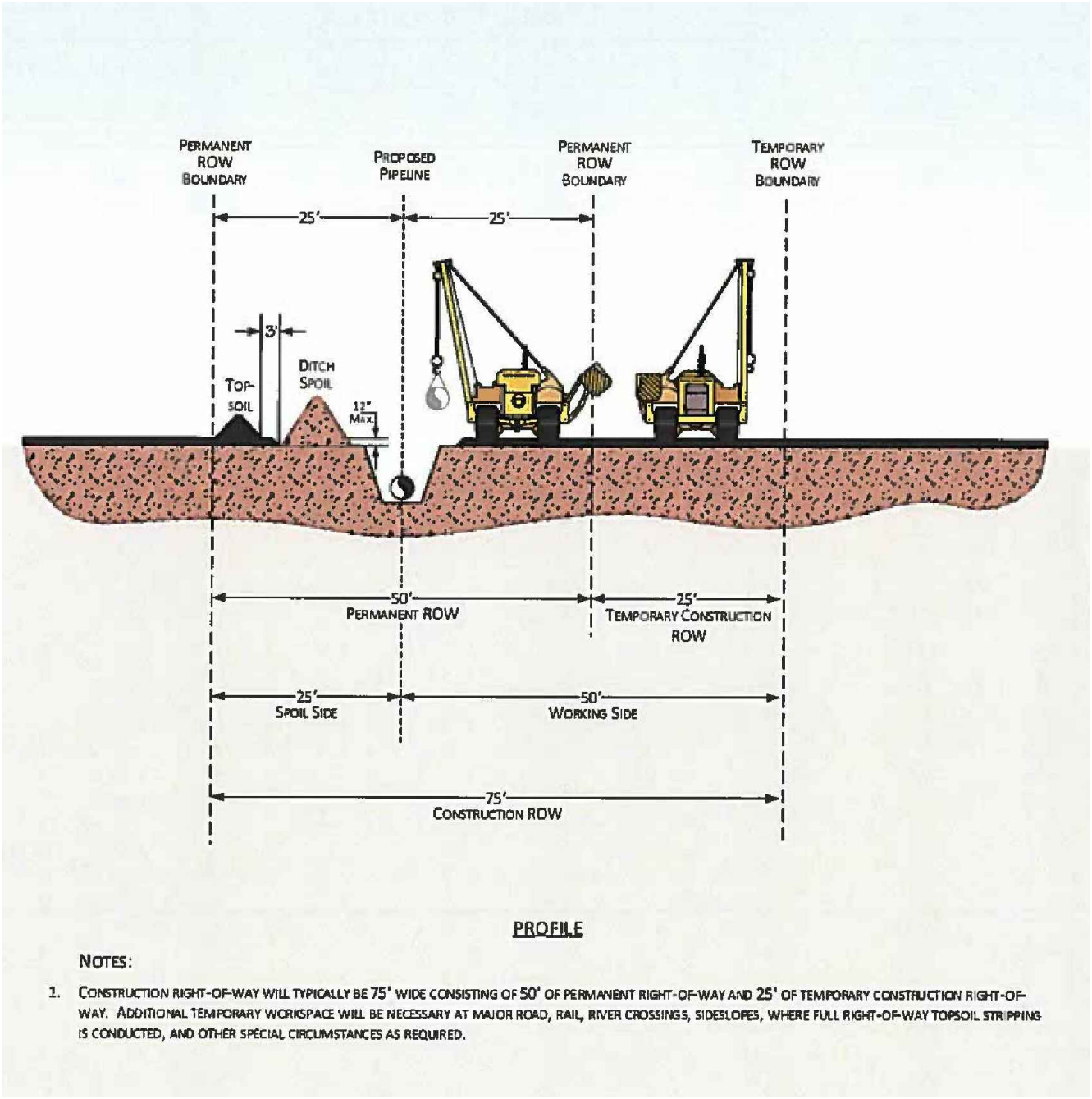
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN WETLANDS ACP AP-1

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13G-1

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 25' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

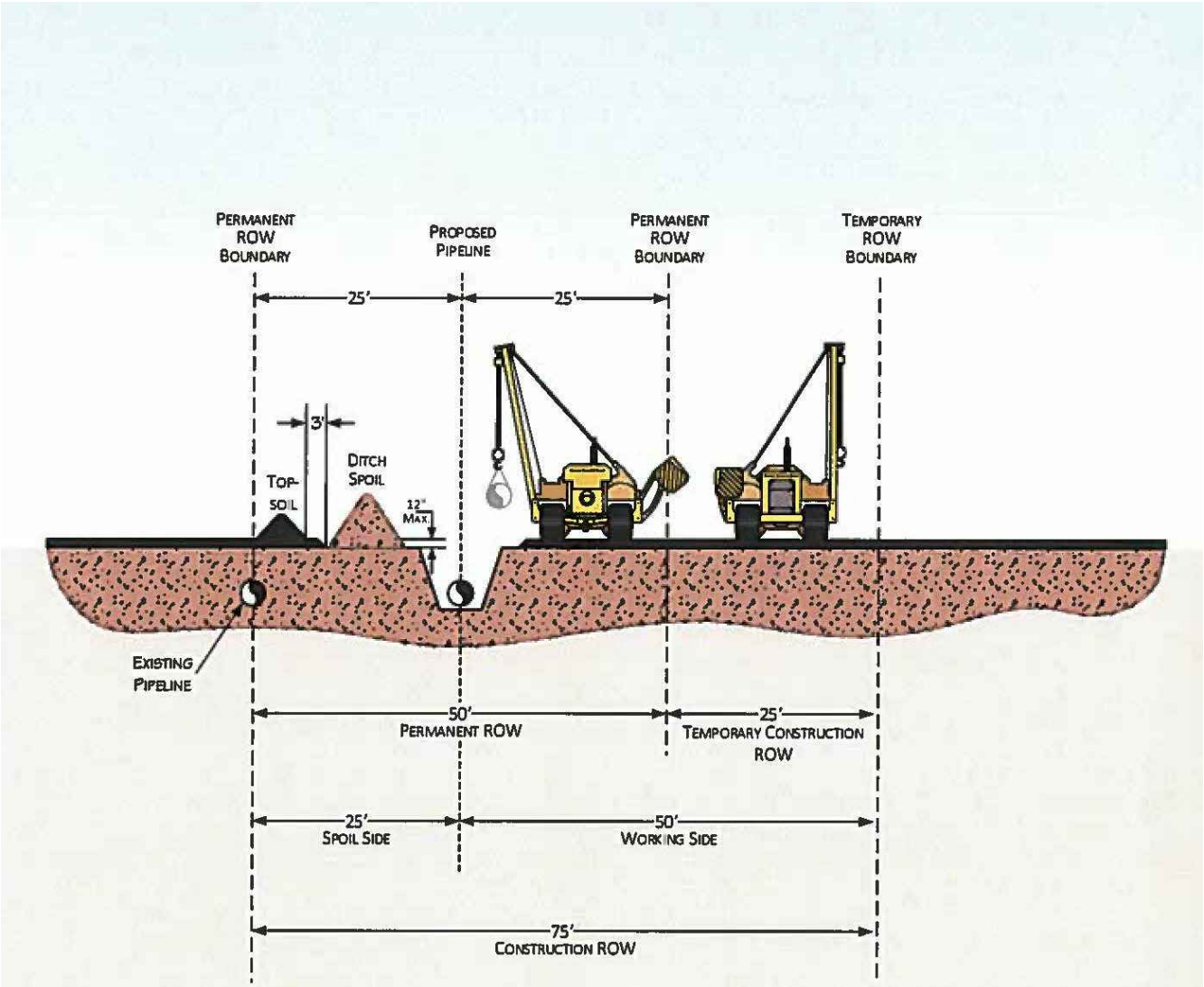
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN WETLANDS ACP AP-2

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13G-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 25' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

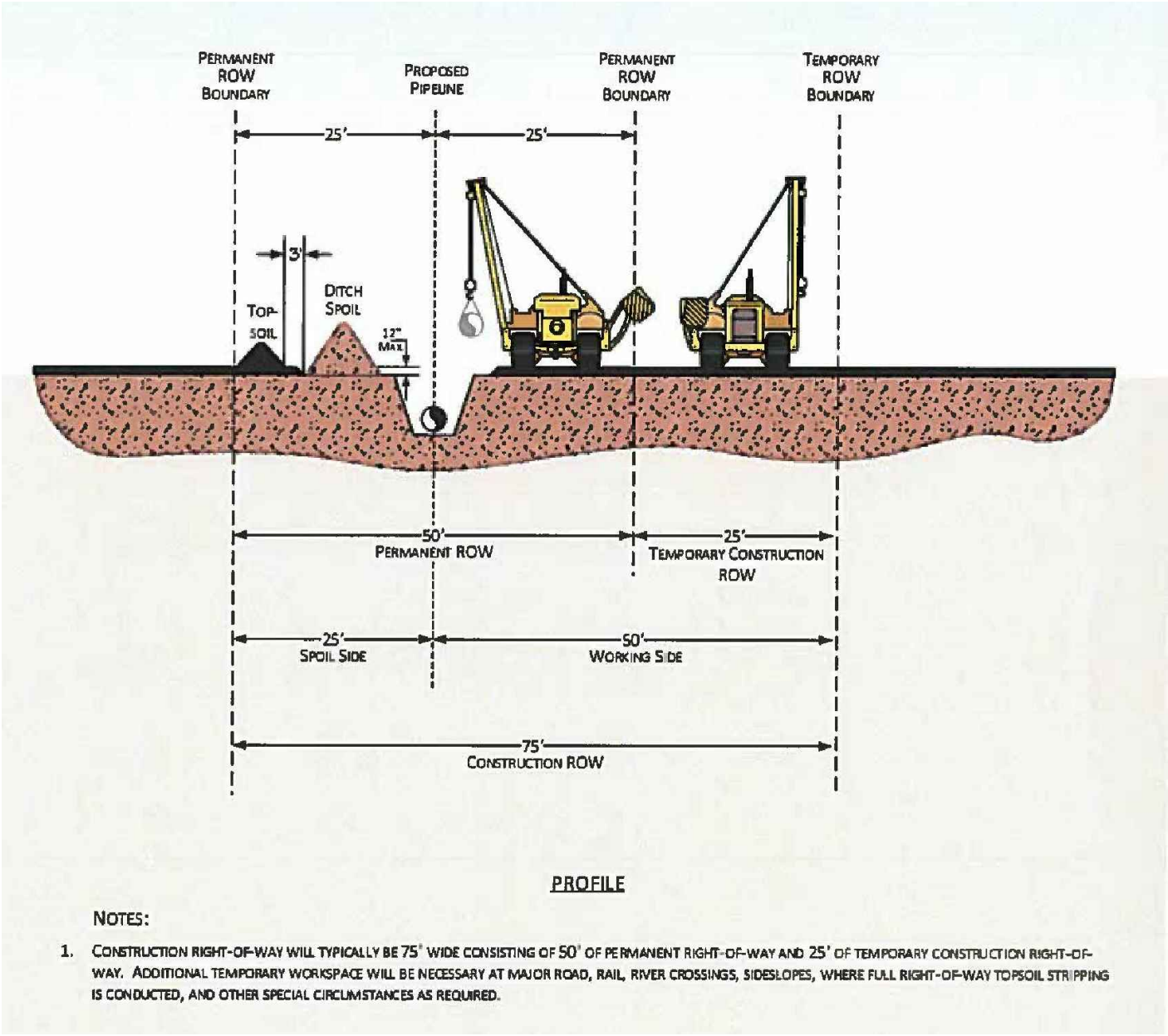
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN WETLANDS COLLOCATED SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13G-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 25' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

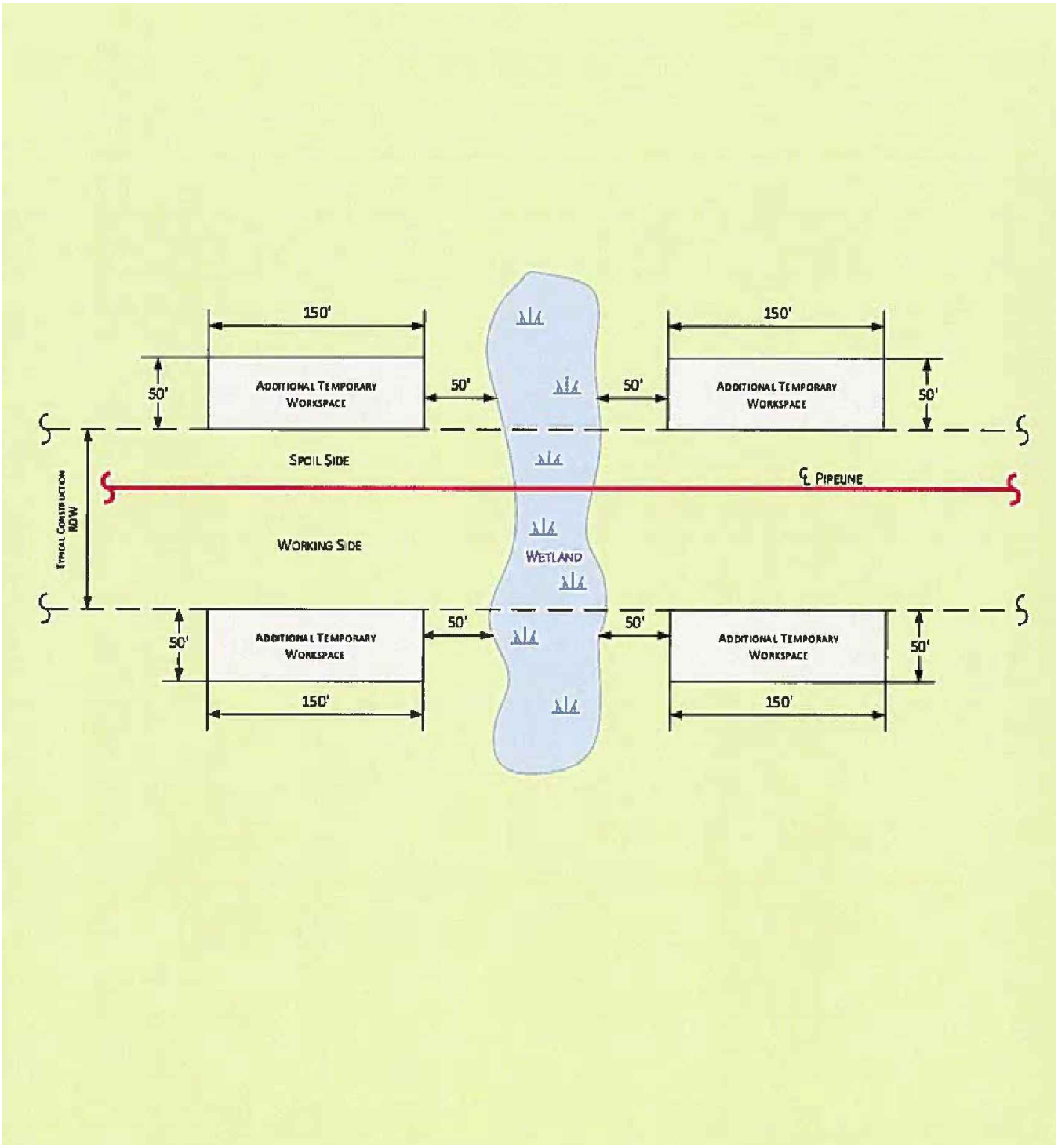
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN WETLANDS NOT-COLLOCATED SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13G-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

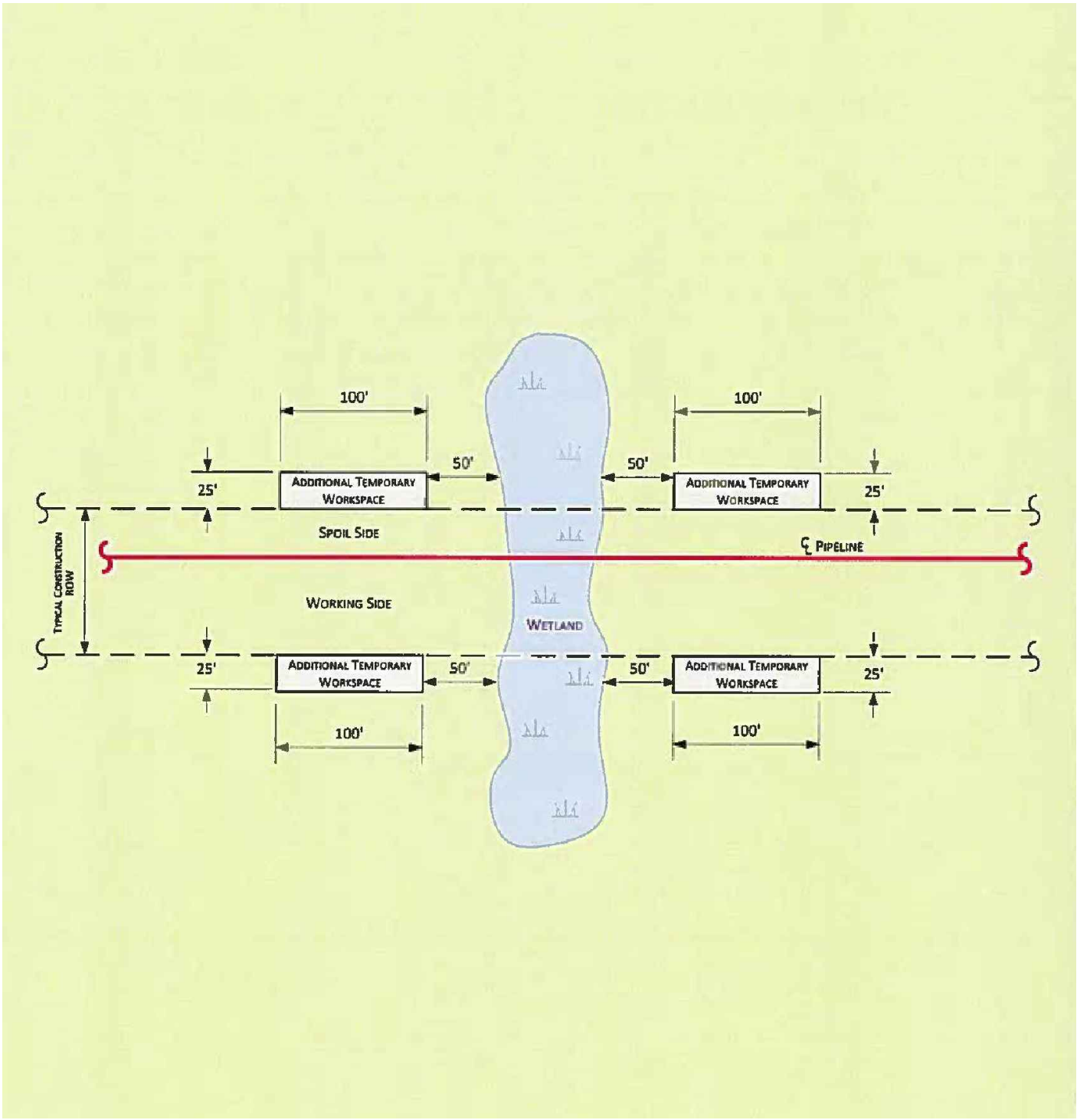
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS ACP AP-1

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13H-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

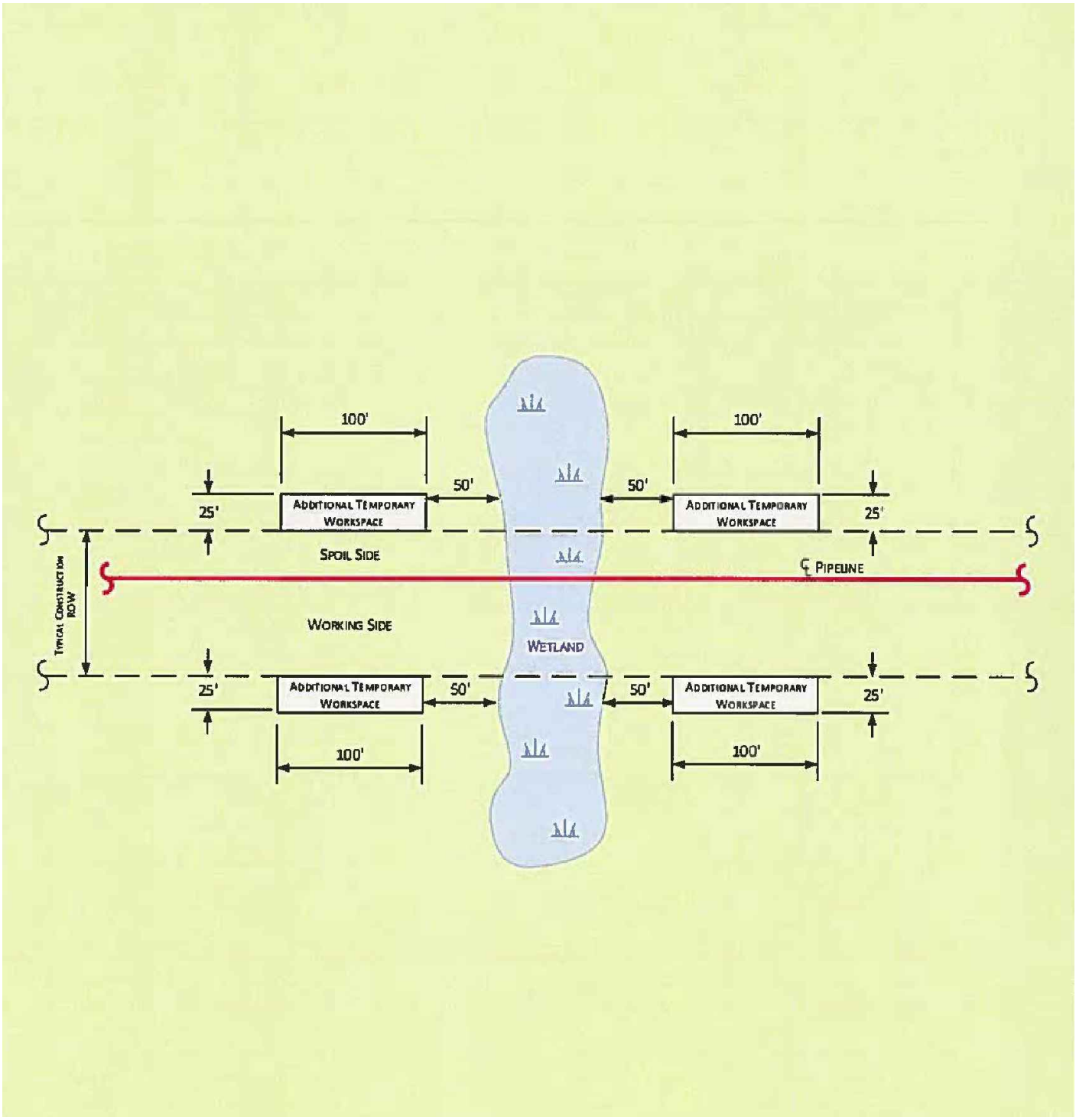
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS ACP AP-2 AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13H-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

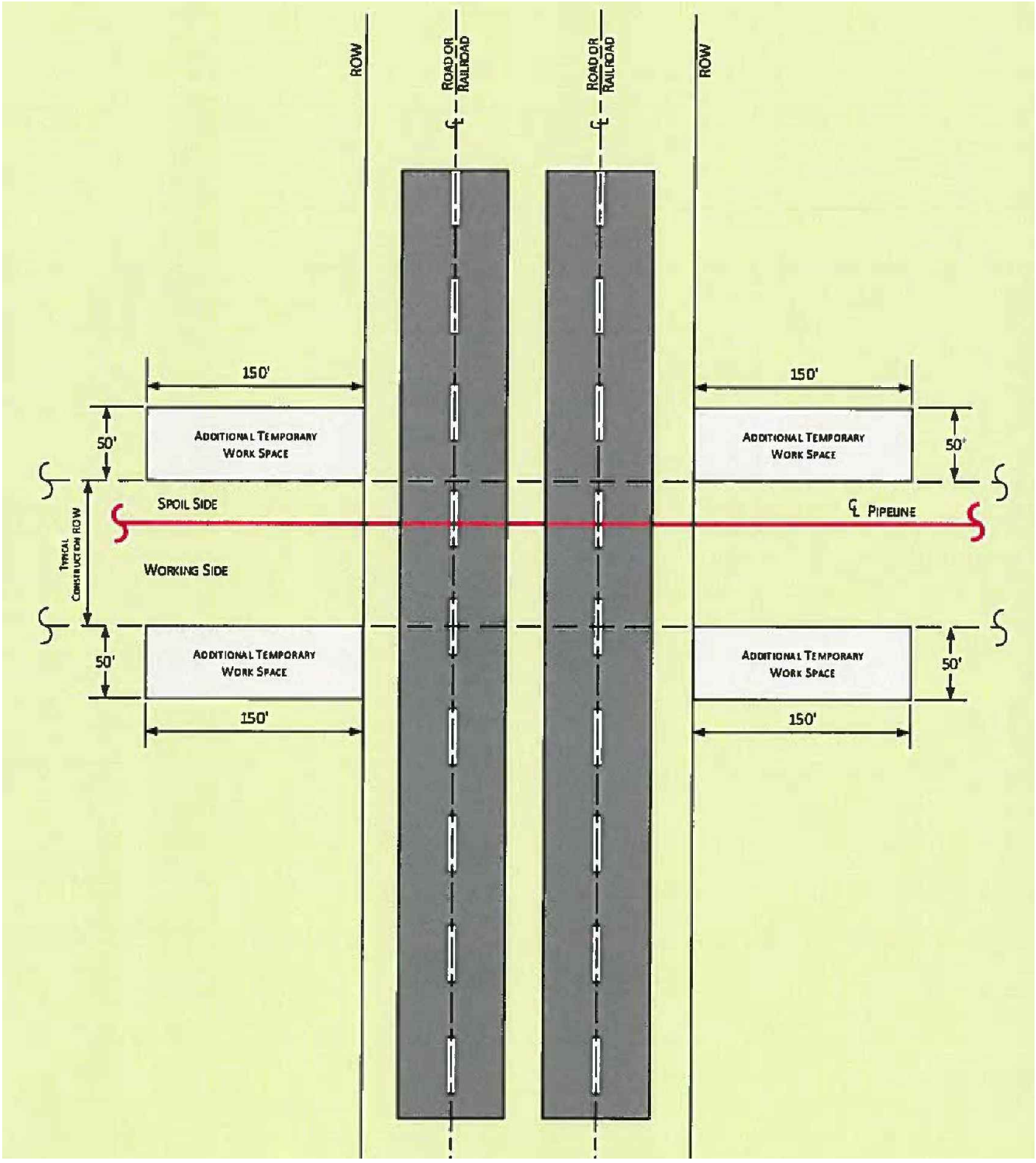
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT WETLAND CROSSINGS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13H-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

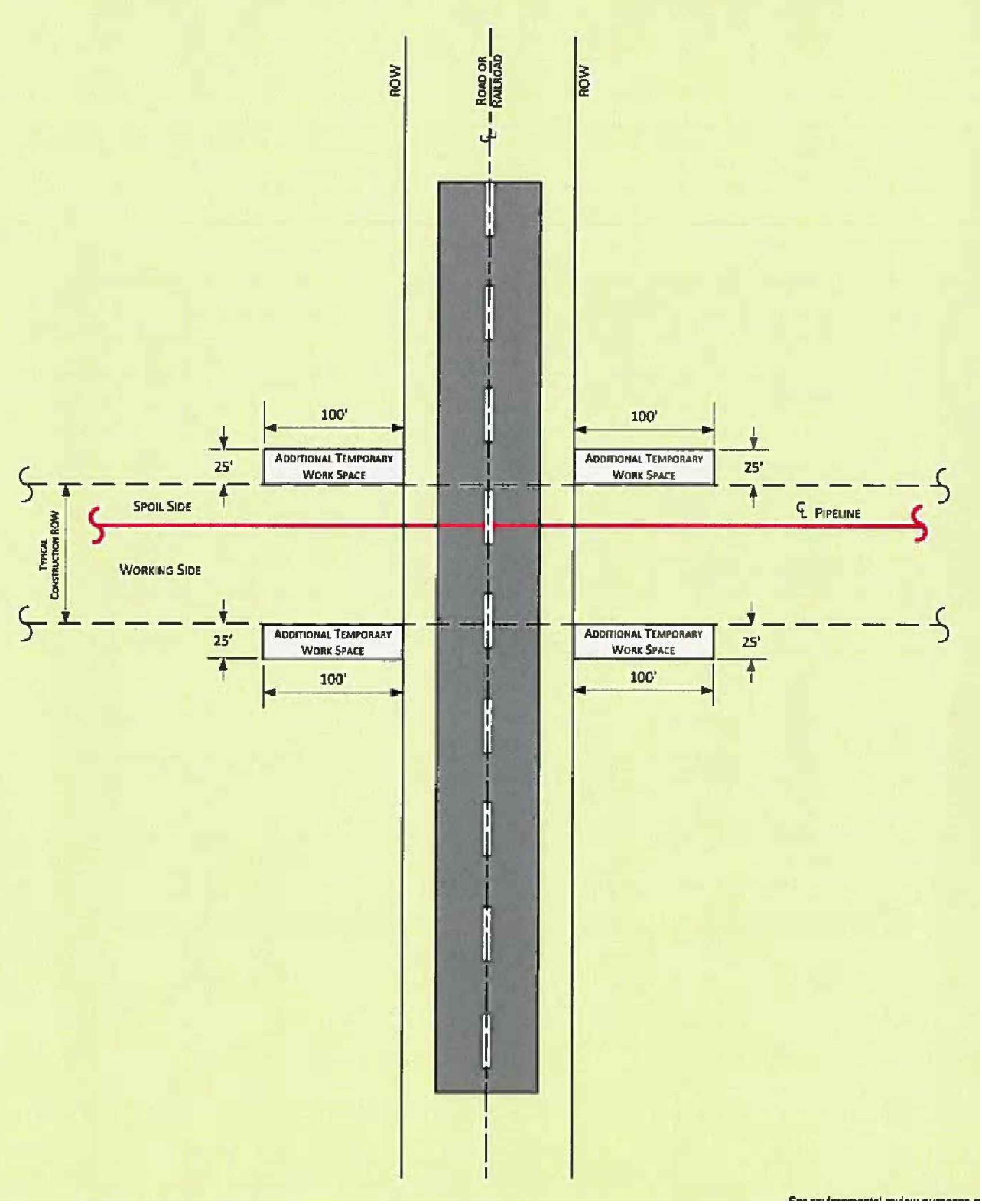
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
WORKSPACE AT BORED CROSSINGS FOR 2-LANE ROADS AND RAILROADS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13I-1

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

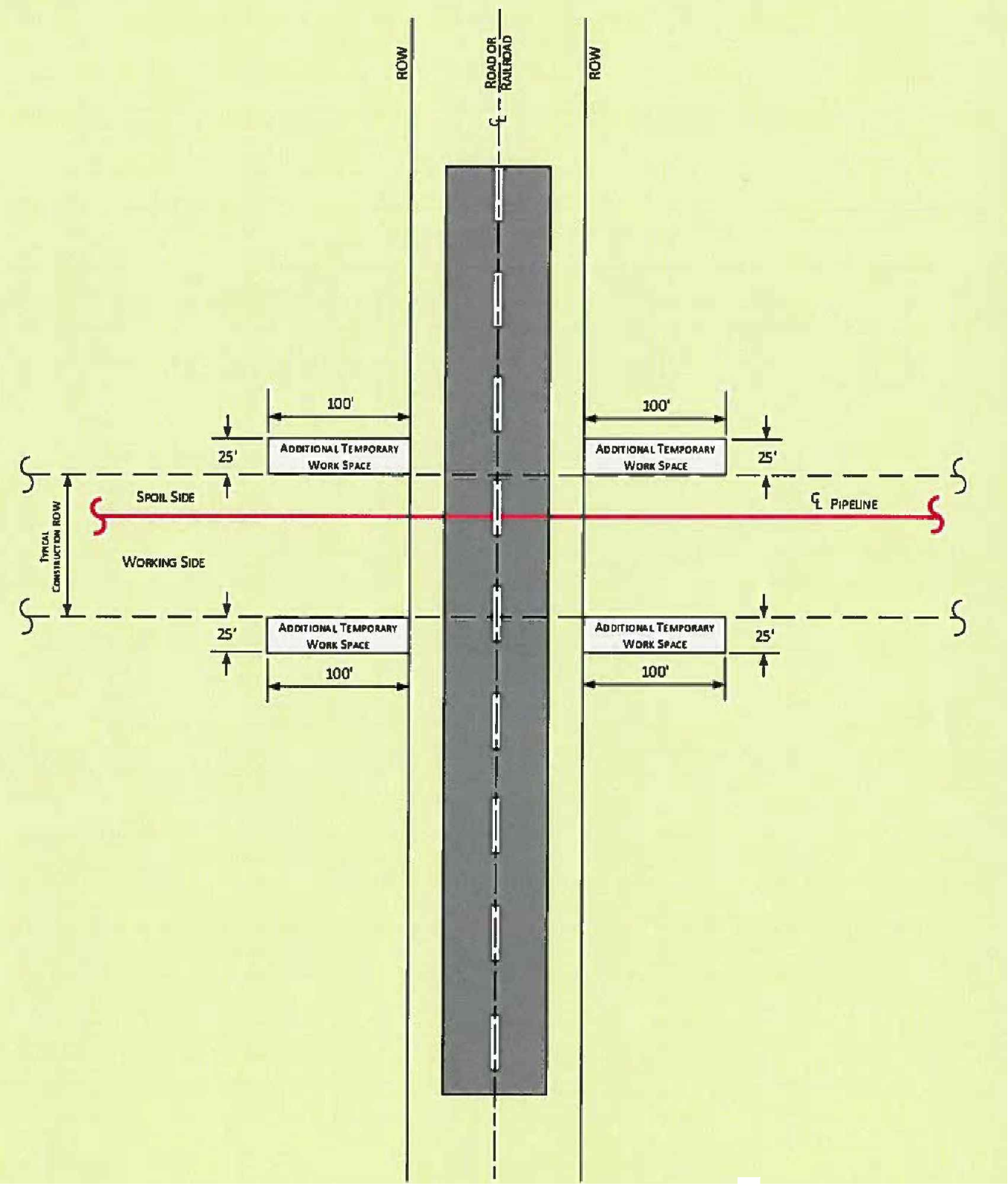
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT SINGLE-LANE ROADS AND BORED ROADS ACP AP-1 AP-2 AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13I-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

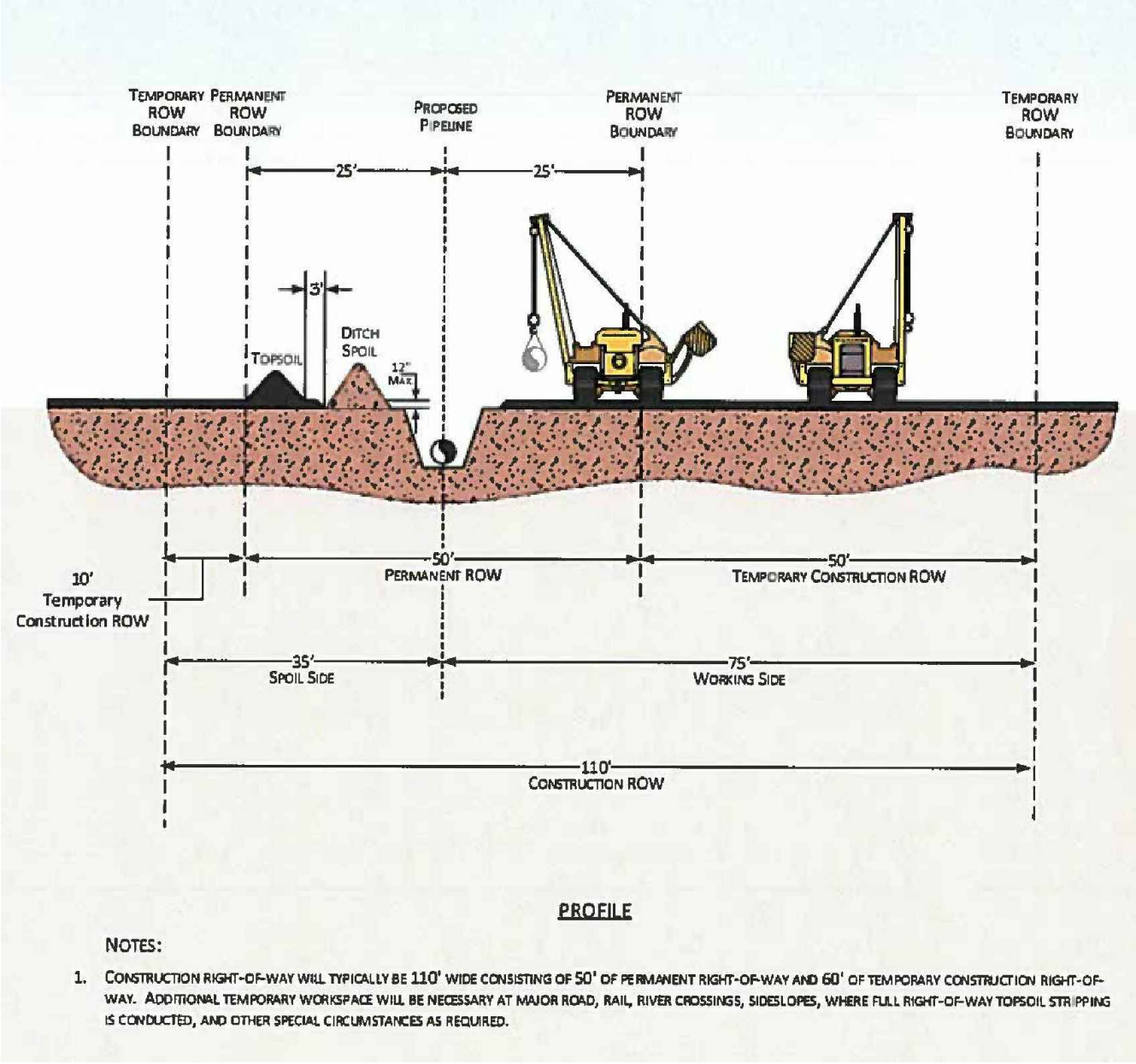
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP ADDITIONAL WORKSPACE AT ALL BORED ROADS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13I-3

0 1in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 110' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 60' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

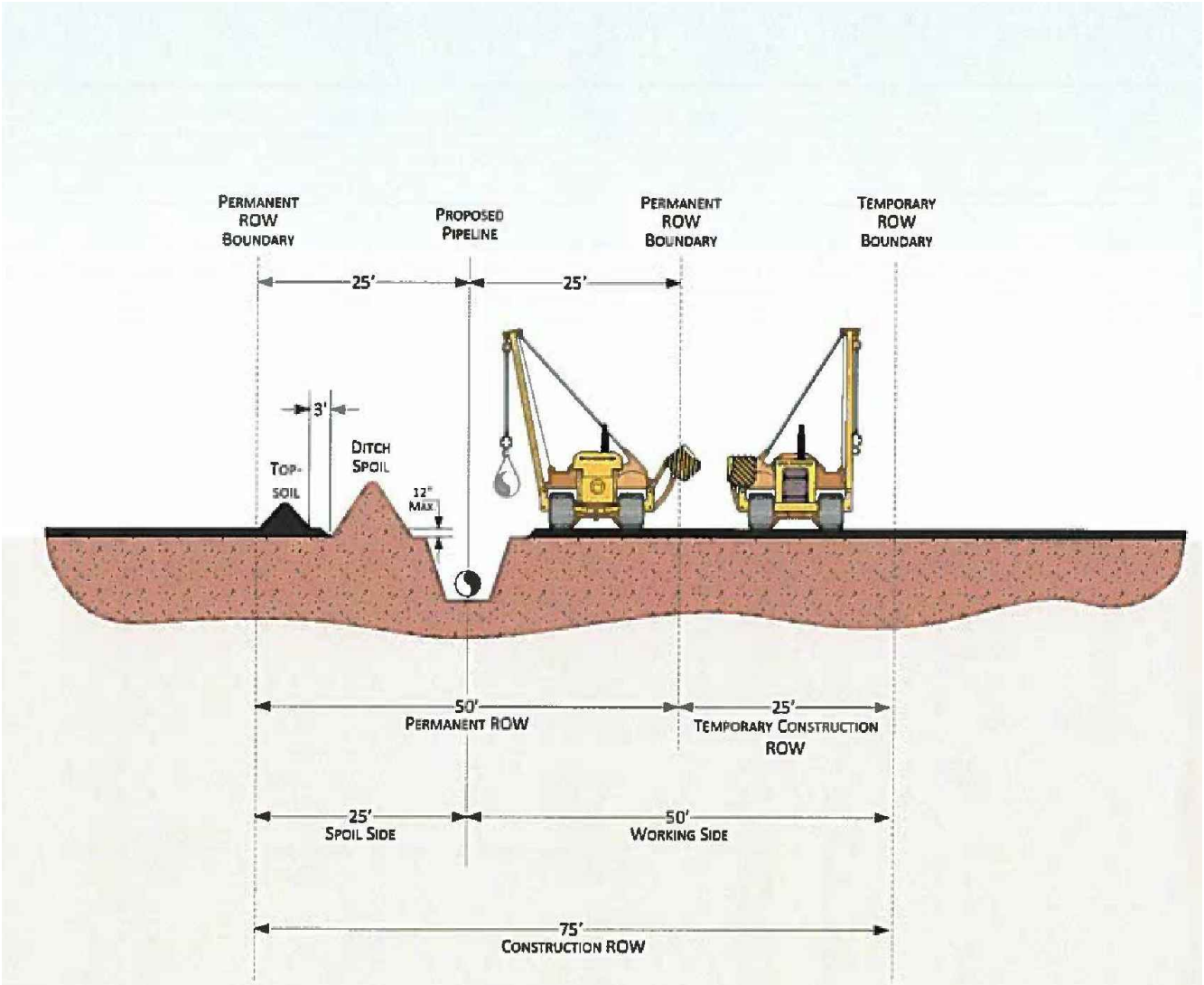
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN NON-AG AREAS ACP AP-2

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13J-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 25' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

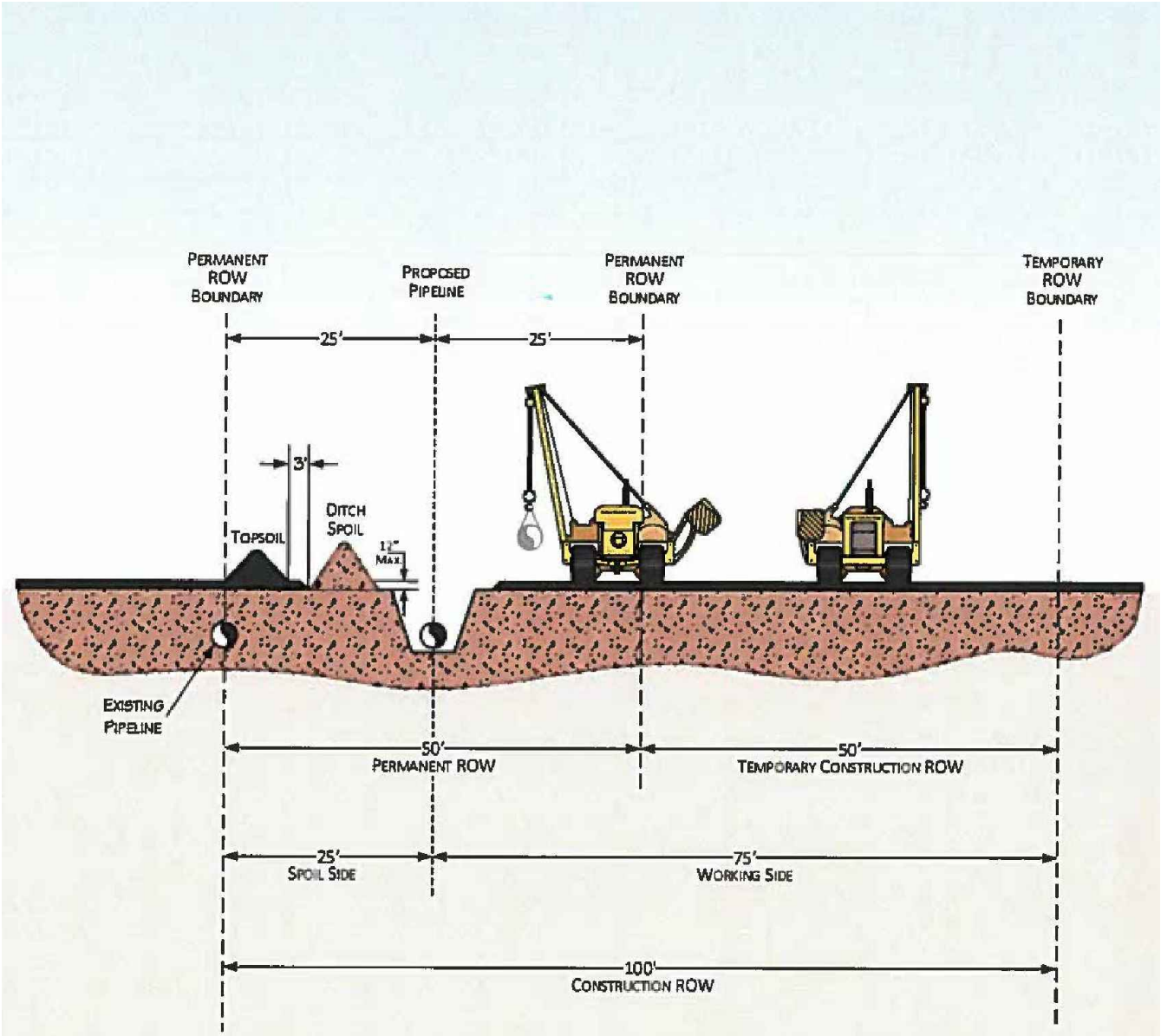
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN NON-AG AREAS AND WETLANDS ACP AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13J-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 50' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

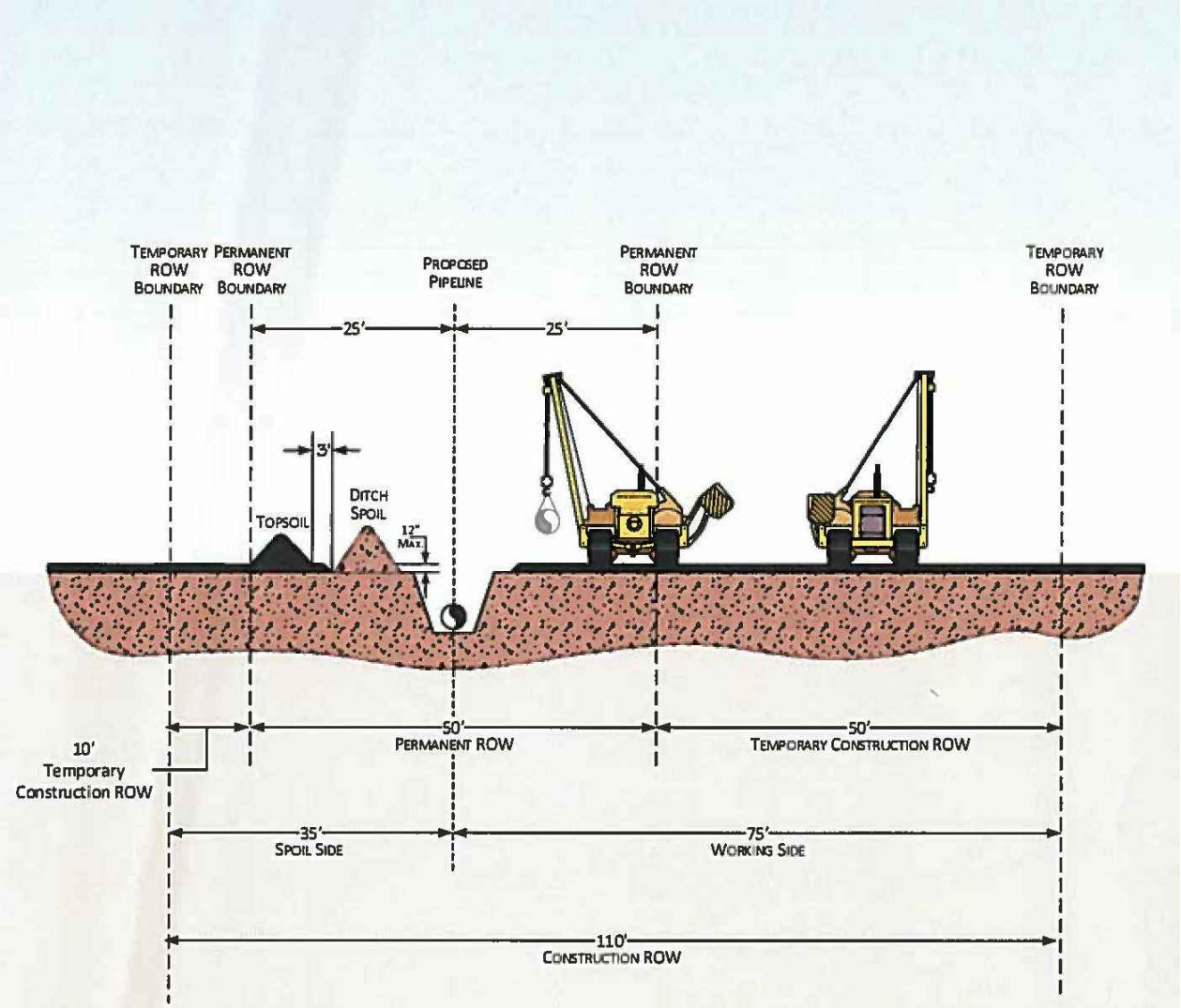
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN COLLOCATED NON-AG AREAS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13J-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 110' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 60' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

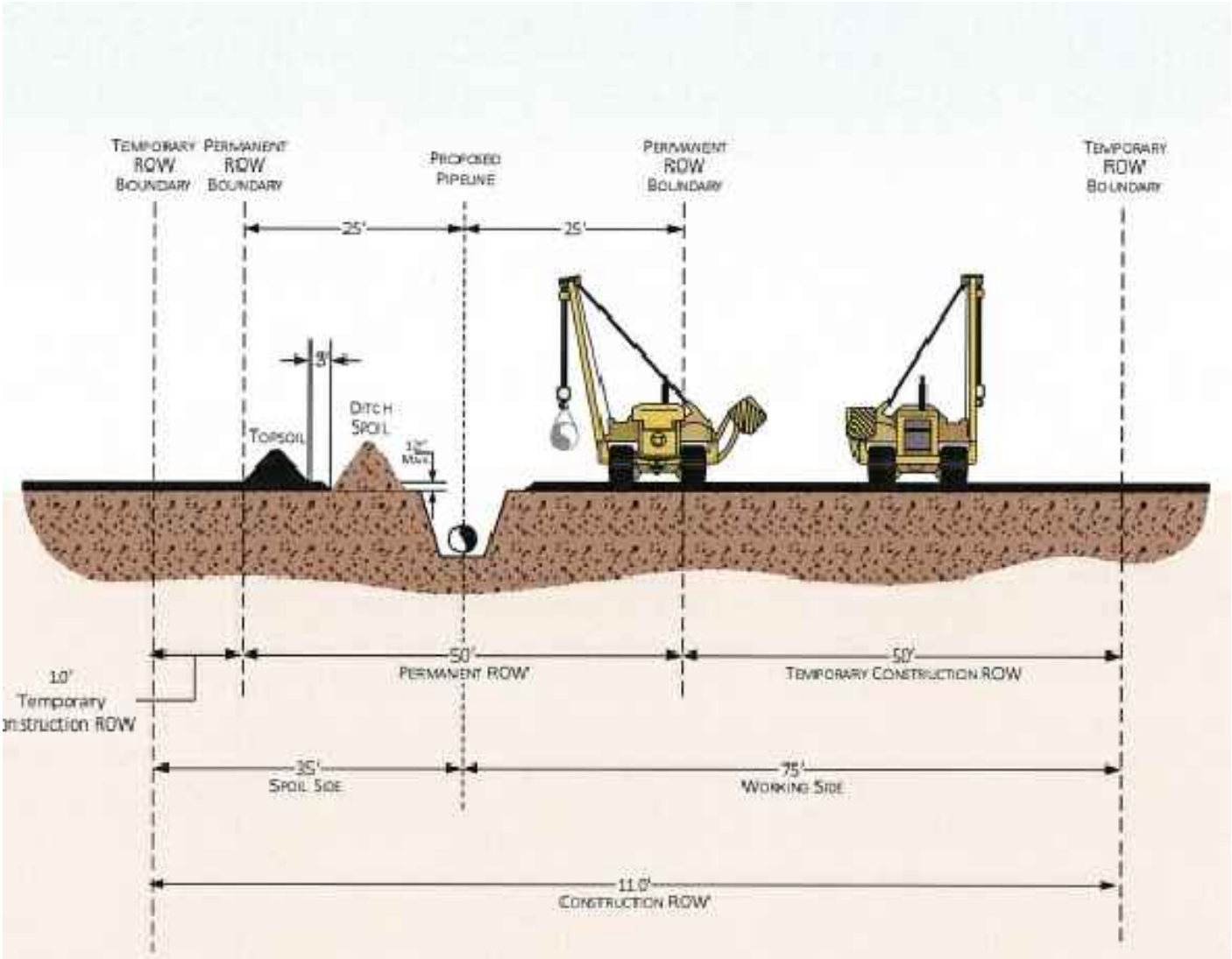
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW NOT-COLLOCATED IN NON-AG AREAS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13J-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 110' WIDE CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 60' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

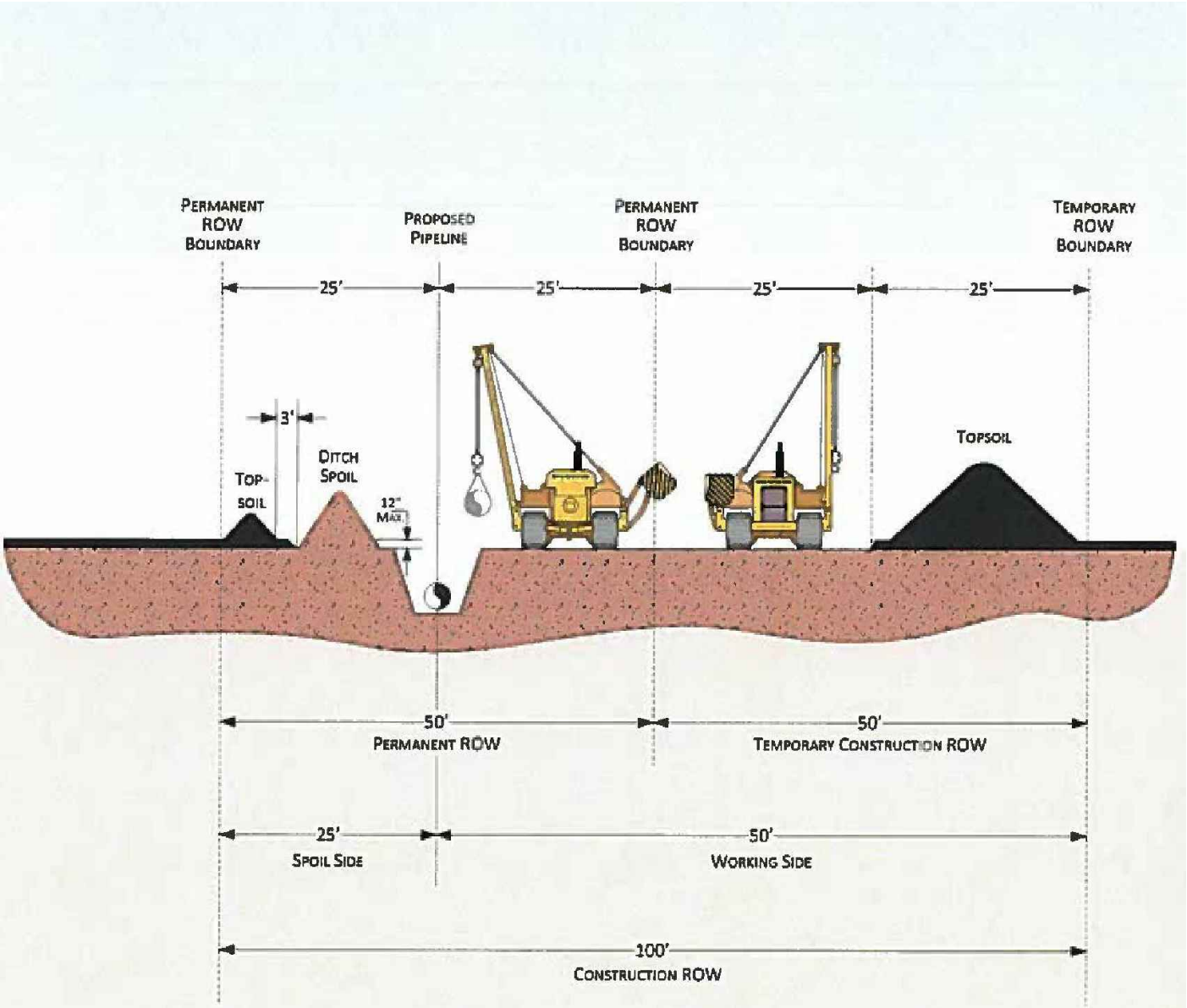
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN AG AREAS ACP AP-2

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13K-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1 in



PROFILE

NOTES:

1. IN AGRICULTURAL AREAS WHERE FULL WIDTH TOPSOIL STRIPPING IS REQUIRED, AN ADDITIONAL 25' OF TEMPORARY WORKSPACE WILL BE REQUIRED. IN THIS SCENARIO, THE CONSTRUCTION RIGHT-OF-WAY WILL BE 100' WIDE, CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 50' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

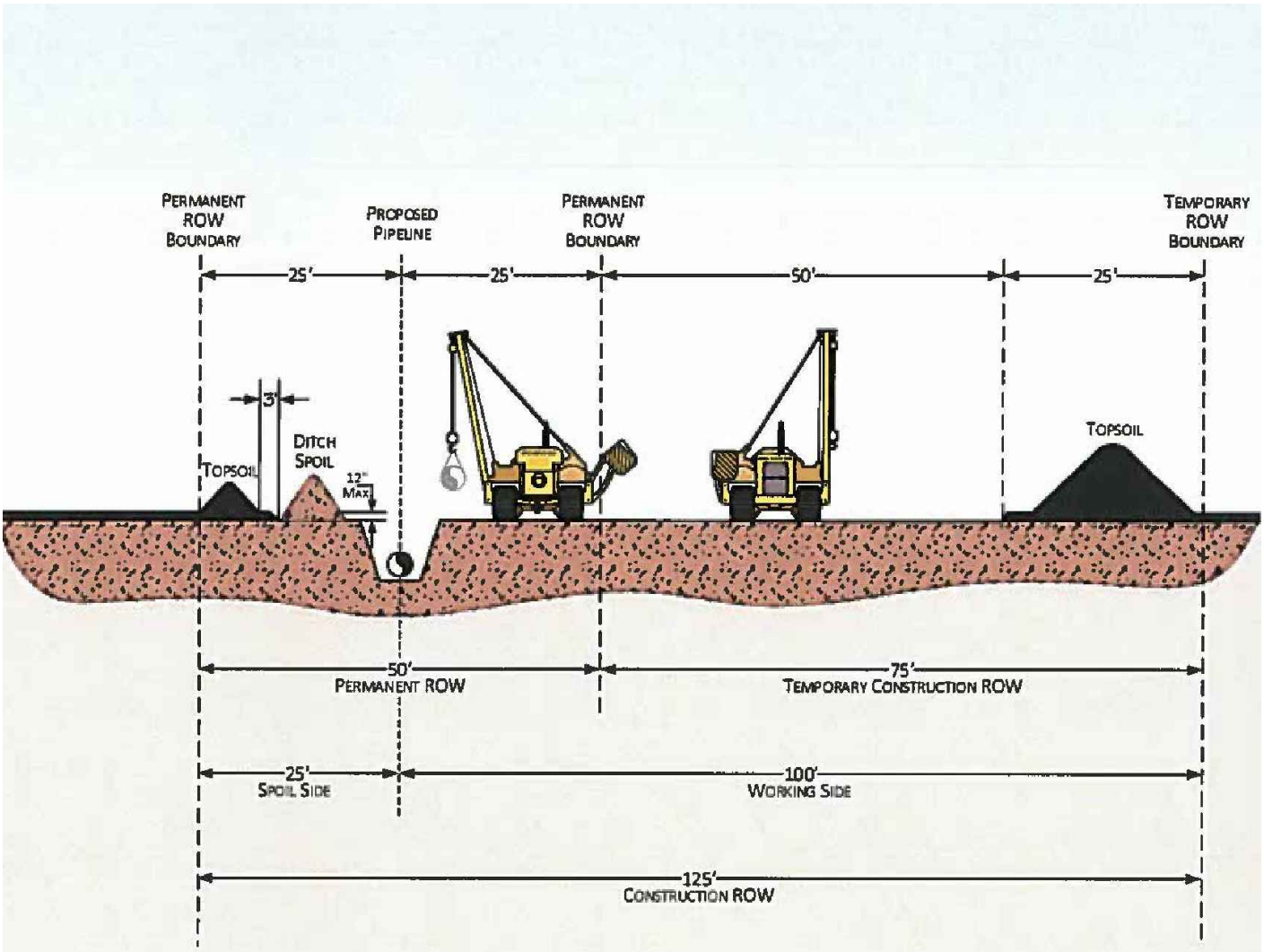
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW IN AG AREAS ACP AP-3 AP-4 AP-5

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13K-2

0 1 in
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



PROFILE

NOTES:

1. IN AGRICULTURAL AREAS WHERE FULL WIDTH TOPSOIL STRIPPING IS REQUIRED, AN ADDITIONAL 25' OF TEMPORARY WORKSPACE WILL BE REQUIRED. IN THIS SCENARIO, THE CONSTRUCTION RIGHT-OF-WAY WILL BE 125' WIDE, CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 75' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

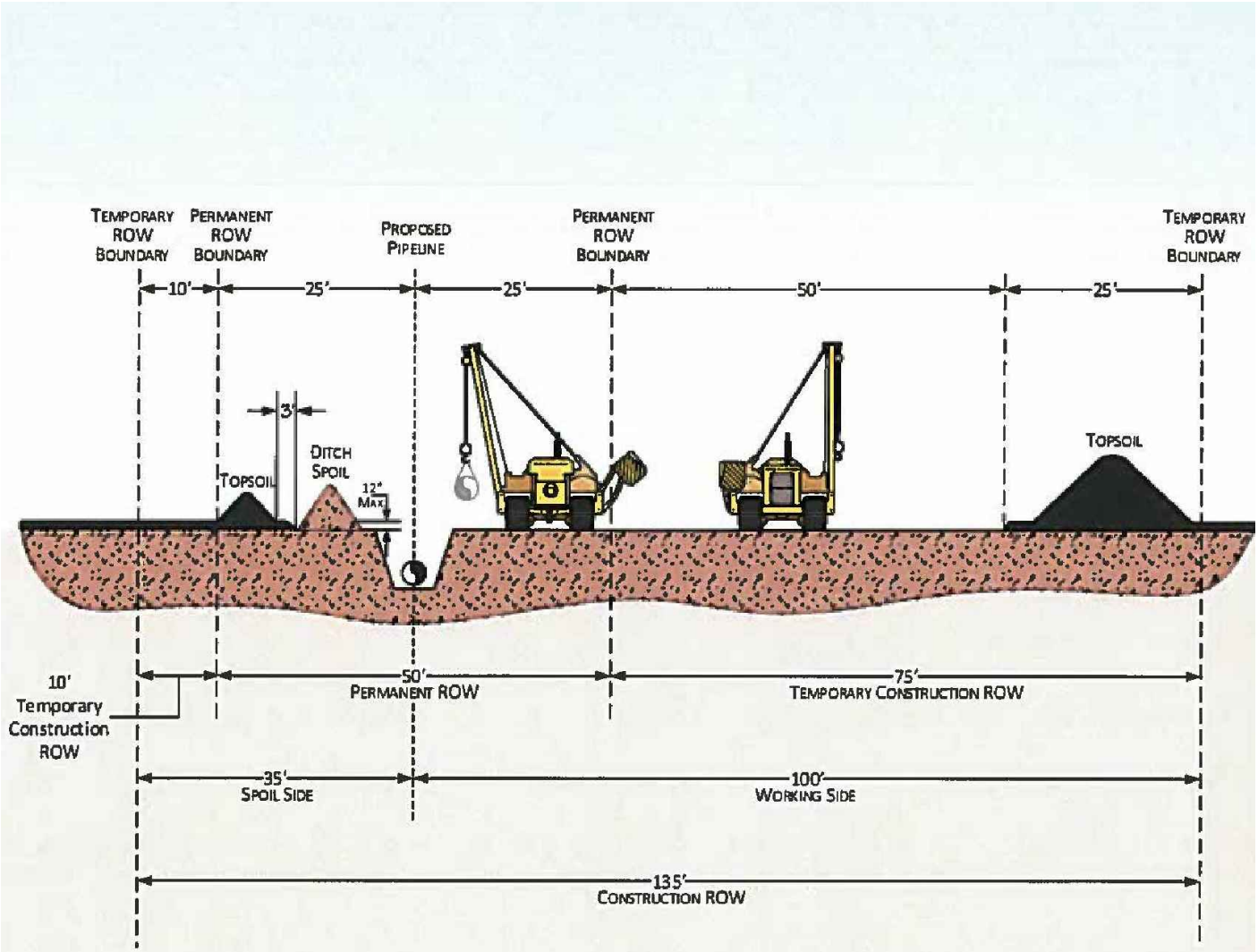
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW COLLOCATED IN AG AREAS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13K-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



PROFILE

NOTES:

1. IN AGRICULTURAL AREAS WHERE FULL WIDTH TOPSOIL STRIPPING IS REQUIRED, AN ADDITIONAL 25' OF TEMPORARY WORKSPACE WILL BE REQUIRED. IN THIS SCENARIO, THE CONSTRUCTION RIGHT-OF-WAY WILL BE 135' WIDE, CONSISTING OF 50' OF PERMANENT RIGHT-OF-WAY AND 85' OF TEMPORARY CONSTRUCTION RIGHT-OF-WAY. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

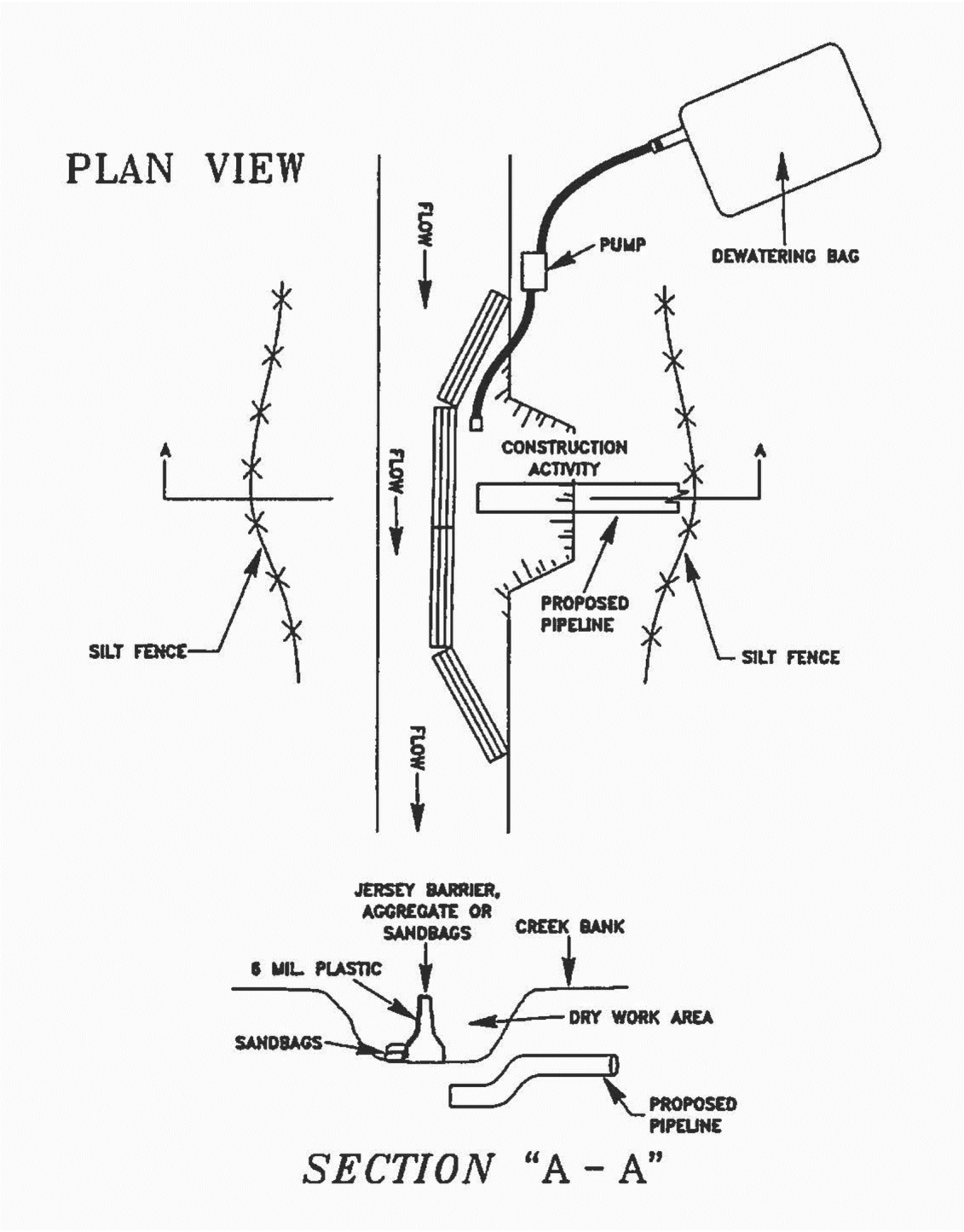
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP CONSTRUCTION ROW NOT-COLLOCATED IN AG AREAS SHP TL-635 TL-636

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13K-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in



CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
TYP COFFERDAM CROSSING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	13L

0 1 cm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. INCLUDES, BUT IS NOT LIMITED TO, SITE SPECIFIC INVESTIGATIONS, ASSESSMENTS, ANALYSIS, DETAILED ENGINEERING, AND DESIGN WORK DEVELOPED TO MITIGATE FOR SPECIALIZED SITE GEOTECHNICAL, HYDROTECHNICAL, OR GEOLOGIC CONDITIONS THAT MAY BE IMPOSED ON THE PIPELINE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

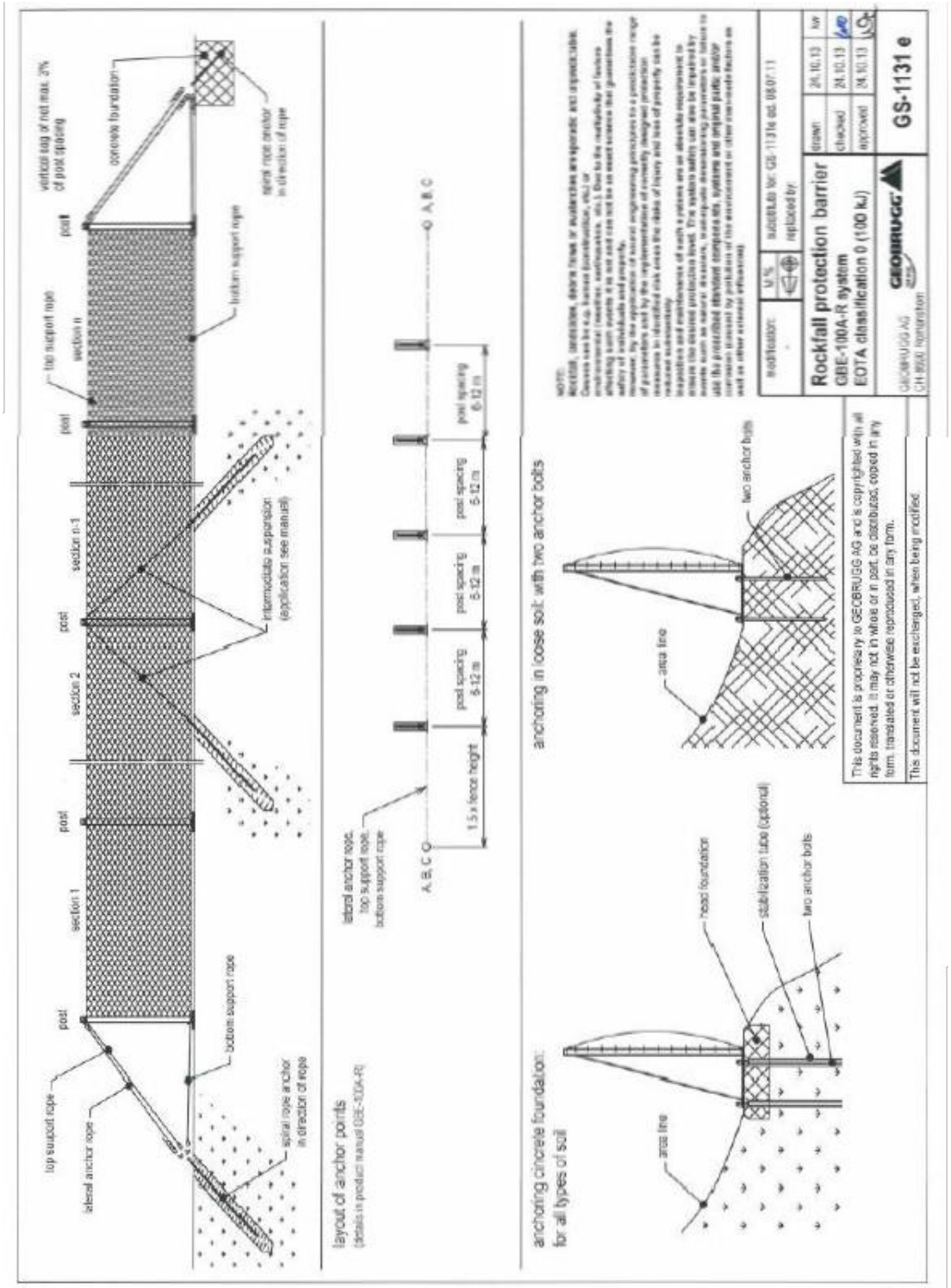
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
SITE SPECIFIC DETAILED ENGINEERING

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	14A

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



NOTE(S)

1. FINAL CONFIGURATION OF ROCK FALL PROTECTION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
MESH FENCE - ROCK FALL PROTECTION

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	14B

0 1 m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL PLANNING, DESIGN, AND IMPLEMENTATION OF BLASTING ACTIVITIES TO BE DETERMINED BASED ON SITE SPECIFIC CONDITIONS, AND MUST FOLLOW SPECIFICATIONS AND REQUIREMENTS AS DIRECTED BY DOMINION.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
BLASTING PLANS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	14C

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

0 1in

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. ADJUST ROUTING, ALIGNMENT, LOCATION (VERTICALLY OR HORIZONTALLY), OR POSITION WITHIN THE ROW OF THE PIPELINE TO AVOID IDENTIFIED HAZARDS. EXAMPLES MAY INCLUDE, BUT ARE NOT LIMITED TO, NEW ROW LOCATIONS THAT DEPART ENTIRELY FROM THE CURRENT ALIGNMENT BY SIGNIFICANT DISTANCES, RELATIVELY SMALLER ALIGNMENT SHIFTS THAT OFFSET FOR SHORTER DISTANCES FROM THE CURRENT ALIGNMENT, MINOR ADJUSTMENTS TO THE ALIGNMENT THAT REMAIN WITHIN THE ROW BOUNDARIES, LOWERING THE PIPELINE BELOW IDENTIFIED HAZARDS WHILE STAYING WITHIN THE ROW, ETC. CHANGING ROW ALIGNMENTS REQUIRES SITE SPECIFIC PLANNING, PERMITTING, ASSESSMENTS, LAND AND PROPERTY REVIEW AND COORDINATION, ENGINEERING DESIGN TO FIT THE NEW SITE CONDITIONS, AND OTHER TECHNICAL SUPPORT EFFORTS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
AVOIDANCE

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	15A

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SITE INVESTIGATIONS NEEDED TO CONFIRM LATERAL AND VERTICAL EXTENT OF IDENTIFIED LANDSLIDE OR OTHER UNSTABLE SLOPE CONDITIONS.

3. INVESTIGATION MAY INCLUDE PROBES, TEST PITS, EXCAVATIONS ALONG PIPELINE TRENCH, GEOPHYSICAL METHODS (I.E. NON-INTRUSIVE GPR, SEISMIC OR ELECTRICAL METHODS), OR MAY REQUIRE DEEPER SUBSURFACE DRILLING METHODS. FINAL INVESTIGATION METHONGS(S) TO BE DETERMINED BASED ON SITE CONDITIONS AND REQUIREMENTS OF SITE WORK.

4. EXCAVATIONS TO REMOVE IDENTIFIED LANDSLIDE OR OTHER UNSTABLE SLOPE CONDITIONS SHOULD BE COMPLETED FOR THE FULL EXTENT OF CHARACTERIZED HAZARD AREA, AT A MINIMUM MATCHING OR EXCEEDING THE UNDERLYING AND/OR LATERAL BOUNDING FAILURE SURFACE AND/OR SLIP PLANE. THE GOAL AND INTENT OF THIS MITIGATION APPROACH IS TO ESSENTIALLY REMOVE THE SLOPE HAZARD FROM THE SITE BY DIGGING OUT THE LIMITS OF THE IDENTIFIED HAZARD.

5. REMOVAL OF TARGETED LANDSLIDE AND/OR UNSTABLE SLOPE MATERIALS MAY REQUIRE SPECIAL CONSIDERATIONS FOR OTHER DIRECTLY OR INDIRECTLY RELATED OR CONNECTED SITE MITIGATION MEASURES AND/OR SITE ACTIVITIES TO ADDRESS SAFETY, SLOPE STABILITY, ACCESS, CONSTRUCTION FEASIBILITY, ETC, THEREFORE, PLANNING FOR IMPLEMENTATION OF THIS OPTION SHOULD INCLUDE A COMPREHENSIVE REVIEW OF EXISTING PROPOSED WORK AT THE SITE.

6. EXCAVATED MATERIALS SHOULD BE SPOILED IN LOCATION(S) THAT DO NOT ACCELERATE OR EXACERBATE THE TARGETED LANDSLIDE OR UNSTABLE SLOPE AREA, OR IMPACT OTHER NEIGHBORING LANDSLIDES OR UNSTABLE SLOPE AREAS.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
EXCAVATION REMOVAL OF HAZARD

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	15B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 1in

NOTE(S)

1. ACCESS FOR PIPELINE ROW'S IN RUGGED AND REMOTE TERRAIN MAY BE LIMITED TO THE CONSTRUCTED ROW. IN THESE SCENARIOS, CONSTRUCTING INDEPENDENT ACCESS POINTS AND ROADS IS TYPICALLY MINIMIZED TO THEREBY ALSO MINIMIZE DISTURBANCE. AS SUCH, THE PRIMARY ACCESS IS COMMONLY ALONG THE TEMPORARY CONSTRUCTED ROW FOLLOWING THE PIPELINE ALIGNMENT, AND IS THEN NO LONGER AVAILABLE AFTER THE ROW IS RESTORED. THIS BIC MITIGATION MEASURE IS INTENDED TO IDENTIFY AREAS WHERE ACCESS MAY BE NEEDED TO SUPPORT MONITORING, OPERATION, AND MAINTENANCE OF THE ROW; AND TO COMPLETE THE PLANNING, PERMITTING, DESIGN, AND CONSTRUCTION FOR ACCESS TO THESE LOCATIONS. ADDITIONAL PLANNING, PERMITTING, LAND COORDINATION, ENVIRONMENTAL, AND TECHNICAL EFFORTS ARE REQUIRED TO SUPPORT THIS MITIGATION MEASURE, NOT SPECIFICALLY OUTLINED AND ADDRESSED HEREIN, BUT ANTICIPATED TO BE NEEDED TO IMPLEMENT THIS MITIGATION MEASURE.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
ACCESS TO REMOTE ROW LOCATIONS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	15C

0 1m
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

NOTE(S)

1. FINAL CONFIGURATION OF ROW RESTORATION MEASURES TO BE DETERMINED BASED ON CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION, AND MAY CHANGE OR VARY AND/OR INCORPORATE ADDITIONAL TYPICAL DETAILS TO MITIGATE TARGETED CONDITIONS.

2. SITE SPECIFIC STUDIES FOR POTENTIAL KARST HAZARDS WILL BE COMPLETED TO IDENTIFY, CHARACTERIZE, AND DEVELOP MITIGATION RECOMMENDATIONS, AS NEEDED.

CLIENT
DOMINION

PROJECT
BIC/INCREMENTAL CONTROLS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-02-28
PREPARED	REDMOND
DESIGN	DBC
REVIEW	-
APPROVED	AQK

TITLE
KARST HAZARDS

PROJECT No.	PHASE	Rev.	FIGURE
1535050	500	F	16A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

0 1 in

Site-Specific Designs

APPENDIX X

Access Road and ROW Post-Construction SWM Evaluation

ENVIRONMENTAL RESOURCES MANAGEMENT

REPORT

Dominion Energy Transmission, Inc.

Appendix X - Access Road and Right-of-Way Post-Construction Stormwater Management Evaluation Report

Atlantic Coast Pipeline

June 12, 2017

Project Number 0345197

Environmental Resources Management
180 Admiral Cochrane Drive, Suite 400
Annapolis, MD 21401

ERM

REPORT

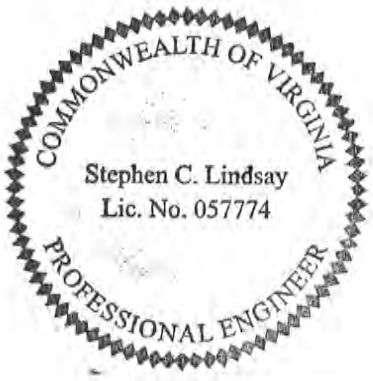
Dominion Energy Transmission, Inc.

Appendix X - Access Road and Right-of-Way Post-Construction Stormwater Management Evaluation Report

Atlantic Coast Pipeline

June 12, 2017

Project Number 0345197



Stephen Lindsay, P.E.
Senior Engineer

Alla Flaksman
Project Engineer

Environmental Resources Management, Inc.
180 Admiral Cochrane Drive, Suite 400
Annapolis, MD 21401

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 HYDROLOGIC CONDITIONS 2

2.1 HYDROLOGIC SOIL GROUPS 2

2.2 LAND COVER 2

2.2.1 Land Cover Development 2

2.2.2 Land Cover Conversion to Curve Numbers for Water Quantity Analysis 3

2.2.3 Land Cover Conversion to VRRM Land Cover for Water Quality Analysis 3

2.3 TOPOGRAPHY 3

2.3.1 Drainage Basin Analysis 3

2.3.2 Culvert Drainage Area Analysis 3

2.4 STORM EVENTS AND PRECIPITATION DEPTHS 3

2.4.1 Storm Events 3

2.4.2 Drainage Basin Precipitation Depths 4

2.4.3 Culvert and Ditch Analysis Precipitation Depths 4

3.0 WATER QUANTITY EVALUATION 5

3.1 DRAINAGE BASIN ANALYSIS 5

3.1.1 Development of Drainage Basins 5

3.1.2 Water Quantity 6

3.2 CULVERT AND DITCH ANALYSIS 7

3.2.1 Development of Culvert Drainage Areas and Time of Concentration 7

3.2.2 Water Quantity 8

3.2.3 Energy Balance 8

3.2.4 Culvert Analysis 9

3.2.5 Roadside Ditch Analysis 10

3.3 CONCLUSIONS 11

3.3.1 Drainage Basin Level Water Quantity Evaluation 11

3.3.2 Culvert Level Water Quantity Evaluation 11

4.0 WATER QUALITY EVALUATION *13*

4.1 METHODOLOGY *13*

4.2 CONCLUSIONS *13*

5.0 REFERENCES *14*

LIST OF TABLES

Table 1.1 Hydrologic Soil Group Assignments for Soils Without SSURGO Database Classification

Table 1.2 Land Cover Conversions

Table 1.3 Curve Number Assignments

Table 2 Water Quantity for Drainage Basins

Table 3 Energy Balance for Drainage Basins

Table 4 through 8 Permanent and Temporary Access Roads

Tables 4.001-007 to 8.001-007 Permanent Access Roads, Spread 3A

Tables 4.001-007 Culvert List

Tables 5.001-007 Water Quantity

Tables 6.001-007 Energy Balance

Tables 7.001-007 Culvert Sizing

Tables 8.001-007 Roadside Ditch Sizing Table

Tables 4.008-015 to 8.008-015 Permanent Access Roads, Spread 4

Tables 4.008-015 Culvert List

Tables 5.008-015 Water Quantity

Tables 6.008-015 Energy Balance

Tables 7.008-015 Culvert Sizing

Tables 8.008-015 Roadside Ditch Sizing Table

Tables 4.016-026 to 8.016-026 Permanent Access Roads, Spread 4A

Tables 4.016-026 Culvert List

Tables 5.016-026 Water Quantity

Tables 6.016-026 Energy Balance

Tables 7.016-026 Culvert Sizing

Tables 8.016-026 Roadside Ditch Sizing Table

Tables 4.027 to 8.027 Temporary Access Road, Spread 4A

Table 4.027 Culvert List

Table 5.027 Water Quantity

Table 7.027 Culvert Sizing

Table 8.027 Roadside Ditch Sizing Table

Tables 4.028-032 to 8.028-032 Permanent Access Roads, Spread 4A

Tables 4.028-032 Culvert List

Tables 5.028-032 Water Quantity

Tables 6.028-032 Energy Balance

Tables 7.028-032 Culvert Sizing

Tables 8.028-032 Roadside Ditch Sizing Table

Tables 4.033-043 to 8.033-043 Permanent Access Roads, Spread 5

Tables 4.033-043 Culvert List

Tables 5.033-043 Water Quantity

Tables 6.33-043 Energy Balance

Tables 7 033-043 Culvert Sizing

Tables 8.033-043 Roadside Ditch Sizing Table

Tables 4.044-052 to 8.044-052 Permanent Access Roads, Spread 6

Tables 4.044-052 Culvert List

Tables 5.044-052 Water Quantity

Tables 6.044-052 Energy Balance

Tables 7.044-052 Culvert Sizing

Tables 8.044-052 Roadside Ditch Sizing Table

Tables 4.053 to 8.053 Temporary Access Road, Spread 6

Table 4.053 Culvert List

Table 5.053 Water Quantity

Table 7.053 Culvert Sizing

Table 8.053 Roadside Ditch Sizing Table

Tables 4.054-057 to 8.054-057 Permanent Access Roads, Spread 6

Tables 4.054-057 Culvert List

Tables 5.054-057 Water Quantity

Tables 6.054-057 Energy Balance

Tables 7.054-057 Culvert Sizing

Tables 8.054-057 Roadside Ditch Sizing Table

Tables 4.058 to 8.058 Temporary Access Road, Spread 6

Table 4.058 Culvert List

Table 5.058 Water Quantity

Table 7.058 Culvert Sizing

Table 8.058 Roadside Ditch Sizing Table

Tables 4.059-061 to 8.059-061 Permanent Access Roads, Spread 6

Tables 4.059-061 Culvert List

Tables 5.059-061 Water Quantity

Tables 6.059-061 Energy Balance

Tables 7.059-061 Culvert Sizing

Tables 8.059-061 Roadside Ditch Sizing Table

Tables 4.062-071 to 8.062-071 Permanent Access Roads, Spread 7

Tables 4.062-071 Culvert List

Tables 5. 062-071 Water Quantity

Tables 6.062-071 Energy Balance

Tables 7.062-071 Culvert Sizing

Tables 8.062-071 Roadside Ditch Sizing Table

Tables 4.072 to 8.072 Temporary Access Road, Spread 7

Table 4.072 Culvert List

Table 5.072 Water Quantity

Table 7.072 Culvert Sizing

Table 8.072 Roadside Ditch Sizing Table

Tables 4.073-077 to 8.073-077 Permanent Access Roads, Spread 7

Tables 4.073-077 Culvert List

Tables 5. 073-077 Water Quantity

Tables 6.073-077 Energy Balance

Tables 7.073-077 Culvert Sizing

Tables 8.073-077 Roadside Ditch Sizing Table

Tables 4.078-089 to 8.078-089 Permanent Access Roads, Spread 11

Tables 4.078-089 Culvert List

Tables 5.078-089 Water Quantity

Tables 6.078-089 Energy Balance

Tables 7.078-089 Culvert Sizing

Tables 8.078-089 Roadside Ditch Sizing Table

Table 9.1 Summary of DEQ Virginia Runoff Reduction Method Water Quality Calculations

Table 9.2 Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations

Table 9.3 Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations

LIST OF FIGURES

Figure 1 Drainage Basin Map Book

Figure 2.1 Culvert and Ditch Analysis Map Book for Permanent Access Roads, Pre-Development Conditions

Figure 2.2 Culvert and Ditch Analysis Map Book for Permanent Access Roads, Post-Development Conditions

Figure 2.3 Culvert and Ditch Analysis Map Book for Temporary Access Roads, Construction Conditions

Figure 3.1 Water Quality Map Book, Pre-Development Conditions

Figure 3.2 Water Quality Map Book, Post-Development Conditions

LIST OF ATTACHMENTS

Attachment 1.1 Permanent Culvert Drainage Areas, Pre-Development Conditions Hydrographs

Attachment 1.2 Permanent Culvert Drainage Areas, Post-Development Conditions Hydrographs

Attachment 1.3 Temporary Culvert Drainage Areas, Construction Conditions Hydrographs

Attachment 2.1 DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheets – Version 3.0

Attachment 2.2 DEQ Virginia Runoff Reduction Method Re-Development Compliance Spreadsheets -Version 3.0

Attachment 3.1 Circular Pipe Flow Charts

Attachment 3.2 Riprap Outlet Protection Reference

Attachment 3.3 Roadside Ditch Analysis Reference

1.0 INTRODUCTION

This Access Road and Right-of-Way (ROW) Post-Construction Stormwater Management (SWM) Evaluation addresses compliance of ACP with Virginia's water quantity and quality criteria as set forth in 9 VAC 25-870-66 and 9 VAC 25-870-63, respectively, and related Virginia Department of Environmental Quality (VDEQ) guidance.

This evaluation considers the ACP project pipeline ROW, which consists of approximately 307 miles in Virginia, as well as those project areas where a permanent change in land cover is expected to occur – specifically, existing permanent access roads that will receive major upgrades and new permanent access roads. For purposes of this evaluation, there are a total of 61 existing permanent access roads to receive major upgrades and 24 new permanent access roads. Existing permanent access roads that will receive no upgrades or minor upgrades are not considered in this evaluation since there is no proposed change in land cover or increase in impervious area associated with these roads. Evaluation of water quantity and quality requirements for aboveground facilities such as compressor stations and metering and regulation (M&R) stations are addressed separately in site-specific plans.

Additionally, this evaluation includes sizing of culverts and associated outlet protection for existing access roads to receive major upgrades and new access roads. Selection of corresponding roadside ditch geometry and lining type is also included. A total of 941 culverts are proposed along 24 new permanent access roads, 61 existing permanent major upgrade roads, and four temporary roads.

The methodology, results, and conclusions of the Access Road and ROW Post-Construction SWM Evaluation are discussed in the following sections.

2.0 HYDROLOGIC CONDITIONS

2.1 HYDROLOGIC SOIL GROUPS

The Hydrologic Soil Group (HSG) classification is obtained from the Soil Survey Geographic Database (SSURGO) publically available from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The HSG D is assigned in cases where the HSG is listed as A/D, B/D, or C/D. In cases where HSG was not listed, HSG was assigned as presented in Table 1.1.

2.2 LAND COVER

2.2.1 Land Cover Development

The baseline land cover data is obtained from the National Land Cover Database 2011 (NLCD 2011) publically available from the Multi-Resolution Land Characteristics (MRLC) Consortium. This evaluation utilizes eleven categories based on the standard NLCD 2011 land cover classifications and one additional category, Gravel, which reflects the assumption for access road land cover. Each of the twelve total land cover categories and the associated NLCD 2011 land cover classification is presented in Table 1.2.

The data set used for the pre-development land cover condition in this analysis is developed using the baseline land cover data and the assumption that each existing major upgrade permanent access road is approximately eight (8) feet wide and surfaced with gravel.

The data set for the post-development land cover condition in this analysis is developed using the baseline land cover data and the following assumptions for each new and existing major upgrade permanent access road:

- the access road is approximately 16 feet wide and surfaced with gravel; and
- all areas categorized as Forest within the pipeline permanent and temporary ROW will be converted to the Shrub land cover category.

2.2.2 *Land Cover Conversion to Curve Numbers for Water Quantity Analysis*

To facilitate the evaluation of water quantity, runoff Curve Numbers (CNs) are assigned to each land cover category using the land cover descriptions presented in the Urban Hydrology for Small Watersheds TR-55 (TR-55) manual. The correlation of the land cover categories with TR-55 land cover descriptions and the associated CN's are presented in Table 1.3.

2.2.3 *Land Cover Conversion to VRRM Land Cover for Water Quality Analysis*

To facilitate the evaluation of water quality, each of the twelve land cover categories, except Water, are associated with one of the three Virginia Runoff Reduction Method (VRRM) land covers. The correlation of land cover categories with the VRRM land cover classifications are listed in Table 1.2. Areas within the Water land cover category were excluded from the water quality analysis.

2.3 *TOPOGRAPHY*

2.3.1 *Drainage Basin Analysis*

The drainage basin analysis utilizes the best consistently-available topography along the project route. The topography was derived from National Elevation Dataset (NED) publically available from the United States Geological Survey (USGS). The resolution of the topography is 1/3 arc-second, or about 10 meters.

2.3.2 *Culvert Drainage Area Analysis*

The culvert drainage area analysis utilizes the best available topography, which is derived from several sources, including project-specific LiDAR fly over and publically available topography. Since multiple sources are utilized, the contour intervals vary with location.

2.4 *STORM EVENTS AND PRECIPITATION DEPTHS*

2.4.1 *Storm Events*

Runoff volumes and peak flow rates are calculated for the 24-hour 1-year, 24-hour 2-year, and 24-hour 10-year storm events.

2.4.2 Drainage Basin Precipitation Depths

The drainage basin analysis utilizes precipitation depths publically available from the National Oceanic and Atmospheric Administration's (NOAA's) National Weather Service (NWS) Precipitation Frequency Data Server. Typical precipitation depths for each storm event are selected for each drainage basin and are listed in Table 2.

2.4.3 Culvert and Ditch Analysis Precipitation Depths

The culvert and ditch analysis utilizes precipitation depths from the TP-40 atlas. The precipitation depths for each storm event are selected for each culvert and ditch based on location by county using HydroCAD look-up tables. The corresponding county, as well as drainage basin and 12-digit Hydrologic Unit Code (HUC-12) watershed, is listed in Tables 4.001-089. The precipitation depths for each culvert and ditch are listed in Tables 5.001-089.

3.0 WATER QUANTITY EVALUATION

The water quantity evaluation considers the local drainage basins delineated along the project ROW and the drainage areas associated with each proposed culvert.

The pre-development and the post-development runoff volumes and peak flow rates for the local drainage basins and the culvert drainage areas are compared to evaluate compliance with flood protection requirements.

The Virginia Stormwater Management Program (VSMP) Energy Balance Method for Natural Stormwater Conveyance Systems is applied to evaluate compliance with downstream channel protection requirements. The Improvement Factor (IF) of 1.0 is selected for the project based on pre-application discussions with the VDEQ.

3.1 DRAINAGE BASIN ANALYSIS

3.1.1 Development of Drainage Basins

Local drainage basins that encompass the permanent and temporary pipeline ROW and the new and existing major upgrade permanent access roads are delineated using the best consistently-available topography as discussed in Section 2.3.1 and the local stream network derived from the National Hydrography Dataset (NHD) publically available from USGS. A total of 170 drainage basins have been delineated using the Watershed Modeling System (WMS) software. The drainage basin boundaries, the corresponding stream network, and the associated Points of Analyses are presented in the map book in Figure 1. A table of contents linking each drainage basin with the corresponding map book page precedes the map book in Figure 1.

The point of analysis for each drainage basin is selected so that no drainage basin flows into another drainage basin and no drainage basin areas overlap.

Composite CNs that represent the pre-development and the post-development conditions are computed for each drainage basin using land covers discussed in Section 2.2.1. Generally, the pre-development and the post-development CNs are the same except for drainage basins 25, 229, and 352 where the post-development CNs are one point lower than the pre-development CNs. Nominal differences in drainage basin CNs are

expected because the project proposes minimal changes to land cover as presented in section 2.2.1.

The Time of Concentration (Tc) for each drainage basin is developed using the Watershed Lag method as described in the National Engineering Handbook (NEH) and computed using the WMS software. The Watershed Lag method, rather than the velocity method, is chosen for the calculation of the drainage basin Tc to capture the topographical and land cover characteristics of the whole drainage basin. The resulting Tc calculations represent the composite characteristic of each drainage basin. The pre-development and post-development Tcs are the same because the project proposes minimal changes to land cover and no changes to existing topography.

3.1.2 Water Quantity

The 24-hour 1-year, 24-hour 2-year, and 24-hour 10-year pre-development and post-development runoff volume and peak flow rates for each drainage basin are calculated using WMS software per TR-55 methodology and are presented in Table 2. The pre-development and the post-development peak flow rates are compared for each storm event. Since peak flow rate increases are not expected in any of the drainage basins evaluated as a result of the project, flooding risk is not expected to increase.

The VSMP Energy Balance is considered to be met so that:

$$Q1\text{-yr Dev.} \leq I.F.(Q1\text{-yr Pre-Dev.})(RV1\text{-yr Pre-Dev.}) / RV1\text{-yr Dev.}$$

where:

Q1-yr Dev.: 1-year, 24-hour post-development peak flow rate;
I.F.: Improvement Factor = 1.0;
Q1-yr Pre-Dev: 1-year, 24-hour pre-development peak flow rate;
RV1-yr Pre-Dev.: 1-year, 24-hour pre-development runoff volume; and
RV1-yr Dev.: 1-year, 24-hour post-development runoff volume.

The 24-hour, 1-year pre-development and post-development peak flow rates and runoff volumes and the evaluation of the VSMP Energy Balance Method are presented in Table 3 for each drainage basin. The VSMP Energy Balance is met for each drainage basin and consequently, the project is not expected to impact downstream receiving channels.

3.2 CULVERT AND DITCH ANALYSIS

The evaluation of culverts and ditches is organized by corresponding access road and construction spread. Tables 4.001 - 089 list each culvert, the corresponding access road, construction spread, and the associated alignment/access road sheets. The county, HUC-12 watershed, and drainage basin associated with each culvert are listed in Tables 4.001 to 4.089 as well.

The pre-development and the post-development drainage areas and Tc flow paths of new permanent access roads and existing permanent access roads with major upgrades are presented in Figures 2.1 and 2.2, respectively. The drainage areas and Tc flow paths associated with culverts on new temporary access roads existing temporary access roads with major upgrades are presented in Figure 2.3. The culverts associated with temporary access roads are proposed to be installed only for the duration of the project construction; therefore only construction conditions are evaluated and depicted.

3.2.1 Development of Culvert Drainage Areas and Time of Concentration

The culvert drainage areas were delineated manually in AutoCAD Civil 3D using project-specific topographic survey data, LiDAR topography, and USGS data. The best-available topography was utilized in each area.

Composite CNs that represent the pre-development and the post-development conditions are computed for each culvert drainage area using land covers discussed in Section 2.2.1.

The Tc path for each culvert drainage area was developed using the velocity method. The measurements of the sheet, shallow concentrated, and channel flow lengths were performed using AutoCAD Civil 3D software. The hydraulically most distant point in each watershed was identified, then the flow path was drawn to the point of the proposed roadside ditch, the line continued along the line of the proposed ditch to the culvert at the culvert drainage area outlet point. The culvert drainage area is then divided into subsets including sheet flow, shallow concentrated flow, and channel flow. The roadside ditch is considered the point where channel flow begins, except for culvert drainage areas large enough to have a blue line stream delineated on the corresponding USGS map or streams that were delineated by field environmental scientists. Sheet flow segments were typically considered to be 100 feet long except for smaller drainage areas where shorter sheet flow segments were considered.

3.2.2 Water Quantity

The 24-hour 1-year, 24-hour 2-year, and 24-hour 10-year pre-development and post-development runoff volumes and peak flow rates for each culvert drainage area were calculated using HydroCAD version 10.0 software per TR-55 methodology and are presented in Tables 5.001 to 5.089. The default rainfall distribution settings for a Type II 24-hour distribution were used. Precipitation depths were selected based on the county in which the access road is located.

A routing diagram was constructed within HydroCAD by placing a subcatchment node for each culvert on an access road. The subcatchments represent the drainage areas for each culvert. Inputs included drainage area size in acres; composite CN; and flow paths and slopes for the drainage area sheet, shallow concentrated, and channel flow segments. As discussed in Section 3.2.1, the point where the Tc flow path entered the roadside ditch is where channel flow was determined to start. For purposes of determining the pre-development Tc flow path, it was assumed that existing major upgrade access roads have roadside ditches that convey stormwater runoff from the drainage area upgradient from the access road. It was also assumed that new access roads do not have existing roadside ditches; therefore there is no channel flow segment in the pre-development condition for new access roads. In these locations the shallow concentrated flow segment was extended an additional 30 feet across the access road ROW.

The pre-development conditions hydrographs for permanent culverts are presented in Attachment 1.1. The post-development conditions hydrographs for permanent culverts are presented in Attachment 1.2. The construction conditions hydrographs for temporary culverts are presented in Attachment 1.3.

3.2.3 Energy Balance

The Energy Balance method under 9 VAC 25-870-66 B.3.a was used to calculate the allowable post-development peak flow rate for each culvert drainage area (see Section 3.1.3 for equation and parameter definitions). Tables 6.001 to 6.089 include the calculation of the allowable post-development peak flow rate based on the 1-year 24-hour pre- and post-development runoff volume and peak flow rate determined from HydroCAD. Column A displays the calculated allowable peak flow rate. If the energy balance conditions are not met and the calculated post-development peak flow rate is greater than the allowable post-development peak flow rate calculated in column A, then column B will

display "not met" and column C will display by how much the calculated post-development peak flow rate exceeds the allowable post-development peak flow rate in cubic feet per second (cfs). If the energy balance conditions are met, column B will display "met" and column C will display "n/a". Columns D and E compare the pre- and post-development peak flow rates calculated using HydroCAD. If the calculated post-development peak flow rate exceeds the pre-development peak flow rate column D will display "exceeded". If the post-development peak flow rate does not exceed the pre-development peak flow rate, column D will display "not exceeded". Column E displays the amount by which the pre-development peak flow rate is exceeded or "n/a" if post-developed conditions do not exceed pre-developed conditions. Per the Energy Balance equation, the calculated post-developed peak flow rate is never required to be less than the peak flow rate associated with a forested land cover condition. Columns F, G and H in Tables 6.001 to 6.089 evaluate this condition. It is noted that the Energy Balance is considered satisfied if the runoff volume associated with a culvert drainage area is less than 0.005 acre-feet.

3.2.4 Culvert Analysis

The proposed culverts are sized for the 10-year, 24-hour peak flow rate using design charts for circular pipe flow presented in Appendix 8C-61 of the Virginia Department of Transportation (VDOT) Drainage Manual and included as Attachment 3.1. The culverts are proposed to be constructed using corrugated metal pipe with approximate Manning's roughness coefficient of 0.024. The design limits the headwater depth to the diameter of the culvert. For example, the design maximum headwater depth for a 12-inch culvert is 12 inches. The design slope and maximum discharge capacity for each culvert size is selected using design charts for circular pipe flow considering headwater depth equivalent to culvert diameter and outlet velocity of six feet per second (fps) for 12-inch diameter culverts and eight fps for all other culverts. Culvert size is selected so that the calculated 10-year, 24-hour post-development peak flow rate is no more than 90 percent of the culvert maximum discharge capacity. The final culvert slope is to be adjusted in the field, as needed, to convey the required peak flow rate and to maintain an acceptable discharge velocity. The table below identifies the design criteria for each size culvert considered in the evaluation.

Diameter of Culvert (inches)	Maximum Headwater (inches)	Design Velocity (fps)	Design Slope (feet/feet)	Maximum Discharge Capacity (cfs)	Maximum Allowable Peak Flow Rate(cfs)
12	12	6	0.06	4.5	4.1
18	18	8	0.06	14	12.6
24	24	8	0.04	25	22.5
30	30	8	0.03	40	36
36	36	8	0.023	55	49.5
42	42	8	0.019	75	67.5
48	48	8	0.017	100	90

The culvert outlet protection is selected in accordance with the VDOT Drainage Manual (relevant sections are presented as Attachment 3.2) based on an allowable design outlet velocity of six fps for 12-inch culverts and to eight fps for all other culverts. Outlet protection materials include EC-3 Type B and EC-1 Class A1 and are selected for culvert outlets where the design outlet velocity is up to six fps and eight fps, respectively. The results of the culvert analyses are presented on Tables 7.001 to 7.089.

3.2.5 *Roadside Ditch Analysis*

Roadside ditches are used to collect runoff from the upgradient drainage area and convey it to culverts located along the access road. The roadside ditches are sized per the Hydraulic Engineering Circular (HEC)-15 manual using an iterative process that utilizes the Manning's equation and the continuity equation. The ditch lining is selected by comparing the calculated shear stress associated with the 2-year, 24-hour storm event with the permissible shear stresses for several different lining materials. Lining materials considered in this evaluation are identified in the table below.

Lining Type	Manning's roughness coefficient, n	Permissible Shear Stress (lbs/ft^2)
Grass Lined	0.035	0.398
Riprap (D_{50} - 6 in)	0.069	2.4
Riprap (D_{50} - 12 in)	0.08	4.8

One of several standard roadside ditch geometries is selected using the 10-year, 24-hour peak flow rate. Once the ditch geometry is selected, the lining selection is checked using the actual depth of flow associated with the 2-year, 24-hour peak flow rate. Ditch geometries considered in this evaluation are identified in the table below.

Roadside Ditch Geometry	Bottom Width (feet)	Side Slope (run/rise)
Type I	0	2
Type II	2	2
Type III	4	2

The identified ditch geometry and lining for each ditch segment are presented on Tables 8.001 to 8.089. A summary of the roadside ditch analysis methodology is presented in Attachment 3.3.

3.3 CONCLUSIONS

Compliance with the water quantity criteria is evaluated using a comparison of pre-development and post-development peak flow rates and the VSMP Energy Balance method.

3.3.1 Drainage Basin Level Water Quantity Evaluation

The comparison of pre-development and post-development peak flow rates for each drainage basin indicates that the project is not expected to increase flooding risk in Virginia in any of the drainage basins evaluated. The VSMP Energy Balance is met indicating that the project is not expected to impact downstream channels in any drainage basin. Consequently, the project complies with Virginia's water quantity criteria on a drainage basin level.

3.3.2 Culvert Level Water Quantity Evaluation

The table below summarizes by construction spread the largest difference between the pre-development and post-development peak flow rate for the 1-year, 24-hour storm for any proposed culvert within that construction spread.

Construction Spread	Access Road	Largest Difference between 1-year, 24-hour Pre-and Post-Development Peak Flow Rates (cfs)
3a	06-001-C037.AR1	0.2
4	36-001.AR1	0.2
4a	07-001-A138-AR 9	0.2
5	07-001-A138.AR 1	0.3
6	08-214-B004-AR 1 08-214-B0007.AR 1 09-001-A001.AR2 09-001-A011-AR 1 09-005-AR 3 09-045.AR 3 09-048.AR 1 09-080-AR 1 09-103.AR 2 09-113-AR 1 09-129-AR 2 10-007-AR 1 12-028-AR 1	0.1
7	12-108-AR 1 14-103-AR 1	0.2
11	27-006-AR 2	0.2

The results indicate that, although in some locations the post-developed peak flow rate may exceed the pre-developed peak flow rate, the exceedance is significantly less than one (1) cfs.

Additionally, as discussed in Section 3.2.4, proposed culverts are sized such that outlet velocities are minimized (less than six feet per second for culverts less than 12 inches in diameter and less than 8 feet per second for larger culverts) and outlet protection is provided as needed. As a result, it is concluded that any increase is insignificant and the post-development conditions associated with the project are hydrologically equivalent to pre-development conditions.

4.0 WATER QUALITY EVALUATION

4.1 METHODOLOGY

Compliance with the water quality requirements is evaluated considering the total phosphorus reduction requirement calculated using the VRRM. The conversion of the project land covers into VRRM land cover categories is presented in Table 1.2 and discussed in Sections 2.2.1 and 2.2.3. Project areas within the Water land cover category were excluded from the water quality analysis.

Based on pre-application discussions with the VDEQ, the net total phosphorus load reduction required is tracked by corresponding HUC-12 watershed. The boundaries of the HUC-12 watersheds are publically available online as the Watershed Boundary Dataset (WBD). The project passes through 71 HUC-12 watersheds.

The pipeline permanent and temporary ROW as well as new permanent access roads are considered to be New Development sites and existing permanent access roads with major upgrades are considered to be Re-Development sites per VRRM methodology. A separate calculation is performed for each segment of the pipeline and access road ROW in each HUC-12 watershed.

The total phosphorus load reduction requirement was calculated using the VDEQ VRRM New Development and Re-Development Compliance Spreadsheets, Version 3.0. The New Development and the Re-Development Spreadsheets are included in Attachments 2.1 and 2.2 respectively.

4.2 CONCLUSIONS

The summary of the net total phosphorus load reduction requirement for each HUC-12 watershed and the overall ACP project is presented in Table 9.1. Summaries of the calculations for the New Development and Re-Development sites are presented in Tables 9.2 and 9.3, respectively.

Per VRRM methodology, the net total phosphorus load reduction for the project is 34.40 pounds per year. Phosphorus load reduction is required in nine out of 71 HUC-12 watersheds. It is anticipated that the phosphorous load reduction requirements will be addressed through purchase of perpetual nutrient credits.

5.0 REFERENCES

Chapter 8 - Culverts, Drainage Manual. Virginia Department of Transportation, 2017.

Chapter 15 – Time of Concentration. Engineering Handbook, Part 630 Hydrology. United States Department of Agriculture. 2010.

Hydraulic Engineering Circular No. 15 (HEC-15), Third Edition. Design of Roadside Channels with Flexible Linings. Federal Highway Administration. 2005.

National Elevation Dataset. United States Geological Survey. Available online at https://lta.cr.usgs.gov/NED. Accessed March 2017.

National Hydrography Dataset (NHD). United States Geological Survey. Available online at https://nhd.usgs.gov/NHD_High_Resolution.html. Accessed March 2017.

National Land Cover Database 2011. Multi-Resolution Land Characteristics (MRLC) Consortium. United States Geological Survey. Available online at http://www.mrlc.gov. Accessed February 2017.

NOAA's National Weather Service Precipitation Frequency Data Server. United States Department of Commerce. Available online at https://hdsc.nws.noaa.gov/hdsc/pfds/. Accessed January 2017.

Soil Survey Geographic Database (SSURGO). Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov Accessed February 2017.

Technical Paper No. 40 Rainfall Frequency Atlas of the United States. United States Department of Commerce, 1961.

Technical Release 55 Urban Hydrology for Small Watersheds (TR-55). United States Department of Agriculture and Natural Resources Conservation Service. 1986.

Watershed Boundary Dataset (WBD). Coordinated effort between the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the United States Geological Survey (USGS), and the Environmental Protection Agency (EPA). Available online at https://nhd.usgs.gov/wbd.html. Accessed January 2017.

TABLES

Table 1.1 Hydrologic Soil Group Assignments for Soils without SSURGO Database Classification

Table 1.2 Land Cover Conversions

Table 1.3 Curve Number Assignments

Table 2 Water Quantity for Drainage Basins

Table 3 Energy Balance for Drainage Basins

Tables 4.001 – 087 Culvert List

Tables 5.001 – 087 Water Quantity

Tables 6.001 – 087 Energy Balance

Tables 7.001 – 087 Culvert Sizing

Tables 8.001 – 087 Roadside Ditch Sizing Table (Note: Final Table is 089)

Table 9.1 Summary of DEQ Virginia Runoff Reduction Method Water Quality Calculations

Table 9.2 Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations

Table 9.3 Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations

TABLE 1.1

Hydrologic Soil Group Assignments for Soils without SSURGO Database Classification

Table 1.1 Hydrologic Soil Group Assignments for Soils Without SSURGO Database Classification	
Soil Name	**HSG Assignment**
Aquents, 0 to 2 percent slopes, frequently ponded	D
Dam	D
Gullied land	D
Industrial waste pond	D
Made Land	D
Mixed alluvial land	B
Mixed alluvium, poorly drained	B
Mixed alluvium, well drained	B
Pits and dumps	D
Pits, quarry	D
Rock land	D
Rock outcrop-Chilhowie complex, steep	D
Rock outcrop-Drall complex, steep	D
Rock outcrop-Frederick complex, sloping	D
Rock outcrop-Frederick complex, steep	D
Rock outcrop-Opequon complex, 55 to 100 percent slopes	D
Rubble land	D
Stony land	D
Udorthents, bouldery	D
Udorthents, dams	D
Udorthents, loamy	D
Udorthents, sandy	D
Udorthents, shaly	D
Udorthents, smoothed	D
Udorthents, smoothed, 0 to 25 percent slopes	D
Udorthents, smoothed, 3 to 35 percent slopes	D
Udorthents, smoothed-Urban land complex	D
Udorthents-Dumps complex	D
Udorthents-Rock outcrop complex, 15 to 100 percent slopes	D
Udorthents-Urban land complex, 0 to 45 percent slopes	D
Urban land	D
Urban land, 0 to 5 percent slopes	D
Urban land-Conetoe-Chesapeake-Tetotum complex, 2 to 40 percent slopes	D
Urban Land-Udorthents complex, 0 to 2 percent slopes	D

TABLE 1.2

Land Cover Conversions

Table 1.2 Land Cover Conversions			
National Land Cover Database 2011 Classification		**Water Quantity Land Classification**	**VRRM Land Cover Classification**
Classification	**Description**		
Planted/Cultivated	*Pasture/Hay* - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation. *Cultivated Crops* - areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.	Agriculture	Managed Turf
Barren Land	*Barren Land (Rock/Sand/Clay)* - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.	Barren Land	Impervious Cover
Developed, High Intensity	*Developed High Intensity* - highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.	Developed, High Intensity 15 % of area 85% of area	Managed Turf Impervious Cover
Developed, Medium Intensity	*Developed, Medium Intensity* - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.	Developed, Medium Intensity 35 % of area 65% of area	Managed Turf Impervious Cover
Developed, Low Intensity	*Developed, Low Intensity* - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.	Developed, Low Intensity 70 % of area 30% of area	Managed Turf Impervious Cover
Developed, Open Space	*Developed, Open Space* - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	Developed, Open Space 80% of area 20% of area	Managed Turf Impervious Cover

National Land Cover Database 2011 Classification		Water Quantity Land Classification	VRRM Land Cover Classification
Classification	**Description**		
Forest	*Deciduous Forest* - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change. *Evergreen Forest* - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage. *Mixed Forest* - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.	Forest	Forest/Open Space
Herbaceous	Grassland/Herbaceous - areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	Grassland	Forest/Open Space
Shrubland	*Shrub/Scrub* - areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	Shrub	Forest/Open Space
Wetlands	*Woody Wetlands* - areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water. *Emergent Herbaceous Wetlands* - Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	Wetlands	Forest/Open Space
Water	*Open Water* - areas of open water, generally with less than 25% cover of vegetation or soil.	Open Water	Not Applicable
Not Applicable	*Gravel* - The road surface cover of permanent access roads to be gravel.	Gravel	Impervious Cover

TABLE 1.3

Curve Number Assignments

Table 1.3 Curve Number Assignments					
Water Quantity Land Classification	**Hydrologic Soil Group**				**Notes**
	A	**B**	**C**	**D**	
Agriculture	39	61	74	80	TR-55, Table 2-2c, Pasture, grassland, or range. Good hydrologic condition.
Barren Land	77	86	91	94	TR-55, Table 2-2b, Fallow, bare soil.
Developed, High Intensity	89	92	94	95	TR-55, Table 2-2a, Urban districts, commercial and business, 85% average impervious area.
Developed, Medium Intensity	77	85	90	92	TR-55, Table 2-2a, Residential districts by average lot size, 1/8 acre or less (town houses), 65% average impervious area.
Developed, Low Intensity	57	72	81	86	TR-55, Table 2-2a, Residential districts by average lot size, 1/3 acre, 30% average impervious area.
Developed, Open Space	51	68	79	84	TR-55, Table 2-2a, Residential districts by average lot size, 1 acre, 20% average impervious area.
Forest	30	55	70	77	TR-55, Table 2-2c, Woods. Good hydrologic condition.
Grassland	39	61	74	80	TR-55, Table 2-2c, Pasture, grassland, or range. Good hydrologic condition.
Gravel	76	85	89	91	TR-55, Table 2-2a, Impervious areas, streets and roads, gravel.
Shrub	30	48	65	73	TR-55, Table 2-2c, Brush. Good hydrologic condition.
Wetlands	100	100	100	100	No capture of stormwater.
Open Water	100	100	100	100	No capture of stormwater.

TABLE 2

Water Quantity for Drainage Basins

Water Quantity for Drainage Basins

Table 2 - Water Quantity For Drainage Basins																	
		Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
							Q (cfs)					Q (cfs)					
Drainage Basin ID	Drainage Area (ac)	1-yr	2-yr	10-yr	Tc (hrs)	Weighted CN	1-yr	2-yr	10-yr	Tc (hrs)	Weighted CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
1	3,507	3.1	3.7	5.6	2.83	56	124	283	1,104	2.83	56	124	283	1,104	0	0	0
2	1,559	3.1	3.7	5.6	2.12	56	64	150	603	2.12	56	64	150	603	0	0	0
3	11,334	3.1	3.7	5.6	3.56	55	300	700	2,815	3.56	55	300	700	2,815	0	0	0
4	1,314	3.1	3.7	5.6	1.58	58	89	196	705	1.58	58	89	196	705	0	0	0
5	2,920	3.1	3.7	5.6	2.29	57	137	305	1,139	2.29	57	137	305	1,139	0	0	0
6	8,252	3.1	3.7	5.6	4.21	57	277	583	2,048	4.21	57	277	583	2,048	0	0	0
7	1,277	3.1	3.7	5.6	1.80	59	95	196	665	1.80	59	95	196	665	0	0	0
8	4,038	3.1	3.7	5.6	2.75	59	234	469	1,556	2.75	59	234	469	1,556	0	0	0
9	3,284	3.0	3.7	5.5	2.36	61	238	517	1,515	2.36	61	238	517	1,515	0	0	0
10	884	3.1	3.7	5.6	1.62	57	50	115	439	1.62	57	50	115	439	0	0	0
11	19,800	3.0	3.6	5.4	5.28	70	2,013	3,132	7,281	5.28	70	2,013	3,132	7,281	0	0	0
12	401	2.9	3.5	5.3	1.17	70	110	177	431	1.17	70	110	177	431	0	0	0
13	1,526	2.9	3.5	5.3	2.77	69	212	348	863	2.77	69	212	348	863	0	0	0
14	2,128	2.9	3.5	5.3	3.09	65	184	335	916	3.09	65	184	335	916	0	0	0
15	685	2.9	3.5	5.2	2.14	65	76	140	370	2.14	65	76	140	370	0	0	0
16	819	2.9	3.5	5.2	2.24	63	70	135	386	2.24	63	70	135	386	0	0	0
17	17,143	2.9	3.5	5.2	5.95	69	1,338	2,161	5,075	5.95	69	1,338	2,161	5,075	0	0	0
18	29,125	2.9	3.5	5.2	8.03	68	1,647	2,682	6,370	8.03	68	1,647	2,682	6,370	0	0	0
19	1,455	2.9	3.4	5.2	1.97	62	117	215	708	1.97	62	117	215	708	0	0	0
20	14,298	2.8	3.4	5.2	6.60	70	1,013	1,648	4,050	6.60	70	1,013	1,648	4,050	0	0	0
21	378	2.8	3.4	5.1	1.31	73	111	175	400	1.31	73	111	175	400	0	0	0
22	303	2.8	3.4	5.1	1.37	72	80	128	298	1.37	72	80	128	298	0	0	0
23	105	2.8	3.4	5.1	0.72	69	32	54	134	0.72	69	32	54	134	0	0	0
24	2,663	2.8	3.4	5.1	3.45	69	285	481	1,181	3.45	69	285	481	1,181	0	0	0
25	111	2.8	3.4	5.1	0.68	68	31	55	140	0.68	67	28	51	131	-4	-5	-9
26	93	2.8	3.4	5.1	0.56	73	46	72	164	0.56	73	46	72	164	0	0	0
27	4,762	2.8	3.4	5.1	5.18	68	342	585	1,455	5.18	68	342	585	1,455	0	0	0
28	1,153	2.8	3.4	5.1	2.18	71	205	333	789	2.18	71	205	333	789	0	0	0
29	127	2.8	3.4	5.1	1.15	69	29	49	122	1.15	69	29	49	122	0	0	0

Drainage Basin ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (hrs)	Weighted CN	Q (cfs)			Tc (hrs)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
30	82	2.8	3.4	5.1	1.02	76	35	54	116	1.02	76	35	54	116	0	0	0
31	2,210	2.8	3.4	5.1	3.33	73	337	531	1,202	3.33	73	337	531	1,202	0	0	0
32	1,007	2.8	3.4	5.1	3.16	69	115	194	478	3.16	69	115	194	478	0	0	0
33	589	2.8	3.4	5.1	1.66	72	137	219	510	1.66	72	137	219	510	0	0	0
45	2,742	3.0	3.7	5.6	5.14	82	614	888	1,703	5.14	82	614	888	1,703	0	0	0
46	84,092	3.0	3.7	5.6	15.27	78	5,663	8,386	16,694	15.27	78	5,663	8,386	16,694	0	0	0
47	5,249	3.0	3.7	5.6	6.43	72	525	844	1,891	6.43	72	525	844	1,891	0	0	0
48	13,738	3.0	3.7	5.6	11.10	75	1,043	1,603	3,368	11.10	75	1,043	1,603	3,368	0	0	0
49	839	3.0	3.7	5.6	5.69	80	154	227	447	5.69	80	154	227	447	0	0	0
50	798	3.0	3.7	5.6	9.00	98	238	299	464	9.00	98	238	299	464	0	0	0
51	20,539	3.0	3.7	5.7	16.29	89	2,261	3,041	5,355	16.29	89	2,261	3,041	5,355	0	0	0
52	1,027	3.0	3.7	5.6	2.80	76	258	399	847	2.80	76	258	399	847	0	0	0
53	2,220	3.0	3.7	5.6	4.84	75	342	533	1,141	4.84	75	342	533	1,141	0	0	0
54	8,574	3.0	3.7	5.6	8.36	77	947	1,432	2,936	8.36	77	947	1,432	2,936	0	0	0
55	895	3.0	3.7	5.6	3.52	79	228	341	687	3.52	79	228	341	687	0	0	0
56	300	2.9	3.5	5.4	1.61	72	78	122	296	1.61	72	78	122	296	0	0	0
57	783	2.9	3.5	5.4	1.94	72	179	280	677	1.94	72	179	280	677	0	0	0
58	440	2.9	3.5	5.4	2.24	75	113	171	389	2.24	75	113	171	389	0	0	0
59	670	2.9	3.5	5.4	2.09	78	220	322	695	2.09	78	220	322	695	0	0	0
60	900	3.0	3.6	5.6	5.11	76	142	206	458	5.11	76	142	206	458	0	0	0
61	4,625	3.0	3.6	5.5	9.57	74	377	555	1,221	9.57	74	377	555	1,221	0	0	0
62	976	3.0	3.6	5.5	3.94	76	189	276	598	3.94	76	189	276	598	0	0	0
63	241	3.0	3.6	5.6	2.75	77	66	95	209	2.75	77	66	95	209	0	0	0
64	416	3.0	3.7	5.6	3.26	72	71	115	262	3.26	72	71	115	262	0	0	0
65	250	3.0	3.6	5.5	2.89	90	136	177	309	2.89	90	136	177	309	0	0	0
66	1,357	3.0	3.6	5.6	10.06	72	93	140	328	10.06	72	93	140	328	0	0	0
67	11,320	3.0	3.7	5.6	7.19	76	1,340	2,051	4,288	7.19	76	1,340	2,051	4,288	0	0	0
68	3,984	2.9	3.6	5.5	8.86	76	366	569	1,213	8.86	76	366	569	1,213	0	0	0
69	496	2.9	3.5	5.4	2.89	78	129	188	405	2.89	78	129	188	405	0	0	0
81	25,617	2.8	3.4	5.2	12.87	64	657	1,115	3,039	12.87	64	657	1,115	3,039	0	0	0

Drainage Basin ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (hrs)	Weighted CN	Q (cfs)			Tc (hrs)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
82	1,401	2.8	3.4	5.2	3.60	69	145	245	624	3.60	69	145	245	624	0	0	0
83	17,914	2.8	3.4	5.2	10.68	65	573	979	2,644	10.68	65	573	979	2,644	0	0	0
84	10,330	2.8	3.4	5.1	6.27	70	763	1,242	2,945	6.27	70	763	1,242	2,945	0	0	0
85	646	2.8	3.4	5.1	1.98	73	143	227	517	1.98	73	143	227	517	0	0	0
86	1,601	2.8	3.4	5.1	3.48	75	273	420	915	3.48	75	273	420	915	0	0	0
87	10,120	2.8	3.4	5.1	8.84	66	406	697	1,781	8.84	66	406	697	1,781	0	0	0
88	4,085	2.8	3.4	5.1	4.74	78	671	994	2,045	4.74	78	671	994	2,045	0	0	0
89	330	2.8	3.4	5.1	2.22	76	84	128	276	2.22	76	84	128	276	0	0	0
90	432	2.8	3.4	5.1	2.95	78	102	152	315	2.95	78	102	152	315	0	0	0
91	3,338	2.9	3.5	5.3	4.34	73	453	696	1,579	4.34	73	453	696	1,579	0	0	0
92	1,934	2.8	3.4	5.1	3.25	77	400	600	1,263	3.25	77	400	600	1,263	0	0	0
93	2,870	2.9	3.5	5.3	4.31	73	391	602	1,365	4.31	73	391	602	1,365	0	0	0
94	1,731	2.9	3.5	5.3	5.33	78	278	404	836	5.33	78	278	404	836	0	0	0
95	1,769	2.9	3.5	5.3	6.95	79	242	347	702	6.95	79	242	347	702	0	0	0
96	6,233	2.8	3.4	5.2	6.06	82	1,070	1,518	3,008	6.06	82	1,070	1,518	3,008	0	0	0
98	61	2.8	3.4	5.3	1.36	73	17	28	68	1.36	73	17	28	68	0	0	0
103	10,018	2.9	3.5	5.3	9.86	83	1,259	1,735	3,291	9.86	83	1,259	1,735	3,291	0	0	0
130	32,890	2.5	3.0	4.3	4.35	57	343	928	3,782	4.35	57	343	928	3,782	0	0	0
131	3,340	2.5	3.0	4.3	0.59	51	10	62	657	0.59	51	10	62	657	0	0	0
132	19,215	2.5	3.0	4.3	5.49	48	9	74	682	5.49	48	9	74	682	0	0	0
133	175	2.5	3.0	4.3	1.27	41	0	0	3	1.27	41	0	0	3	0	0	0
134	177	2.5	3.0	4.3	1.19	40	0	0	2	1.19	40	0	0	2	0	0	0
135	797	2.5	3.0	4.3	2.47	32	0	1	0	2.47	32	0	1	0	0	0	0
136	2,156	2.5	3.0	4.3	2.61	49	2	14	133	2.61	49	2	14	133	0	0	0
137	3,846	2.5	3.0	4.3	4.39	44	0	3	76	4.39	44	0	3	76	0	0	0
138	646	2.5	3.0	4.3	1.74	44	0	1	19	1.74	44	0	1	19	0	0	0
139	16,156	2.5	3.0	4.3	6.18	44	0	13	277	6.18	44	0	13	277	0	0	0
140	1,911	2.5	3.0	4.3	2.74	44	0	2	46	2.74	44	0	2	46	0	0	0
199	5,652	2.8	3.4	5.1	2.45	65	505	964	2,660	2.45	65	505	964	2,660	0	0	0
201	43,545	2.8	3.4	5.1	11.06	69	1,863	3,026	7,181	11.06	69	1,863	3,026	7,181	0	0	0

Drainage Basin ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (hrs)	Weighted CN	Q (cfs)			Tc (hrs)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
202	32,613	2.8	3.4	5.1	10.60	62	795	1,434	3,994	10.60	62	795	1,434	3,994	0	0	0
204	566	2.8	3.4	5.1	0.92	75	242	373	818	0.92	75	242	373	818	0	0	0
206	1,163	2.8	3.4	5.1	2.24	60	54	127	439	2.24	60	54	127	439	0	0	0
207	5,960	2.8	3.4	5.1	4.36	64	324	611	1,713	4.36	64	324	611	1,713	0	0	0
208	2,237	2.8	3.4	5.0	4.28	60	73	159	497	4.28	60	73	159	497	0	0	0
209	376	2.8	3.4	5.0	1.18	67	68	125	311	1.18	67	68	125	311	0	0	0
210	3,896	2.8	3.4	5.0	4.38	66	261	472	1,187	4.38	66	261	472	1,187	0	0	0
211	123	2.8	3.3	5.0	0.90	71	39	59	146	0.90	71	39	59	146	0	0	0
212	9,214	2.8	3.3	5.0	5.64	63	376	651	1,951	5.64	63	376	651	1,951	0	0	0
213	1,571	2.8	3.3	5.0	3.19	62	81	151	492	3.19	62	81	151	492	0	0	0
214	1,533	2.8	3.3	5.0	2.89	58	44	98	402	2.89	58	44	98	402	0	0	0
215	359	2.8	3.3	5.0	2.11	62	24	46	152	2.11	62	24	46	152	0	0	0
216	1,096	2.8	3.3	5.0	2.65	66	104	177	491	2.65	66	104	177	491	0	0	0
217	6,648	2.8	3.3	5.0	5.24	62	253	452	1,414	5.24	62	253	452	1,414	0	0	0
218	209	2.8	3.3	5.0	1.27	60	13	29	111	1.27	60	13	29	111	0	0	0
219	5,795	2.8	3.4	5.0	4.96	64	289	539	1,438	4.96	64	289	539	1,438	0	0	0
220	2,468	2.8	3.4	5.0	4.13	65	155	288	748	4.13	65	155	288	748	0	0	0
221	4,498	2.8	3.4	5.0	3.82	64	267	509	1,374	3.82	64	267	509	1,374	0	0	0
222	5,459	2.8	3.4	5.1	5.02	66	332	595	1,554	5.02	66	332	595	1,554	0	0	0
223	132	2.8	3.4	5.1	1.14	59	7	19	74	1.14	59	7	19	74	0	0	0
224	357	2.8	3.4	5.1	1.73	59	16	41	152	1.73	59	16	41	152	0	0	0
225	2,851	2.8	3.4	5.1	3.70	63	153	301	884	3.70	63	153	301	884	0	0	0
226	422	2.8	3.4	5.1	1.95	61	25	56	187	1.95	61	25	56	187	0	0	0
227	643	2.8	3.4	5.1	2.58	60	28	64	219	2.58	60	28	64	219	0	0	0
228	7,457	2.8	3.4	5.1	6.97	61	210	414	1,241	6.97	61	210	414	1,241	0	0	0
229	146	2.8	3.4	5.1	1.42	59	7	19	71	1.42	58	6	16	65	-1	-3	-6
230	707	2.8	3.4	5.1	2.69	59	25	61	220	2.69	59	25	61	220	0	0	0
231	927	2.8	3.4	5.1	2.60	59	34	82	295	2.60	59	34	82	295	0	0	0
232	522	2.8	3.4	5.1	2.10	59	21	53	193	2.10	59	21	53	193	0	0	0
233	108	2.8	3.4	5.1	1.26	56	3	10	46	1.26	56	3	10	46	0	0	0

Drainage Basin ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (hrs)	Weighted CN	Q (cfs)			Tc (hrs)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
234	2,665	2.8	3.4	5.1	2.35	60	121	282	972	2.35	60	121	282	972	0	0	0
235	476	2.8	3.4	5.2	2.02	66	54	101	282	2.02	66	54	101	282	0	0	0
236	1,483	2.8	3.4	5.2	3.34	68	147	256	669	3.34	68	147	256	669	0	0	0
237	216	2.8	3.4	5.2	1.56	58	9	23	97	1.56	58	9	23	97	0	0	0
238	23,952	2.8	3.4	5.2	15.73	63	491	822	2,245	15.73	63	491	822	2,245	0	0	0
239	2,654	2.8	3.4	5.2	5.20	62	101	200	622	5.20	62	101	200	622	0	0	0
240	452	2.8	3.4	5.2	2.07	59	19	46	178	2.07	59	19	46	178	0	0	0
241	166	2.8	3.4	5.2	1.59	61	11	25	89	1.59	61	11	25	89	0	0	0
242	335	2.8	3.4	5.2	1.97	66	39	73	202	1.97	66	39	73	202	0	0	0
245	2,303	2.8	3.4	5.2	5.30	63	98	187	561	5.30	63	98	187	561	0	0	0
303	1,668	2.5	3.0	4.4	2.41	45	0	2	60	2.41	45	0	2	60	0	0	0
304	7,578	2.6	3.1	4.5	3.79	47	4	31	350	3.79	47	4	31	350	0	0	0
305	279	2.6	3.1	4.5	1.11	58	8	23	103	1.11	58	8	23	103	0	0	0
307	1,096	2.6	3.1	4.5	1.71	58	27	71	306	1.71	58	27	71	306	0	0	0
308	3,386	2.5	3.0	4.3	2.98	63	127	271	819	2.98	63	127	271	819	0	0	0
310	619	2.4	2.9	4.3	1.65	62	22	55	213	1.65	62	22	55	213	0	0	0
311	3,227	2.6	3.1	4.5	2.51	53	20	69	427	2.51	53	20	69	427	0	0	0
312	13,740	2.6	3.1	4.6	7.51	41	2	2	178	7.51	41	2	2	178	0	0	0
313	22,804	2.6	3.1	4.3	7.45	51	60	210	1,012	7.45	51	60	210	1,012	0	0	0
316	48,878	2.5	3.0	4.4	11.18	56	293	729	2,712	11.18	56	293	729	2,712	0	0	0
317	9,210	2.5	3.0	4.4	6.15	62	197	408	1,263	6.15	62	197	408	1,263	0	0	0
319	11,670	2.6	3.1	4.6	4.01	55	104	292	1,475	4.01	55	104	292	1,475	0	0	0
320	22,916	2.6	3.1	4.6	5.26	52	88	293	1,809	5.26	52	88	293	1,809	0	0	0
321	596	2.6	3.1	4.6	1.81	64	42	83	259	1.81	64	42	83	259	0	0	0
327	13,057	2.6	3.1	4.4	3.74	60	320	715	2,309	3.74	60	320	715	2,309	0	0	0
328	984	2.5	3.0	4.4	1.82	62	41	96	336	1.82	62	41	96	336	0	0	0
329	140	2.6	3.1	4.4	0.47	67	33	61	150	0.47	67	33	61	150	0	0	0
330	6,861	2.5	3.0	4.5	4.93	62	166	352	1,188	4.93	62	166	352	1,188	0	0	0
331	2,124	2.5	3.0	4.5	3.54	62	61	135	475	3.54	62	61	135	475	0	0	0
332	396	2.5	3.0	4.5	1.68	61	14	35	141	1.68	61	14	35	141	0	0	0

Drainage Basin ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (hrs)	Weighted CN	Q (cfs)			Tc (hrs)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
333	8,715	2.6	3.1	4.7	4.17	56	95	252	1,251	4.17	56	95	252	1,251	0	0	0
334	75	2.5	3.0	4.5	0.61	64	8	18	61	0.61	64	8	18	61	0	0	0
335	1,724	2.6	3.1	4.5	1.08	72	436	684	1,552	1.08	72	436	684	1,552	0	0	0
336	191	2.5	3.0	4.5	0.87	70	39	69	177	0.87	70	39	69	177	0	0	0
338	9,048	2.6	3.1	4.7	2.83	62	359	757	2,669	2.83	62	359	757	2,669	0	0	0
339	16,787	2.5	3.0	4.5	7.32	66	539	951	2,659	7.32	66	539	951	2,659	0	0	0
340	523	2.5	3.1	4.5	1.98	69	57	111	270	1.98	69	57	111	270	0	0	0
341	1,560	2.6	3.1	4.6	2.45	64	91	179	547	2.45	64	91	179	547	0	0	0
344	18,084	2.7	3.2	4.8	7.39	52	85	240	1,296	7.39	52	85	240	1,296	0	0	0
347	275	2.7	3.3	4.9	2.35	62	15	33	103	2.35	62	15	33	103	0	0	0
348	4,416	2.8	3.3	5.0	6.26	47	6	26	247	6.26	47	6	26	247	0	0	0
349	460	2.8	3.4	5.0	4.74	57	9	22	78	4.74	57	9	22	78	0	0	0
350	66	2.8	3.4	5.0	1.69	65	8	15	39	1.69	65	8	15	39	0	0	0
351	1,500	2.8	3.4	5.0	3.80	43	0	4	61	3.80	43	0	4	61	0	0	0
352	36	2.8	3.4	5.0	1.31	59	2	5	18	1.31	58	2	4	16	0	-1	-1
353	13,344	3.0	3.6	5.4	4.41	56	318	733	2,734	4.41	56	318	733	2,734	0	0	0
355	12,598	3.0	3.6	5.4	4.12	53	179	475	2,171	4.12	53	179	475	2,171	0	0	0
356	431	3.1	3.7	5.6	1.09	57	30	71	276	1.09	57	30	71	276	0	0	0
400	303	2.8	3.3	5.1	0.58	73	146	215	522	0.58	73	146	215	522	0	0	0
401	599	2.8	3.4	5.1	0.98	76	264	402	867	0.98	76	264	402	867	0	0	0
402	2,735	3.0	3.6	5.1	3.08	79	774	1,100	2,011	3.08	79	774	1,100	2,011	0	0	0

TABLE 3

Energy Balance for Drainage Basins

Water Quantity for Drainage Basin

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note 1: Some drainage basins have a runoff volume of less than 0.5 acre-feet. Therefore, the conditions in columns B and G are satisfied.

Note 2: Since Energy Balance is met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ for each drainage basin, the computation of $Q_{1\text{-yr Forest}}$ (cfs) and $RV_{1\text{-yr Forest}}$ (ac-ft) as well as columns C, D, E, F, G, and H are not applicable.

Table 3 - Energy Balance for Drainage Basins

Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
1	124	73	124	73			124	met						
2	64	32	64	32			64	met						
3	300	210	300	210			300	met						
4	89	34	89	34			89	met						
5	137	67	137	67			137	met						
6	277	190	277	190			277	met						
7	95	36	95	36			95	met						
8	234	114	234	114			234	met						
9	238	100	238	100			238	met						
10	50	20	50	20			50	met						
11	2,013	1,178	2,013	1,178			2,013	met						
12	110	22	110	22			110	met						
13	212	78	212	78			212	met						
14	184	82	184	82			184	met						
15	76	26	76	26			76	met						
16	70	27	70	27			70	met						
17	1,338	881	1,338	881			1,338	met						
18	1,647	1,398	1,647	1,398			1,647	met						
19	117	44	117	44			117	met						
20	1,013	722	1,013	722			1,013	met						
21	111	23	111	23			111	met						
22	80	17	80	17			80	met						
23	32	5	32	5			32	met						
24	285	125	285	125			285	met						

Table 3 - Energy Balance for Drainage Basins														
Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
25	31	5	28	0			312	met						
26	46	6	46	6			46	met						
27	342	209	342	209			342	met						
28	205	62	205	62			205	met						
29	29	6	29	6			29	met						
30	35	6	35	6			35	met						
31	337	136	337	136			337	met						
32	115	47	115	47			115	met						
33	137	34	137	34			137	met						
45	614	315	614	315			614	met						
46	5,663	7,912	5,663	7,912			5,663	met						
47	525	353	525	353			525	met						
48	1,043	1,100	1,043	1,100			1,043	met						
49	154	87	154	87			154	met						
50	238	184	238	184			238	met						
51	2,261	3,252	2,261	3,252			2,261	met						
52	258	87	258	87			258	met						
53	342	178	342	178			342	met						
54	947	765	947	765			947	met						
55	228	89	228	89			228	met						
56	78	19	78	19			78	met						
57	179	49	179	49			179	met						
58	113	33	113	33			113	met						
59	220	59	220	59			220	met						
60	142	76	142	76			142	met						
61	377	350	377	350			377	met						
62	189	83	189	83			189	met						
63	66	21	66	21			66	met						
64	71	28	71	28			71	met						
65	136	41	136	41			136	met						
66	93	91	93	91			93	met						

Table 3 - Energy Balance for Drainage Basins														
Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
67	1,340	958	1,340	958			1,340	met						
68	366	315	366	315			366	met						
69	129	44	129	44			129	met						
81	657	820	657	820			657	met						
82	145	66	145	66			145	met						
83	573	624	573	624			573	met						
84	763	522	763	522			763	met						
85	143	40	143	40			143	met						
86	273	111	273	111			273	met						
87	406	381	406	381			406	met						
88	671	337	671	337			671	met						
89	84	24	84	24			84	met						
90	102	36	102	36			102	met						
91	453	222	453	222			453	met						
92	400	151	400	151			400	met						
93	391	191	391	191			391	met						
94	278	153	278	153			278	met						
95	242	165	242	165			242	met						
96	1,070	166	1,070	166			1,070	met						
98	17	4	17	4			17	met						
103	1,259	168	1,259	168			1,259	met						
130	343	169	343	169			343	met						
131	10	170	10	170			10	met						
132	9	171	9	171			9	met						
133	0	172	0	172			See Note 1	met						
134	0	173	0	173			See Note 1	met						
135	0	174	0	174			See Note 1	met						
136	2	175	2	175			2	met						
137	0	176	0	176			See Note 1	met						
138	0	177	0	177			See Note 1	met						
139	0	178	0	178			See Note 1	met						

Table 3 - Energy Balance for Drainage Basins														
Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
140	0	179	0	179			See Note 1	met						
199	505	181	505	181			505	met						
201	1,863	182	1,863	182			1,863	met						
202	795	183	795	183			795	met						
204	242	184	242	184			242	met						
206	54	185	54	185			54	met						
207	324	186	324	186			324	met						
208	73	187	73	187			73	met						
209	68	188	68	188			68	met						
210	261	189	261	189			261	met						
211	39	190	39	190			39	met						
212	376	191	376	191			376	met						
213	81	192	81	192			81	met						
214	44	193	44	193			44	met						
215	24	194	24	194			24	met						
216	104	195	104	195			104	met						
217	253	196	253	196			253	met						
218	13	197	13	197			13	met						
219	289	198	289	198			289	met						
220	155	199	155	199			155	met						
221	267	200	267	200			267	met						
222	332	201	332	201			332	met						
223	7	202	7	202			7	met						
224	16	203	16	203			16	met						
225	153	204	153	204			153	met						
226	25	205	25	205			25	met						
227	28	206	28	206			28	met						
228	210	207	210	207			210	met						
229	7	208	6	208			7	met						
230	25	209	25	209			25	met						
231	34	210	34	210			34	met						

Table 3 - Energy Balance for Drainage Basins														
Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
232	21	211	21	211			21	met						
233	3	212	3	212			3	met						
234	121	214	121	214			121	met						
235	54	215	54	215			54	met						
236	147	216	147	216			147	met						
237	9	217	9	217			9	met						
238	491	218	491	218			491	met						
239	101	219	101	219			101	met						
240	19	220	19	220			19	met						
241	11	221	11	221			11	met						
242	39	222	39	222			39	met						
245	98	223	98	223			98	met						
303	0	224	0	224			See Note 1	met						
304	4	225	4	225			4	met						
305	8	226	8	226			8	met						
307	27	227	27	227			27	met						
308	127	228	127	228			127	met						
310	22	229	22	229			22	met						
311	20	230	20	230			20	met						
312	2	231	2	231			2	met						
313	60	232	60	232			60	met						
316	293	233	293	233			293	met						
317	197	234	197	234			197	met						
319	104	235	104	235			104	met						
320	88	236	88	236			88	met						
321	42	237	42	237			42	met						
327	320	238	320	238			320	met						
328	41	239	41	239			41	met						
329	33	240	33	240			33	met						
330	166	241	166	241			166	met						
331	61	242	61	242			61	met						

Table 3 - Energy Balance for Drainage Basins														
Drainage Basin ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs) *See Note 2*	$RV_{1\text{-yr Forest}}$ (ac-ft) *See Note 2*	A	B	C *See Note 2*	D *See Note 2*	E *See Note 2*	F *See Note 2*	G *See Note 2*	H *See Note 2*
332	14	243	14	243			14	met						
333	95	244	95	244			95	met						
334	8	245	8	245			8	met						
335	436	246	436	246			436	met						
336	39	247	39	247			39	met						
338	359	248	359	248			359	met						
339	539	249	539	249			539	met						
340	57	250	57	250			57	met						
341	91	251	91	251			91	met						
344	85	252	85	252			85	met						
347	15	253	15	253			15	met						
348	6	254	6	254			6	met						
349	9	255	9	255			9	met						
350	8	256	8	256			8	met						
351	0	257	0	257			See Note 1	met						
352	2	258	2	258			2	met						
353	318	259	318	259			318	met						
355	179	260	179	260			179	met						
356	30	261	30	261			30	met						
400	146	262	146	262			146	met						
401	264	263	264	263			264	met						
402	774	264	774	264			774	met						

TABLES 4 THROUGH 8

Permanent and Temporary Access Roads

Tables 4.001 – 087 Culvert List

Tables 5.001 – 087 Water Quantity

Tables 6.001 – 087 Energy Balance

Tables 7.001 – 087 Culvert Sizing

Tables 8.001 – 087 Roadside Ditch Sizing Tables (Note: Final Table is 089)

Tables 4.001-007 to 8.001-007

Permanent Access Roads, Spread 3A

Tables 4.001-007 Culvert List

Tables 5.001-007 Water Quantity

Tables 6.001-007 Energy Balance

Tables 7.001-007 Culvert Sizing

Tables 8.001-007 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 06-001-C004.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.001

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C004.AR3	C AR-300.001	3A	AR-300	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C AR-300.002	3A	AR-300	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C AR-300.003	3A	AR-300	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C AR-300.004	3A	AR-300	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C AR-300.005	3A	AR-300	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C 117.001	3A	117	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C 117.002	3A	117	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C 117.003	3A	117	Highland	Jim Dave Run-Back Creek	131	1
06-001-C004.AR3	C 117.004	3A	117	Highland	Jim Dave Run-Back Creek	131	1

Water Quantity for Culverts and Ditches
Access Road: 06-001-C004.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.001

Table 5.001 - Water Quantity - 06-001-C004.AR3

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-300.001	2.24	2.5	3.0	5.0	7	31	0.0	0.0	0.0	7	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.002	1.21	2.5	3.0	5.0	7	31	0.0	0.0	0.0	7	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.003	1.59	2.5	3.0	5.0	14	31	0.0	0.0	0.0	14	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.004	2.53	2.5	3.0	5.0	16	31	0.0	0.0	0.0	16	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.005	0.86	2.5	3.0	5.0	14	32	0.0	0.0	0.0	14	34	0.0	0.0	0.0	0.0	0.0	0.0
C 117.001	0.77	2.5	3.0	5.0	16	32	0.0	0.0	0.0	16	33	0.0	0.0	0.0	0.0	0.0	0.0
C 117.002	1.26	2.5	3.0	5.0	17	31	0.0	0.0	0.0	17	33	0.0	0.0	0.0	0.0	0.0	0.0
C 117.003	1.06	2.5	3.0	5.0	20	32	0.0	0.0	0.0	20	34	0.0	0.0	0.0	0.0	0.0	0.0
C 117.004	0.60	2.5	3.0	5.0	18	31	0.0	0.0	0.0	18	33	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C004.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.001

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.001 - Energy Balance - 06-001-C004.AR3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-300.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 117.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 117.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 117.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 117.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 06-001-C004.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.001

Table 7.001 - Culvert Sizing - 06-001-C004.AR3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-300.001	2.24	0.0	12	< 6	EC-3 Type B
C AR-300.002	1.21	0.0	12	< 6	EC-3 Type B
C AR-300.003	1.59	0.0	12	< 6	EC-3 Type B
C AR-300.004	2.53	0.0	12	< 6	EC-3 Type B
C AR-300.005	0.86	0.0	12	< 6	EC-3 Type B
C 117.001	0.77	0.0	12	< 6	EC-3 Type B
C 117.002	1.26	0.0	12	< 6	EC-3 Type B
C 117.003	1.06	0.0	12	< 6	EC-3 Type B
C 117.004	0.60	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C004.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.001

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.001 - Roadside Ditch Sizing - 06-001-C004.AR3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-300.001	0.0	0.0	0.01	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-300.002	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.003	0.0	0.0	0.33	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-300.004	0.0	0.0	0.33	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-300.005	0.0	0.0	0.38	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C 117.001	0.0	0.0	0.03	See Note 2	1.0	See Note 1	0.4	Grass Lined
C 117.002	0.0	0.0	0.06	Type I	1.0	See Note 1	0.4	Grass Lined
C 117.003	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C 117.004	0.0	0.0	0.04	See Note 2	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 06-001-C026.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.002

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C026.AR2	C AR-300.010	3A	AR-300	Highland	Gotta delineate	no DL	3
06-001-C026.AR2	C AR-300.011	3A	AR-300	Highland	Gotta delineate	no DL	3
06-001-C026.AR2	C AR-300.012	3A	AR-300	Highland	Gotta delineate	no DL	3
06-001-C026.AR2	C AR-300.013	3A	AR-300	Highland	Gotta delineate	no DL	2, 3
06-001-C026.AR2	C AR-300.014	3A	AR-300	Highland	Gotta delineate	no DL	2, 3
06-001-C026.AR2	C AR-300.015	3A	AR-300	Highland	Gotta delineate	no DL	2, 3
06-001-C026.AR2	C AR-300.016	3A	AR-300	Highland	Gotta delineate	no DL	2, 3

Water Quantity for Culverts and Ditches
Access Road: 06-001-C026.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.002

Table 5.002 - Water Quantity - 06-001-C026.AR2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-300.010	1.31	2.5	3.0	5.0	9	31	0.0	0.0	0.0	9	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.011	0.70	2.5	3.0	5.0	8	31	0.0	0.0	0.0	8	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.012	1.23	2.5	3.0	5.0	7	32	0.0	0.0	0.0	7	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.013	0.77	2.5	3.0	5.0	9	35	0.0	0.0	0.0	9	40	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.014	0.71	2.5	3.0	5.0	27	33	0.0	0.0	0.0	27	36	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.015	0.26	2.5	3.0	5.0	9	34	0.0	0.0	0.0	9	39	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.016	0.13	2.5	3.0	5.0	8	30	0.0	0.0	0.0	8	31	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C026.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.002

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.002 - Energy Balance - 06-001-C026.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-300.010	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.012	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.013	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.014	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.015	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.016	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 06-001-C026.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.002

Table 7.002 - Culvert Sizing - 06-001-C026.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-300.010	1.31	0.0	12	< 6	EC-3 Type B
C AR-300.011	0.70	0.0	12	< 6	EC-3 Type B
C AR-300.012	1.23	0.0	12	< 6	EC-3 Type B
C AR-300.013	0.77	0.0	12	< 6	EC-3 Type B
C AR-300.014	0.71	0.0	12	< 6	EC-3 Type B
C AR-300.015	0.26	0.0	12	< 6	EC-3 Type B
C AR-300.016	0.13	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C026.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.002

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.002 - Roadside Ditch Sizing - 06-001-C026.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-300.010	0.0	0.0	0.05	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-300.011	0.0	0.0	0.31	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-300.012	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.013	0.0	0.0	0.31	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-300.014	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.015	0.0	0.0	0.16	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.016	0.0	0.0	0.03	See Note 2	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 06-001-C028.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.003

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C028.AR2	C AR-300.017	3A	AR-300	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C AR-300.018	3A	AR-300	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C AR-300.019	3A	AR-300	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C AR-300.020	3A	AR-300	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C AR-300.021	3A	AR-300	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C AR-300.022	3A	AR-300	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C AR-302.016	3A	AR-302	Highland	Bolar Run-Jackson River	132	2
06-001-C028.AR2	C AR-302.017	3A	AR-302	Highland	Bolar Run-Jackson River	132	2
06-001-C028.AR2	C AR-302.018	3A	AR-302	Highland	Bolar Run-Jackson River	132	2, 3
06-001-C028.AR2	C AR-302.019	3A	AR-302	Highland	Bolar Run-Jackson River	132	2, 3
06-001-C028.AR2	C E120.001	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.002	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.003	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.004	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.005	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.006	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.007	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.008	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.009	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.010	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.011	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.012	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.013	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.014	3A	120	Highland	Bolar Run-Jackson River	132	3, 4
06-001-C028.AR2	C E120.015	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.016	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.017	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.018	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.019	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.020	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.021	3A	120	Highland	Bolar Run-Jackson River	132	3
06-001-C028.AR2	C E120.022	3A	120	Highland	Bolar Run-Jackson River	132	3

Water Quantity for Culverts and Ditches
Access Road: 06-001-C028.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.003

Table 5.003 - Water Quantity - 06-001-C028.AR2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-300.017	1.68	2.5	3.0	5.0	8	31	0.0	0.0	0.0	8	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.018	1.94	2.5	3.0	5.0	8	35	0.0	0.0	0.0	8	36	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.019	1.15	2.5	3.0	5.0	10	38	0.0	0.0	0.0	10	39	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.020	1.51	2.5	3.0	5.0	9	34	0.0	0.0	0.0	9	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.021	2.93	2.5	3.0	5.0	10	34	0.0	0.0	0.0	10	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-300.022	4.00	2.5	3.0	5.0	8	34	0.0	0.0	0.0	8	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-302.016	0.21	2.5	3.0	5.0	11	30	0.0	0.0	0.0	11	30	0.0	0.0	0.0	0.0	0.0	0.0
C AR-302.017	0.75	2.5	3.0	5.0	9	33	0.0	0.0	0.0	9	36	0.0	0.0	0.0	0.0	0.0	0.0
C AR-302.018	0.78	2.5	3.0	5.0	9	33	0.0	0.0	0.0	9	36	0.0	0.0	0.0	0.0	0.0	0.0
C AR-302.019	0.89	2.5	3.0	5.0	9	32	0.0	0.0	0.0	9	34	0.0	0.0	0.0	0.0	0.0	0.0
C E120.001	3.07	2.5	3.0	5.0	13	31	0.0	0.0	0.0	13	32	0.0	0.0	0.0	0.0	0.0	0.0
C E120.002	2.16	2.5	3.0	5.0	11	31	0.0	0.0	0.0	11	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.003	0.81	2.5	3.0	5.0	11	31	0.0	0.0	0.0	11	32	0.0	0.0	0.0	0.0	0.0	0.0
C E120.004	2.15	2.5	3.0	5.0	11	30	0.0	0.0	0.0	11	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.005	1.64	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.006	1.32	2.5	3.0	5.0	12	31	0.0	0.0	0.0	12	32	0.0	0.0	0.0	0.0	0.0	0.0
C E120.007	2.69	2.5	3.0	5.0	13	31	0.0	0.0	0.0	13	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.008	2.61	2.5	3.0	5.0	13	30	0.0	0.0	0.0	13	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.009	2.96	2.5	3.0	5.0	9	31	0.0	0.0	0.0	9	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.010	1.78	2.5	3.0	5.0	9	31	0.0	0.0	0.0	9	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.011	1.21	2.5	3.0	5.0	6	31	0.0	0.0	0.0	6	32	0.0	0.0	0.0	0.0	0.0	0.0
C E120.012	0.45	2.5	3.0	5.0	9	31	0.0	0.0	0.0	9	32	0.0	0.0	0.0	0.0	0.0	0.0
C E120.013	0.30	2.5	3.0	5.0	10	37	0.0	0.0	0.0	10	44	0.0	0.0	0.1	0.0	0.0	0.1
C E120.014	0.11	2.5	3.0	5.0	0	39	0.0	0.0	0.0	0	48	0.0	0.0	0.1	0.0	0.0	0.1
C E120.015	2.26	2.5	3.0	5.0	11	32	0.0	0.0	0.0	11	35	0.0	0.0	0.0	0.0	0.0	0.0
C E120.016	0.41	2.5	3.0	5.0	9	33	0.0	0.0	0.0	9	35	0.0	0.0	0.0	0.0	0.0	0.0
C E120.017	1.64	2.5	3.0	5.0	10	32	0.0	0.0	0.0	10	34	0.0	0.0	0.0	0.0	0.0	0.0
C E120.018	1.54	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	33	0.0	0.0	0.0	0.0	0.0	0.0
C E120.019	1.42	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C E120.020	0.81	2.5	3.0	5.0	7	34	0.0	0.0	0.0	7	34	0.0	0.0	0.0	0.0	0.0	0.0
C E120.021	1.64	2.5	3.0	5.0	7	32	0.0	0.0	0.0	7	33	0.0	0.0	0.0	0.0	0.0	0.0
C E120.022	0.80	2.5	3.0	5.0	8	33	0.0	0.0	0.0	8	35	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C028.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.003

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.003 - Energy Balance - 06-001-C028.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-300.017	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.018	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.019	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.020	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.021	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-300.022	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-302.016	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-302.017	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-302.018	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-302.019	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.007	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.008	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.009	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.010	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.012	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.013	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.014	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.015	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.016	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.017	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.018	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.019	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.020	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.021	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E120.022	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 06-001-C028.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.003

Table 7.003 - Culvert Sizing - 06-001-C028.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-300.017	1.68	0.0	12	< 6	EC-3 Type B
C AR-300.018	1.94	0.0	12	< 6	EC-3 Type B
C AR-300.019	1.15	0.0	12	< 6	EC-3 Type B
C AR-300.020	1.51	0.0	12	< 6	EC-3 Type B
C AR-300.021	2.93	0.0	12	< 6	EC-3 Type B
C AR-300.022	4.00	0.0	12	< 6	EC-3 Type B
C AR-302.016	0.21	0.0	12	< 6	EC-3 Type B
C AR-302.017	0.75	0.0	12	< 6	EC-3 Type B
C AR-302.018	0.78	0.0	12	< 6	EC-3 Type B
C AR-302.019	0.89	0.0	12	< 6	EC-3 Type B
C E120.001	3.07	0.0	12	< 6	EC-3 Type B
C E120.002	2.16	0.0	12	< 6	EC-3 Type B
C E120.003	0.81	0.0	12	< 6	EC-3 Type B
C E120.004	2.15	0.0	12	< 6	EC-3 Type B
C E120.005	1.64	0.0	12	< 6	EC-3 Type B
C E120.006	1.32	0.0	12	< 6	EC-3 Type B
C E120.007	2.69	0.0	12	< 6	EC-3 Type B
C E120.008	2.61	0.0	12	< 6	EC-3 Type B
C E120.009	2.96	0.0	12	< 6	EC-3 Type B
C E120.010	1.78	0.0	12	< 6	EC-3 Type B
C E120.011	1.21	0.0	12	< 6	EC-3 Type B
C E120.012	0.45	0.0	12	< 6	EC-3 Type B
C E120.013	0.30	0.1	12	< 6	EC-3 Type B
C E120.014	0.11	0.1	12	< 6	EC-3 Type B
C E120.015	2.26	0.0	12	< 6	EC-3 Type B
C E120.016	0.41	0.0	12	< 6	EC-3 Type B
C E120.017	1.64	0.0	12	< 6	EC-3 Type B
C E120.018	1.54	0.0	12	< 6	EC-3 Type B
C E120.019	1.42	0.0	12	< 6	EC-3 Type B
C E120.020	0.81	0.0	12	< 6	EC-3 Type B
C E120.021	1.64	0.0	12	< 6	EC-3 Type B
C E120.022	0.80	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C028.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.003

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.003 - Roadside Ditch Sizing - 06-001-C028.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-300.017	0.0	0.0	0.16	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.018	0.0	0.0	0.12	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.019	0.0	0.0	0.14	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-300.020	0.0	0.0	0.14	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-300.021	0.0	0.0	0.17	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-300.022	0.0	0.0	0.14	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-302.016	0.0	0.0	0.22	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-302.017	0.0	0.0	0.19	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-302.018	0.0	0.0	0.22	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-302.019	0.0	0.0	0.26	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E120.001	0.0	0.0	0.24	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E120.002	0.0	0.0	0.19	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.003	0.0	0.0	0.18	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.004	0.0	0.0	0.23	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.005	0.0	0.0	0.16	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.006	0.0	0.0	0.25	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.007	0.0	0.0	0.14	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.008	0.0	0.0	0.21	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.009	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C E120.010	0.0	0.0	0.03	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.011	0.0	0.0	0.28	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.012	0.0	0.0	0.54	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.013	0.0	0.1	0.11	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E120.014	0.0	0.1	0.10	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E120.015	0.0	0.0	0.13	Type I	1.0	See Note 1	0.4	Grass Lined
C E120.016	0.0	0.0	0.40	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.017	0.0	0.0	0.30	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E120.018	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C E120.019	0.0	0.0	0.23	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E120.020	0.0	0.0	0.15	Type I	1.0	See Note 1	0.4	Grass Lined
C E120.021	0.0	0.0	0.16	Type I	1.0	See Note 1	0.4	Grass Lined
C E120.022	0.0	0.0	0.24	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 06-001-C032.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.004

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C032.AR1	C AR-302.001	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.002	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.003	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.004	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.005	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.006	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.007	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.008	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.009	3A	AR-302	Highland	Bolar Run-Jackson River	132	6
06-001-C032.AR1	C AR-302.010	3A	AR-302	Highland	Bolar Run-Jackson River	132	5, 6
06-001-C032.AR1	C AR-302.011	3A	AR-302	Highland	Bolar Run-Jackson River	132	5, 6
06-001-C032.AR1	C AR-302.012	3A	AR-302	Highland	Bolar Run-Jackson River	132	5, 6
06-001-C032.AR1	C AR-302.013	3A	AR-302	Highland	Bolar Run-Jackson River	132	5
06-001-C032.AR1	C AR-302.014	3A	AR-302	Highland	Bolar Run-Jackson River	132	5
06-001-C032.AR1	C AR-302.015	3A	AR-302	Highland	Bolar Run-Jackson River	132	5
06-001-C032.AR1	C E121.001	3A	121	Highland	Bolar Run-Jackson River	132	5

Water Quantity for Culverts and Ditches
Access Road: 06-001-C032.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.004

Table 5.004 - Water Quantity - 06-001-C032.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-302.001	2.83	2.5	3.0	5.0	11	56	0.1	0.3	3.8	11	56	0.1	0.3	3.8	0.0	0.0	0.0
C AR-302.002	2.10	2.5	3.0	5.0	17	57	0.1	0.3	2.4	17	57	0.1	0.3	2.4	0.0	0.0	0.0
C AR-302.003	5.37	2.5	3.0	5.0	13	54	0.0	0.3	5.5	13	54	0.0	0.3	5.5	0.0	0.0	0.0
C AR-302.004	4.47	2.5	3.0	5.0	11	48	0.0	0.0	2.5	11	48	0.0	0.0	2.5	0.0	0.0	0.0
C AR-302.005	0.57	2.5	3.0	5.0	11	65	0.2	0.4	1.4	11	67	0.2	0.4	1.5	0.1	0.1	0.1
C AR-302.006	0.46	2.5	3.0	5.0	10	71	0.3	0.5	1.5	10	72	0.3	0.5	1.5	0.0	0.0	0.1
C AR-302.007	0.35	2.5	3.0	5.0	11	71	0.2	0.4	1.1	11	72	0.2	0.4	1.1	0.0	0.0	0.0
C AR-302.008	5.01	2.5	3.0	5.0	15	64	1.0	2.3	9.7	15	64	1.0	2.3	9.7	0.0	0.0	0.0
C AR-302.009	7.65	2.5	3.0	5.0	15	57	0.2	1.0	9.4	15	58	0.3	1.3	10.1	0.1	0.3	0.7
C AR-302.010	5.57	2.5	3.0	5.0	13	47	0.0	0.0	2.4	13	47	0.0	0.0	2.4	0.0	0.0	0.0
C AR-302.011	4.72	2.5	3.0	5.0	12	47	0.0	0.0	2.1	12	47	0.0	0.0	2.1	0.0	0.0	0.0
C AR-302.012	0.60	2.5	3.0	5.0	10	55	0.0	0.1	0.8	10	56	0.0	0.1	0.9	0.0	0.0	0.1
C AR-302.013	0.80	2.5	3.0	5.0	10	58	0.0	0.2	1.3	10	58	0.0	0.2	1.3	0.0	0.0	0.0
C AR-302.014	1.40	2.5	3.0	5.0	16	57	0.0	0.2	1.7	16	58	0.1	0.2	1.8	0.0	0.0	0.1
C AR-302.015	1.30	2.5	3.0	5.0	13	55	0.0	0.1	1.5	13	55	0.0	0.1	1.5	0.0	0.0	0.0
C E121.001	280.36	2.5	3.0	5.0	26	35	0.0	0.0	2.4	26	35	0.0	0.0	2.4	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C032.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.004

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.004 - Energy Balance - 06-001-C032.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-302.001	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C AR-302.002	0.1	0.02	0.1	0.02	0.0	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.003	0.0	0.02	0.0	0.02	0.0	0.02	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.004	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.005	0.2	0.01	0.2	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C AR-302.006	0.3	0.02	0.3	0.02	0.3	0.02	0.3	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-302.007	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-302.008	1.0	0.10	1.0	0.10	0.8	0.09	1.0	met	n/a	not exceeded	n/a	0.7	exceeded	0.3
C AR-302.009	0.2	0.06	0.3	0.07	0.2	0.06	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C AR-302.010	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-302.012	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.013	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-302.014	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-302.015	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C E121.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 06-001-C032.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.004

Table 7.004 - Culvert Sizing - 06-001-C032.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-302.001	2.83	3.8	12	< 6	EC-3 Type B
C AR-302.002	2.10	2.4	12	< 6	EC-3 Type B
C AR-302.003	5.37	5.5	18	< 8	EC-1 Class A1
C AR-302.004	4.47	2.5	12	< 6	EC-3 Type B
C AR-302.005	0.57	1.5	12	< 6	EC-3 Type B
C AR-302.006	0.46	1.5	12	< 6	EC-3 Type B
C AR-302.007	0.35	1.1	12	< 6	EC-3 Type B
C AR-302.008	5.01	9.7	18	< 8	EC-1 Class A1
C AR-302.009	7.65	10.1	18	< 8	EC-1 Class A1
C AR-302.010	5.57	2.4	12	< 6	EC-3 Type B
C AR-302.011	4.72	2.1	12	< 6	EC-3 Type B
C AR-302.012	0.60	0.9	12	< 6	EC-3 Type B
C AR-302.013	0.80	1.3	12	< 6	EC-3 Type B
C AR-302.014	1.40	1.8	12	< 6	EC-3 Type B
C AR-302.015	1.30	1.5	12	< 6	EC-3 Type B
C E121.001	280.36	2.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C032.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.004

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Table 8.004 - Roadside Ditch Sizing - 06-001-C032.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-302.001	0.3	3.8	0.01	Type I	2.0	0.1	0.4	Grass Lined
C AR-302.002	0.3	2.4	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-302.003	0.3	5.5	0.06	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-302.004	0.0	2.5	0.10	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-302.005	0.4	1.5	0.13	Type I	1.5	2.5	2.4	Riprap (D50 - 6 in)
C AR-302.006	0.5	1.5	0.05	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C AR-302.007	0.4	1.1	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-302.008	2.3	9.7	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)
C AR-302.009	1.3	10.1	0.09	Type I	2.0	3.0	4.8	Riprap (D50 - 12 in)
C AR-302.010	0.0	2.4	0.08	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-302.011	0.0	2.1	0.12	Type I	1.5	0.8	4.8	Riprap (D50 - 12 in)
C AR-302.012	0.1	0.9	0.07	Type I	1.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-302.013	0.2	1.3	0.10	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-302.014	0.2	1.8	0.13	Type I	1.5	2.1	4.8	Riprap (D50 - 12 in)
C AR-302.015	0.1	1.5	0.09	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C E121.001	0.0	2.4	0.16	Type I	1.5	See Note 1	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 06-001-C036.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.005

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C036.AR1	C E122.001	3A	122	Highland	Bolar Run-Jackson River	132	7
06-001-C036.AR1	C E122.002	3A	122	Highland	Bolar Run-Jackson River	132	7
06-001-C036.AR1	C E122.003	3A	122	Highland	Bolar Run-Jackson River	132	7
06-001-C036.AR1	C E122.004	3A	122	Highland	Bolar Run-Jackson River	132	7

Water Quantity for Culverts and Ditches
Access Road: 06-001-C036.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.005

Table 5.005 - Water Quantity - 06-001-C036.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E122.001	0.78	2.5	3.0	5.0	13	70	0.4	0.7	2.2	13	70	0.4	0.7	2.2	0.0	0.0	0.0
C E122.002	0.63	2.5	3.0	5.0	11	71	0.4	0.7	2.0	11	71	0.4	0.7	2.0	0.0	0.0	0.0
C E122.003	0.12	2.5	3.0	5.0	4	71	0.1	0.2	0.5	4	73	0.1	0.2	0.5	0.0	0.0	0.0
C E122.004	21.33	2.5	3.0	5.0	19	71	9.7	16.5	50.9	19	71	9.7	16.5	50.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches

Access Road: 06-001-C036.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.005

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.005 - Energy Balance - 06-001-C036.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E122.001	0.4	0.03	0.4	0.03	0.4	0.02	0.4	met	n/a	not exceeded	n/a	0.3	exceeded	0.1
C E122.002	0.4	0.02	0.4	0.02	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.3	exceeded	0.1
C E122.003	0.1	0.00	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E122.004	9.7	0.76	9.7	0.76	9.7	0.76	9.7	met	n/a	not exceeded	n/a	9.7	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 06-001-C036.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.005

Table 7.005 - Culvert Sizing - 06-001-C036.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E122.001	0.78	2.2	12	< 6	EC-3 Type B
C E122.002	0.63	2.0	12	< 6	EC-3 Type B
C E122.003	0.12	0.5	12	< 6	EC-3 Type B
C E122.004	21.33	50.9	42	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 06-001-C036.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.005

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.005 - Roadside Ditch Sizing - 06-001-C036.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E122.001	0.7	2.2	0.14	Type I	1.5	3.5	4.8	Riprap (D50 - 12 in)
C E122.002	0.7	2.0	0.07	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C E122.003	0.2	0.5	0.01	Type I	1.0	0.1	0.4	Grass Lined
C E122.004	16.5	50.9	0.01	Type III	2.5	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.006

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C037.AR1	C AR-303.008	3A	AR-303	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C AR-303.009	3A	AR-303	Bath	Bolar Run-Jackson River	132	9, 10
06-001-C037.AR1	C AR-303.010	3A	AR-303	Bath	Bolar Run-Jackson River	132	9, 10
06-001-C037.AR1	C AR-303.011	3A	AR-303	Bath	Bolar Run-Jackson River	132	9, 10
06-001-C037.AR1	C AR-303.012	3A	AR-303	Bath	Bolar Run-Jackson River	132	9, 10
06-001-C037.AR1	C AR-303.013	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9, 10
06-001-C037.AR1	C AR-303.014	3A	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR1	C AR-303.015	3A	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR1	C AR-303.016	3A	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR1	C AR-303.017	3A	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR1	C AR-303.018	3A	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR1	C E123.003	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.004	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.005	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.006	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.007	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.008	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.009	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.010	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR1	C E123.011	3A	123	Bath	Bolar Run-Jackson River	132	9

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.006

Table 5.006 - Water Quantity - 06-001-C037.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-303.008	35.82	2.5	3.0	5.0	11	30	0.0	0.0	0.0	11	31	0.0	0.0	0.1	0.0	0.0	0.0
C AR-303.009	0.54	2.5	3.0	5.0	9	45	0.0	0.0	0.2	9	46	0.0	0.0	0.2	0.0	0.0	0.0
C AR-303.010	2.12	2.5	3.0	5.0	8	37	0.0	0.0	0.0	8	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.011	53.37	2.5	3.0	5.0	10	36	0.0	0.0	0.6	10	36	0.0	0.0	0.6	0.0	0.0	0.0
C AR-303.012	1.82	2.5	3.0	5.0	8	41	0.0	0.0	0.2	8	42	0.0	0.0	0.3	0.0	0.0	0.1
C AR-303.013	6.74	2.5	3.0	5.0	12	45	0.0	0.0	2.0	12	45	0.0	0.0	2.0	0.0	0.0	0.0
C AR-303.014	3.11	2.5	3.0	5.0	9	49	0.0	0.0	2.2	9	49	0.0	0.0	2.2	0.0	0.0	0.0
C AR-303.015	0.26	2.5	3.0	5.0	5	65	0.1	0.2	0.8	5	66	0.1	0.2	0.8	0.0	0.0	0.0
C AR-303.016	1.62	2.5	3.0	5.0	9	56	0.0	0.2	2.4	9	56	0.0	0.2	2.4	0.0	0.0	0.0
C AR-303.017	3.13	2.5	3.0	5.0	10	48	0.0	0.0	1.9	10	48	0.0	0.0	1.9	0.0	0.0	0.0
C AR-303.018	3.32	2.5	3.0	5.0	10	50	0.0	0.0	2.6	10	50	0.0	0.0	2.6	0.0	0.0	0.0
C E123.003	1.65	2.5	3.0	5.0	9	35	0.0	0.0	0.0	9	35	0.0	0.0	0.0	0.0	0.0	0.0
C E123.004	35.07	2.5	3.0	5.0	14	32	0.0	0.0	0.1	14	32	0.0	0.0	0.1	0.0	0.0	0.0
C E123.005	8.39	2.5	3.0	5.0	17	47	0.0	0.0	3.0	17	47	0.0	0.0	3.0	0.0	0.0	0.0
C E123.006	2.79	2.5	3.0	5.0	15	74	2.0	3.1	8.5	15	74	2.0	3.1	8.5	0.0	0.0	0.0
C E123.007	0.69	2.5	3.0	5.0	7	74	0.7	1.1	2.8	7	75	0.7	1.1	2.9	0.1	0.1	0.1
C E123.008	0.92	2.5	3.0	5.0	15	77	0.8	1.2	3.1	15	78	0.9	1.3	3.2	0.1	0.1	0.1
C E123.009	1.33	2.5	3.0	5.0	15	77	1.2	1.8	4.4	15	78	1.3	1.9	4.6	0.1	0.1	0.2
C E123.010	2.05	2.5	3.0	5.0	17	77	1.7	2.6	6.5	17	77	1.7	2.6	6.5	0.0	0.0	0.0
C E123.011	2.06	2.5	3.0	5.0	13	77	2.0	2.9	7.3	13	78	2.1	3.1	7.6	0.2	0.2	0.3

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.006

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.006 - Energy Balance - 06-001-C037.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-303.008	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.009	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.010	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.012	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.013	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.014	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-303.015	0.1	0.01	0.1	0.01	0.1	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-303.016	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-303.017	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-303.018	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C E123.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E123.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E123.005	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C E123.006	2.0	0.13	2.0	0.13	2.0	0.13	2.0	met	n/a	not exceeded	n/a	2.0	exceeded	0.0
C E123.007	0.7	0.03	0.7	0.03	0.6	0.03	0.6	not met	0.1	exceeded	0.1	0.5	exceeded	0.3
C E123.008	0.8	0.05	0.9	0.05	0.8	0.05	0.8	not met	0.1	exceeded	0.1	0.8	exceeded	0.1
C E123.009	1.2	0.07	1.3	0.08	1.2	0.07	1.1	not met	0.2	exceeded	0.1	1.1	exceeded	0.2
C E123.010	1.7	0.11	1.7	0.11	1.7	0.11	1.7	met	n/a	not exceeded	n/a	1.7	exceeded	0.0
C E123.011	2.0	0.11	2.1	0.12	2.0	0.11	1.8	not met	0.3	exceeded	0.2	1.8	exceeded	0.3

Water Quantity for Culverts and Ditches

Access Road: 06-001-C037.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.006

Table 7.006 - Culvert Sizing - 06-001-C037.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-303.008	35.82	0.1	12	< 6	EC-3 Type B
C AR-303.009	0.54	0.2	12	< 6	EC-3 Type B
C AR-303.010	2.12	0.0	12	< 6	EC-3 Type B
C AR-303.011	53.37	0.6	12	< 6	EC-3 Type B
C AR-303.012	1.82	0.3	12	< 6	EC-3 Type B
C AR-303.013	6.74	2.0	12	< 6	EC-3 Type B
C AR-303.014	3.11	2.2	12	< 6	EC-3 Type B
C AR-303.015	0.26	0.8	12	< 6	EC-3 Type B
C AR-303.016	1.62	2.4	12	< 6	EC-3 Type B
C AR-303.017	3.13	1.9	12	< 6	EC-3 Type B
C AR-303.018	3.32	2.6	12	< 6	EC-3 Type B
C E123.003	1.65	0.0	12	< 6	EC-3 Type B
C E123.004	35.07	0.1	12	< 6	EC-3 Type B
C E123.005	8.39	3.0	12	< 6	EC-3 Type B
C E123.006	2.79	8.5	18	< 8	EC-1 Class A1
C E123.007	0.69	2.9	12	< 6	EC-3 Type B
C E123.008	0.92	3.2	12	< 6	EC-3 Type B
C E123.009	1.33	4.6	18	< 8	EC-1 Class A1
C E123.010	2.05	6.5	18	< 8	EC-1 Class A1
C E123.011	2.06	7.6	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.006

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.006 - Roadside Ditch Sizing - 06-001-C037.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-303.008	0.0	0.1	0.06	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.009	0.0	0.2	0.08	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.010	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.011	0.0	0.6	0.08	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.012	0.0	0.3	0.05	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.013	0.0	2.0	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-303.014	0.0	2.2	0.19	Type I	1.5	1.4	4.8	Riprap (D50 - 12 in)
C AR-303.015	0.2	0.8	0.05	Type I	1.0	0.9	2.4	Riprap (D50 - 6 in)
C AR-303.016	0.2	2.4	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-303.017	0.0	1.9	0.05	Type I	1.5	0.4	2.4	Riprap (D50 - 6 in)
C AR-303.018	0.0	2.6	0.09	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C E123.003	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C E123.004	0.0	0.1	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C E123.005	0.0	3.0	0.03	Type I	1.5	0.3	2.4	Riprap (D50 - 6 in)
C E123.006	3.1	8.5	0.02	Type I	2.0	1.4	2.4	Riprap (D50 - 6 in)
C E123.007	1.1	2.9	0.16	Type I	1.5	4.5	4.8	Riprap (D50 - 12 in)
C E123.008	1.3	3.2	0.05	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C E123.009	1.9	4.6	0.05	Type I	1.5	2.0	2.4	Riprap (D50 - 6 in)
C E123.010	2.6	6.5	0.26	Type I	1.5	9.3	See Note 3	See Note 3
C E123.011	3.1	7.6	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.007

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C037.AR3	C AR-303.001	3A	AR-303	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR3	C AR-303.002	3A	AR-303	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR3	C AR-303.003	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9
06-001-C037.AR3	C AR-303.004	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9
06-001-C037.AR3	C AR-303.005	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9, 10
06-001-C037.AR3	C AR-303.006	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9, 10
06-001-C037.AR3	C AR-303.007	3A	AR-303	Bath	Bolar Run-Jackson River	132	8, 9, 10
06-001-C037.AR3	C E123.001	3A	123	Bath	Bolar Run-Jackson River	132	9
06-001-C037.AR3	C E123.002	3A	123	Bath	Bolar Run-Jackson River	132	9

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.007

Table 5.007 - Water Quantity - 06-001-C037.AR3

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-303.001	1.99	2.5	3.0	5.0	12	63	0.4	0.9	4.1	12	63	0.4	0.9	4.1	0.0	0.0	0.0
C AR-303.002	1.38	2.5	3.0	5.0	12	46	0.0	0.0	0.5	12	46	0.0	0.0	0.5	0.0	0.0	0.0
C AR-303.003	1.34	2.5	3.0	5.0	12	38	0.0	0.0	0.0	12	39	0.0	0.0	0.1	0.0	0.0	0.0
C AR-303.004	1.15	2.5	3.0	5.0	12	36	0.0	0.0	0.0	12	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.005	0.47	2.5	3.0	5.0	12	32	0.0	0.0	0.0	12	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.006	0.92	2.5	3.0	5.0	12	32	0.0	0.0	0.0	12	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.007	5.18	2.5	3.0	5.0	11	46	0.0	0.0	2.1	11	46	0.0	0.0	2.1	0.0	0.0	0.0
C E123.001	0.18	2.5	3.0	5.0	14	78	0.2	0.3	0.7	14	78	0.2	0.3	0.7	0.0	0.0	0.0
C E123.002	1.02	2.5	3.0	5.0	14	78	1.0	1.5	3.6	14	78	1.0	1.5	3.6	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.007

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.007 - Energy Balance - 06-001-C037.AR3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-303.001	0.4	0.03	0.4	0.03	0.4	0.03	0.4	met	n/a	not exceeded	n/a	0.4	exceeded	0.0
C AR-303.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.007	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E123.001	0.2	0.01	0.2	0.01	0.2	0.01	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C E123.002	1.0	0.06	1.0	0.06	0.9	0.06	1.0	met	n/a	not exceeded	n/a	0.9	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 06-001-C037.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.007

Table 7.007 - Culvert Sizing - 06-001-C037.AR3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-303.001	1.99	4.1	12	< 6	EC-3 Type B
C AR-303.002	1.38	0.5	12	< 6	EC-3 Type B
C AR-303.003	1.34	0.1	12	< 6	EC-3 Type B
C AR-303.004	1.15	0.0	12	< 6	EC-3 Type B
C AR-303.005	0.47	0.0	12	< 6	EC-3 Type B
C AR-303.006	0.92	0.0	12	< 6	EC-3 Type B
C AR-303.007	5.18	2.1	12	< 6	EC-3 Type B
C E123.001	0.18	0.7	12	< 6	EC-3 Type B
C E123.002	1.02	3.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.007

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.007 - Roadside Ditch Sizing - 06-001-C037.AR3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-303.001	0.9	4.1	0.08	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-303.002	0.0	0.5	0.13	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C AR-303.003	0.0	0.1	0.10	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.004	0.0	0.0	0.07	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.005	0.0	0.0	0.02	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-303.006	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.007	0.0	2.1	0.10	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C E123.001	0.3	0.7	0.16	Type I	1.0	2.6	2.4	Riprap (D50 - 6 in)
C E123.002	1.5	3.6	0.15	Type I	1.5	4.8	4.8	Riprap (D50 - 12 in)

Tables 4.008-015 to 8.008-015

Permanent Access Roads, Spread 4

Tables 4.008-015 Culvert List

Tables 5.008-015 Water Quantity

Tables 6.008-015 Energy Balance

Tables 7.008-015 Culvert Sizing

Tables 8.008-015 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches

Access Road: 06-001-C037.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.008

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
06-001-C037.AR2	C AR-303.019	4	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR2	C AR-303.020	4	AR-303	Bath	Bolar Run-Jackson River	132	8
06-001-C037.AR2	C AR-303.021	4	AR-303	Bath	Bolar Run-Jackson River	132	10
06-001-C037.AR2	C AR-303.022	4	AR-303	Bath	Bolar Run-Jackson River	132	10
06-001-C037.AR2	C AR-303.023	4	AR-303	Bath	Bolar Run-Jackson River	132	10
06-001-C037.AR2	C AR-303.024	4	AR-303	Bath	Bolar Run-Jackson River	132	10
06-001-C037.AR2	C AR-303.025	4	AR-303	Bath	Bolar Run-Jackson River	132	10, 11
06-001-C037.AR2	C AR-303.026	4	AR-303	Bath	Bolar Run-Jackson River	132	11
06-001-C037.AR2	C AR-303.027	4	AR-303	Bath	Bolar Run-Jackson River	132	11
06-001-C037.AR2	C AR-303.028	4	AR-303	Bath	Bolar Run-Jackson River	132	11
06-001-C037.AR2	C E124.001	4	124	Bath	Bolar Run-Jackson River	132	11
06-001-C037.AR2	C E124.002	4	124	Bath	Bolar Run-Jackson River	132	11
06-001-C037.AR2	C E124.003	4	124	Bath	Bolar Run-Jackson River	133	11
06-001-C037.AR2	C E124.004	4	124	Bath	Bolar Run-Jackson River	133	11
06-001-C037.AR2	C E124.005	4	124	Bath	Bolar Run-Jackson River	133	11
06-001-C037.AR2	C E124.006	4	124	Bath	Bolar Run-Jackson River	133	11
06-001-C037.AR2	C E124.007	4	124	Bath	Bolar Run-Jackson River	133	11
06-001-C037.AR2	C E124.008	4	124	Bath	Bolar Run-Jackson River	133	11, 12
06-001-C037.AR2	C E124.009	4	124	Bath	Bolar Run-Jackson River	133	11, 12
06-001-C037.AR2	C E124.010	4	124	Bath	Bolar Run-Jackson River	133	12
06-001-C037.AR2	C E124.011	4	124	Bath	Bolar Run-Jackson River	133	12
06-001-C037.AR2	C E125.001	4	125	Bath	Bolar Run-Jackson River	134	12
06-001-C037.AR2	C E125.002	4	125	Bath	Bolar Run-Jackson River	133	12

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.008

Table 5.008 - Water Quantity - 06-001-C037.AR2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-303.019	0.74	2.5	3.0	5.0	8	41	0.0	0.0	0.1	8	43	0.0	0.0	0.2	0.0	0.0	0.1
C AR-303.020	1.44	2.5	3.0	5.0	9	32	0.0	0.0	0.0	9	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.021	0.78	2.5	3.0	5.0	9	56	0.0	0.1	1.2	9	57	0.0	0.1	1.3	0.0	0.0	0.1
C AR-303.022	4.01	2.5	3.0	5.0	9	42	0.0	0.0	0.6	9	42	0.0	0.0	0.6	0.0	0.0	0.0
C AR-303.023	12.86	2.5	3.0	5.0	11	33	0.0	0.0	0.1	11	33	0.0	0.0	0.1	0.0	0.0	0.0
C AR-303.024	5.85	2.5	3.0	5.0	9	30	0.0	0.0	0.0	9	30	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.025	6.27	2.5	3.0	5.0	11	30	0.0	0.0	0.0	11	30	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.026	4.09	2.5	3.0	5.0	10	30	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.027	5.92	2.5	3.0	5.0	10	30	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-303.028	4.31	2.5	3.0	5.0	10	30	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.001	0.94	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.002	2.50	2.5	3.0	5.0	10	33	0.0	0.0	0.0	10	33	0.0	0.0	0.0	0.0	0.0	0.0
C E124.003	5.95	2.5	3.0	5.0	14	31	0.0	0.0	0.0	14	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.004	3.29	2.5	3.0	5.0	14	31	0.0	0.0	0.0	14	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.005	3.83	2.5	3.0	5.0	14	32	0.0	0.0	0.0	14	32	0.0	0.0	0.0	0.0	0.0	0.0
C E124.006	2.28	2.5	3.0	5.0	15	37	0.0	0.0	0.0	15	37	0.0	0.0	0.0	0.0	0.0	0.0
C E124.007	1.21	2.5	3.0	5.0	15	37	0.0	0.0	0.0	15	37	0.0	0.0	0.0	0.0	0.0	0.0
C E124.008	7.12	2.5	3.0	5.0	14	31	0.0	0.0	0.0	14	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.009	2.15	2.5	3.0	5.0	13	31	0.0	0.0	0.0	13	31	0.0	0.0	0.0	0.0	0.0	0.0
C E124.010	2.94	2.5	3.0	5.0	12	31	0.0	0.0	0.0	12	32	0.0	0.0	0.0	0.0	0.0	0.0
C E124.011	3.93	2.5	3.0	5.0	14	30	0.0	0.0	0.0	14	31	0.0	0.0	0.0	0.0	0.0	0.0
C E125.001	0.90	2.5	3.0	5.0	13	32	0.0	0.0	0.0	13	35	0.0	0.0	0.0	0.0	0.0	0.0
C E125.002	1.36	2.5	3.0	5.0	14	31	0.0	0.0	0.0	14	33	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.008

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.008 - Energy Balance - 06-001-C037.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-303.019	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.020	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.021	0.0	0.01	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-303.022	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.023	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.024	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.025	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.026	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.027	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-303.028	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.007	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.008	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.009	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.010	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E124.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E125.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E125.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 06-001-C037.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.008

Table 7.008 - Culvert Sizing - 06-001-C037.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-303.019	0.74	0.2	12	< 6	EC-3 Type B
C AR-303.020	1.44	0.0	12	< 6	EC-3 Type B
C AR-303.021	0.78	1.3	12	< 6	EC-3 Type B
C AR-303.022	4.01	0.6	12	< 6	EC-3 Type B
C AR-303.023	12.86	0.1	12	< 6	EC-3 Type B
C AR-303.024	5.85	0.0	12	< 6	EC-3 Type B
C AR-303.025	6.27	0.0	12	< 6	EC-3 Type B
C AR-303.026	4.09	0.0	12	< 6	EC-3 Type B
C AR-303.027	5.92	0.0	12	< 6	EC-3 Type B
C AR-303.028	4.31	0.0	12	< 6	EC-3 Type B
C E124.001	0.94	0.0	12	< 6	EC-3 Type B
C E124.002	2.50	0.0	12	< 6	EC-3 Type B
C E124.003	5.95	0.0	12	< 6	EC-3 Type B
C E124.004	3.29	0.0	12	< 6	EC-3 Type B
C E124.005	3.83	0.0	12	< 6	EC-3 Type B
C E124.006	2.28	0.0	12	< 6	EC-3 Type B
C E124.007	1.21	0.0	12	< 6	EC-3 Type B
C E124.008	7.12	0.0	12	< 6	EC-3 Type B
C E124.009	2.15	0.0	12	< 6	EC-3 Type B
C E124.010	2.94	0.0	12	< 6	EC-3 Type B
C E124.011	3.93	0.0	12	< 6	EC-3 Type B
C E125.001	0.90	0.0	12	< 6	EC-3 Type B
C E125.002	1.36	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 06-001-C037.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.008

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.008 - Roadside Ditch Sizing - 06-001-C037.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-303.019	0.0	0.2	0.09	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.020	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.021	0.1	1.3	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-303.022	0.0	0.6	0.17	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.023	0.0	0.1	0.12	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-303.024	0.0	0.0	0.23	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-303.025	0.0	0.0	0.04	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-303.026	0.0	0.0	0.08	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.027	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-303.028	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.001	0.0	0.0	0.04	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E124.002	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.003	0.0	0.0	0.04	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.004	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.005	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.006	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.007	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.008	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C E124.009	0.0	0.0	0.28	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E124.010	0.0	0.0	0.25	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E124.011	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C E125.001	0.0	0.0	0.12	Type I	1.0	See Note 1	0.4	Grass Lined
C E125.002	0.0	0.0	0.17	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-014.AR2	C AR-304.001	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.002	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.003	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.004	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.005	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.006	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.007	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.008	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.009	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.010	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.011	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.012	4	AR-304	Bath	Bolar Run-Jackson River	139	21
36-014.AR2	C AR-304.013	4	AR-304	Bath	Warm Springs Run-Jackson River	140	21
36-014.AR2	C AR-304.014	4	AR-304	Bath	Warm Springs Run-Jackson River	140	21
36-014.AR2	C AR-304.015	4	AR-304	Bath	Warm Springs Run-Jackson River	140	20, 21
36-014.AR2	C AR-304.016	4	AR-304	Bath	Warm Springs Run-Jackson River	140	20
36-014.AR2	C AR-304.017	4	AR-304	Bath	Warm Springs Run-Jackson River	140	20
36-014.AR2	C AR-304.019	4	AR-304	Bath	Warm Springs Run-Jackson River	140	19, 20
36-014.AR2	C AR-304.020	4	AR-304	Bath	Warm Springs Run-Jackson River	140	19, 20
36-014.AR2	C AR-304.021	4	AR-304	Bath	Warm Springs Run-Jackson River	140	19, 20
36-014.AR2	C AR-304.022	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.023	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.024	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.025	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.026	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.027	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.028	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.029	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.030	4	AR-304	Bath	Dry Run	137	19
36-014.AR2	C AR-304.031	4	AR-304	Bath	Dry Run	137	18, 19
36-014.AR2	C AR-304.032	4	AR-304	Bath	Dry Run	137	18, 19
36-014.AR2	C AR-304.033	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.034	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.035	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.036	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.037	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.038	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.039	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.040	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.041	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.042	4	AR-304	Bath	Dry Run	137	18
36-014.AR2	C AR-304.043	4	AR-304	Bath	Dry Run	137	17, 18
36-014.AR2	C AR-304.044	4	AR-304	Bath	Bolar Run-Jackson River	139	17
36-014.AR2	C AR-304.045	4	AR-304	Bath	Bolar Run-Jackson River	139	16, 17
36-014.AR2	C AR-304.046	4	AR-304	Bath	Bolar Run-Jackson River	139	16
36-014.AR2	C AR-304.047	4	AR-304	Bath	Bolar Run-Jackson River	139	16
36-014.AR2	C AR-304.048	4	AR-304	Bath	Bolar Run-Jackson River	139	16
36-014.AR2	C AR-304.049	4	AR-304	Bath	Bolar Run-Jackson River	139	16
36-014.AR2	C AR-304.050	4	AR-304	Bath	Bolar Run-Jackson River	139	16, 17
36-014.AR2	C AR-304.051	4	AR-304	Bath	Bolar Run-Jackson River	139	16, 17
36-014.AR2	C AR-304.052	4	AR-304	Bath	Dry Run	137	16, 17
36-014.AR2	C AR-304.053	4	AR-304	Bath	Dry Run	137	16, 17
36-014.AR2	C AR-304.054	4	AR-304	Bath	Dry Run	137	17
36-014.AR2	C AR-304.055	4	AR-304	Bath	Dry Run	137	17
36-014.AR2	C AR-304.056	4	AR-304	Bath	Dry Run	137	17
36-014.AR2	C AR-304.057	4	AR-304	Bath	Dry Run	137	16
36-014.AR2	C AR-304.058	4	AR-304	Bath	Dry Run	137	16
36-014.AR2	C AR-304.059	4	AR-304	Bath	Dry Run	137	16
36-014.AR2	C AR-304.060	4	AR-304	Bath	Dry Run	137	16
36-014.AR2	C AR-304.061	4	AR-304	Bath	Dry Run	137	16
36-014.AR2	C AR-304.062	4	AR-304	Bath	Dry Run	137	15, 16
36-014.AR2	C AR-304.063	4	AR-304	Bath	Dry Run	137	15
36-014.AR2	C AR-304.064	4	AR-304	Bath	Dry Run	137	15
36-014.AR2	C AR-304.065	4	AR-304	Bath	Dry Run	137	15
36-014.AR2	C AR-304.066	4	AR-304	Bath	Dry Run	137	15

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

36-014.AR2	C AR-304.067	4	AR-304	Bath	Dry Run	137	15
36-014.AR2	C AR-304.068	4	AR-304	Bath	Dry Run	137	14, 15
36-014.AR2	C AR-304.069	4	AR-304	Bath	Dry Run	137	14, 15
36-014.AR2	C AR-304.070	4	AR-304	Bath	Dry Run	137	14
36-014.AR2	C AR-304.071	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.072	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.073	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.074	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.075	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.076	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.077	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.078	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.079	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.080	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.081	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.082	4	AR-304	Bath	Dry Run	135	14
36-014.AR2	C AR-304.083	4	AR-304	Bath	Dry Run	135	13, 14
36-014.AR2	C AR-304.084	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.085	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.086	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.087	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.088	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.089	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.090	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.091	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.092	4	AR-304	Bath	Dry Run	135	13
36-014.AR2	C AR-304.093	4	AR-304	Bath	Dry Run	135	13

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Table 5.009 - Water Quantity - 36-014.AR2																		
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-304.001	0.43	2.5	3.0	5.0	8	50	0.0	0.0	0.4	8	53	0.0	0.0	0.5	0.0	0.0	0.1
C AR-304.002	1.30	2.5	3.0	5.0	11	49	0.0	0.0	0.8	11	50	0.0	0.0	1.0	0.0	0.0	0.1
C AR-304.003	0.63	2.5	3.0	5.0	11	47	0.0	0.0	0.3	11	48	0.0	0.0	0.4	0.0	0.0	0.1
C AR-304.004	0.83	2.5	3.0	5.0	11	51	0.0	0.0	0.7	11	53	0.0	0.0	0.9	0.0	0.0	0.2
C AR-304.005	12.40	2.5	3.0	5.0	13	54	0.1	0.7	13.1	13	54	0.1	0.7	13.1	0.0	0.0	0.0
C AR-304.006	4.52	2.5	3.0	5.0	7	52	0.0	0.1	5.2	7	52	0.0	0.1	5.2	0.0	0.0	0.0
C AR-304.007	2.89	2.5	3.0	5.0	14	52	0.0	0.1	2.3	14	52	0.0	0.1	2.3	0.0	0.0	0.0
C AR-304.008	6.15	2.5	3.0	5.0	11	57	0.1	1.0	9.1	11	57	0.1	1.0	9.1	0.0	0.0	0.0
C AR-304.009	1.65	2.5	3.0	5.0	13	61	0.2	0.5	3.0	13	61	0.2	0.5	3.0	0.0	0.0	0.0
C AR-304.010	0.75	2.5	3.0	5.0	6	62	0.2	0.4	1.8	6	63	0.2	0.5	1.9	0.0	0.1	0.1
C AR-304.011	0.53	2.5	3.0	5.0	9	60	0.1	0.2	1.0	9	61	0.1	0.2	1.1	0.0	0.0	0.1
C AR-304.012	0.05	2.5	3.0	5.0	3	64	0.0	0.0	0.2	3	69	0.0	0.1	0.2	0.0	0.0	0.0
C AR-304.013	0.55	2.5	3.0	5.0	12	58	0.0	0.1	0.9	12	60	0.1	0.2	1.0	0.0	0.1	0.1
C AR-304.014	0.74	2.5	3.0	5.0	14	57	0.0	0.1	1.0	14	58	0.0	0.1	1.0	0.0	0.0	0.1
C AR-304.015	0.58	2.5	3.0	5.0	13	57	0.0	0.1	0.8	13	58	0.0	0.1	0.9	0.0	0.0	0.1
C AR-304.016	0.62	2.5	3.0	5.0	10	57	0.0	0.1	0.9	10	58	0.0	0.1	1.0	0.0	0.0	0.1
C AR-304.017	0.74	2.5	3.0	5.0	11	56	0.0	0.1	1.0	11	57	0.0	0.1	1.1	0.0	0.0	0.1
C AR-304.019	0.26	2.5	3.0	5.0	2	63	0.1	0.2	0.8	2	65	0.1	0.2	0.8	0.0	0.0	0.1
C AR-304.020	0.65	2.5	3.0	5.0	13	63	0.1	0.3	1.3	13	64	0.1	0.3	1.4	0.0	0.0	0.1
C AR-304.021	2.32	2.5	3.0	5.0	11	58	0.1	0.5	3.6	11	59	0.1	0.6	3.9	0.1	0.1	0.3
C AR-304.022	1.02	2.5	3.0	5.0	13	58	0.0	0.2	1.5	13	58	0.0	0.2	1.5	0.0	0.0	0.0
C AR-304.023	1.47	2.5	3.0	5.0	13	56	0.0	0.2	1.9	13	56	0.0	0.2	1.9	0.0	0.0	0.0
C AR-304.024	0.37	2.5	3.0	5.0	12	57	0.0	0.1	0.5	12	58	0.0	0.1	0.6	0.0	0.0	0.0
C AR-304.025	0.91	2.5	3.0	5.0	13	57	0.0	0.1	1.2	13	58	0.0	0.2	1.3	0.0	0.0	0.1
C AR-304.026	0.94	2.5	3.0	5.0	10	57	0.0	0.2	1.4	10	58	0.0	0.2	1.5	0.0	0.0	0.1
C AR-304.027	2.29	2.5	3.0	5.0	11	59	0.1	0.6	3.8	11	60	0.2	0.7	4.0	0.1	0.1	0.3
C AR-304.028	1.39	2.5	3.0	5.0	13	59	0.1	0.3	2.2	13	59	0.1	0.3	2.2	0.0	0.0	0.0
C AR-304.029	1.38	2.5	3.0	5.0	13	60	0.1	0.4	2.3	13	60	0.1	0.4	2.3	0.0	0.0	0.0
C AR-304.030	1.26	2.5	3.0	5.0	13	59	0.1	0.3	2.0	13	60	0.1	0.3	2.1	0.0	0.1	0.1
C AR-304.031	1.24	2.5	3.0	5.0	11	59	0.1	0.3	2.1	11	59	0.1	0.3	2.1	0.0	0.0	0.0
C AR-304.032	0.74	2.5	3.0	5.0	11	63	0.2	0.4	1.6	11	63	0.2	0.4	1.6	0.0	0.0	0.0
C AR-304.033	0.86	2.5	3.0	5.0	11	60	0.1	0.3	1.5	11	61	0.1	0.3	1.6	0.0	0.0	0.1
C AR-304.034	0.31	2.5	3.0	5.0	10	56	0.0	0.0	0.4	10	56	0.0	0.0	0.4	0.0	0.0	0.0
C AR-304.035	1.88	2.5	3.0	5.0	10	59	0.1	0.5	3.3	10	60	0.2	0.6	3.6	0.1	0.1	0.2
C AR-304.036	0.66	2.5	3.0	5.0	9	61	0.1	0.3	1.3	9	62	0.1	0.3	1.4	0.0	0.0	0.1
C AR-304.037	0.34	2.5	3.0	5.0	8	64	0.1	0.2	0.9	8	65	0.1	0.2	0.9	0.0	0.0	0.0
C AR-304.038	0.59	2.5	3.0	5.0	5	66	0.3	0.5	1.8	5	67	0.3	0.6	1.9	0.0	0.1	0.1
C AR-304.039	0.73	2.5	3.0	5.0	10	62	0.1	0.3	1.6	10	63	0.2	0.4	1.7	0.0	0.1	0.1
C AR-304.040	0.70	2.5	3.0	5.0	11	64	0.2	0.4	1.6	11	65	0.2	0.4	1.7	0.0	0.1	0.1
C AR-304.041	0.51	2.5	3.0	5.0	5	66	0.2	0.4	1.6	5	67	0.3	0.5	1.6	0.0	0.0	0.1
C AR-304.042	1.70	2.5	3.0	5.0	18	59	0.1	0.3	2.2	18	59	0.1	0.3	2.2	0.0	0.0	0.0
C AR-304.043	2.61	2.5	3.0	5.0	14	59	0.1	0.6	3.8	14	60	0.2	0.7	4.1	0.1	0.1	0.3
C AR-304.044	3.40	2.5	3.0	5.0	15	35	0.0	0.0	0.0	15	36	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.045	4.16	2.5	3.0	5.0	11	37	0.0	0.0	0.1	11	38	0.0	0.0	0.1	0.0	0.0	0.0
C AR-304.046	2.33	2.5	3.0	5.0	12	36	0.0	0.0	0.0	12	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.047	1.40	2.5	3.0	5.0	11	33	0.0	0.0	0.0	11	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.048	0.97	2.5	3.0	5.0	17	32	0.0	0.0	0.0	17	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.049	1.55	2.5	3.0	5.0	12	31	0.0	0.0	0.0	12	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.050	2.81	2.5	3.0	5.0	9	31	0.0	0.0	0.0	9	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.051	1.51	2.5	3.0	5.0	13	31	0.0	0.0	0.0	13	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.052	2.43	2.5	3.0	5.0	18	31	0.0	0.0	0.0	18	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.053	1.68	2.5	3.0	5.0	17	31	0.0	0.0	0.0	17	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.054	0.76	2.5	3.0	5.0	9	32	0.0	0.0	0.0	9	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.055	1.30	2.5	3.0	5.0	10	32	0.0	0.0	0.0	10	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.056	1.23	2.5	3.0	5.0	12	34	0.0	0.0	0.0	12	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.057	0.17	2.5	3.0	5.0	7	34	0.0	0.0	0.0	7	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.058	0.47	2.5	3.0	5.0	7	36	0.0	0.0	0.0	7	39	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.059	0.71	2.5	3.0	5.0	10	35	0.0	0.0	0.0	10	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.060	0.93	2.5	3.0	5.0	13	33	0.0	0.0	0.0	13	35	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

C AR-304.061	0.99	2.5	3.0	5.0	17	36	0.0	0.0	0.0	17	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.062	1.10	2.5	3.0	5.0	15	39	0.0	0.0	0.0	15	40	0.0	0.0	0.1	0.0	0.0	0.0
C AR-304.063	1.15	2.5	3.0	5.0	13	41	0.0	0.0	0.1	13	42	0.0	0.0	0.1	0.0	0.0	0.0
C AR-304.064	0.37	2.5	3.0	5.0	10	42	0.0	0.0	0.1	10	44	0.0	0.0	0.1	0.0	0.0	0.1
C AR-304.065	0.19	2.5	3.0	5.0	10	37	0.0	0.0	0.0	10	39	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.066	0.82	2.5	3.0	5.0	13	35	0.0	0.0	0.0	13	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.067	0.74	2.5	3.0	5.0	13	40	0.0	0.0	0.0	13	41	0.0	0.0	0.1	0.0	0.0	0.0
C AR-304.068	0.79	2.5	3.0	5.0	9	36	0.0	0.0	0.0	9	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.069	0.69	2.5	3.0	5.0	9	37	0.0	0.0	0.0	9	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.070	0.45	2.5	3.0	5.0	11	35	0.0	0.0	0.0	11	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.071	0.43	2.5	3.0	5.0	10	34	0.0	0.0	0.0	10	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.072	0.63	2.5	3.0	5.0	12	35	0.0	0.0	0.0	12	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.073	0.73	2.5	3.0	5.0	14	33	0.0	0.0	0.0	14	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.074	0.88	2.5	3.0	5.0	17	32	0.0	0.0	0.0	17	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.075	0.78	2.5	3.0	5.0	14	38	0.0	0.0	0.0	14	40	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.076	0.90	2.5	3.0	5.0	11	36	0.0	0.0	0.0	11	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.077	0.80	2.5	3.0	5.0	12	35	0.0	0.0	0.0	12	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.078	0.34	2.5	3.0	5.0	12	39	0.0	0.0	0.0	12	42	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.079	0.28	2.5	3.0	5.0	4	43	0.0	0.0	0.1	4	48	0.0	0.0	0.2	0.0	0.0	0.1
C AR-304.080	0.52	2.5	3.0	5.0	8	34	0.0	0.0	0.0	8	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.081	0.36	2.5	3.0	5.0	11	35	0.0	0.0	0.0	11	40	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.082	0.20	2.5	3.0	5.0	8	45	0.0	0.0	0.1	8	51	0.0	0.0	0.2	0.0	0.0	0.1
C AR-304.083	0.22	2.5	3.0	5.0	9	45	0.0	0.0	0.1	9	51	0.0	0.0	0.2	0.0	0.0	0.1
C AR-304.084	1.13	2.5	3.0	5.0	16	37	0.0	0.0	0.0	16	39	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.085	0.03	2.5	3.0	5.0	7	43	0.0	0.0	0.0	7	54	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.086	1.12	2.5	3.0	5.0	12	33	0.0	0.0	0.0	12	35	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.087	0.19	2.5	3.0	5.0	10	34	0.0	0.0	0.0	10	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.088	0.50	2.5	3.0	5.0	10	34	0.0	0.0	0.0	10	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.089	0.50	2.5	3.0	5.0	10	35	0.0	0.0	0.0	10	38	0.0	0.0	0.0	0.0	0.0	0.0
C AR-304.090	0.31	2.5	3.0	5.0	10	67	0.1	0.2	0.9	10	67	0.1	0.2	0.9	0.0	0.0	0.0
C AR-304.091	0.39	2.5	3.0	5.0	7	46	0.0	0.0	0.2	7	47	0.0	0.0	0.2	0.0	0.0	0.0
C AR-304.092	0.59	2.5	3.0	5.0	13	45	0.0	0.0	0.2	13	46	0.0	0.0	0.2	0.0	0.0	0.0
C AR-304.093	0.54	2.5	3.0	5.0	10	34	0.0	0.0	0.0	10	38	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.009 - Energy Balance - 36-014.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-304.001	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.002	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.004	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.005	0.1	0.05	0.1	0.05	0.1	0.04	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C AR-304.006	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.007	0.0	0.01	0.0	0.01	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.008	0.1	0.05	0.1	0.05	0.1	0.04	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C AR-304.009	0.2	0.02	0.2	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C AR-304.010	0.2	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-304.011	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.012	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.013	0.0	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.014	0.0	0.01	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.015	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.016	0.0	0.01	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.017	0.0	0.01	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.019	0.1	0.00	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C AR-304.020	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.021	0.1	0.02	0.1	0.02	0.0	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-304.022	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.023	0.0	0.01	0.0	0.01	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.024	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.025	0.0	0.01	0.0	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.026	0.0	0.01	0.0	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-304.027	0.1	0.02	0.2	0.03	0.1	0.02	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.2
C AR-304.028	0.1	0.01	0.1	0.01	0.0	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C AR-304.029	0.1	0.02	0.1	0.02	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C AR-304.030	0.1	0.01	0.1	0.02	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.031	0.1	0.01	0.1	0.01	0.0	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C AR-304.032	0.2	0.01	0.2	0.01	0.1	0.01	0.2	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C AR-304.033	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.034	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.035	0.1	0.02	0.2	0.02	0.0	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.2
C AR-304.036	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.037	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-304.038	0.3	0.01	0.3	0.02	0.1	0.01	0.3	not met	0.0	exceeded	0.0	0.1	exceeded	0.2
C AR-304.039	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-304.040	0.2	0.01	0.2	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Column Legend

A	I.F.(Q1-yr Pre-Dev.)(RV1-yr Pre-Dev.) / RV1-yr Dev. where I.F.= 1
B	Is Energy Balance met so that Q1-yr Dev. ≤ I.F.(Q1-yr Pre-Dev.)(RV1-yr Pre-Dev.) / RV1-yr Dev. ?
C	Exceedance of Q1-yr Dev. ≤ I.F.(Q1-yr Pre-Dev.)(RV1-yr Pre-Dev.) / RV1-yr Dev. Where I.F. = 1 (cfs)
D	Is condition exceeded? Q 1-yr Dev. > Q 1-yr Pre-Dev.
E	Exceedance of Q 1-yr Dev. > Q 1-yr Pre-Dev. (cfs)
F	(Q1-yr Forest)(RV1-yr Forest) / RV1-yr Dev.
G	Is condition exceeded? Q 1-yr Dev. < (Q1-yr Forest*RV1-yr Forest) / RV1-yr Dev.
H	Exceedance Q 1-yr Dev. < (Q1-yr Forest * RV1-yr Forest) / RV1-yr Dev. (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.009 - Energy Balance - 36-014.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-304.041	0.2	0.01	0.3	0.01	0.1	0.01	0.2	not met	0.0	exceeded	0.0	0.0	exceeded	0.2
C AR-304.042	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-304.043	0.1	0.03	0.2	0.03	0.1	0.02	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C AR-304.044	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.045	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.046	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.047	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.048	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.049	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.050	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.051	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.052	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.053	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.054	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.055	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.056	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.057	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.058	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.059	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.060	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.061	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.062	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.063	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.064	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.065	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.066	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.067	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.068	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.069	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.070	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.071	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.072	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.073	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.074	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.075	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.076	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.077	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.078	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.079	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.080	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.081	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.082	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.083	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.084	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.085	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.086	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.009 - Energy Balance - 36-014.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-304.087	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.088	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.089	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.090	0.1	0.01	0.1	0.01	0.0	0.00	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C AR-304.091	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.092	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-304.093	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Table 7.009 - Culvert Sizing - 36-014.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-304.001	0.43	0.5	12	< 6	EC-3 Type B
C AR-304.002	1.30	1.0	12	< 6	EC-3 Type B
C AR-304.003	0.63	0.4	12	< 6	EC-3 Type B
C AR-304.004	0.83	0.9	12	< 6	EC-3 Type B
C AR-304.005	12.40	13.1	24	< 8	EC-1 Class A1
C AR-304.006	4.52	5.2	18	< 8	EC-1 Class A1
C AR-304.007	2.89	2.3	12	< 6	EC-3 Type B
C AR-304.008	6.15	9.1	18	< 8	EC-1 Class A1
C AR-304.009	1.65	3.0	12	< 6	EC-3 Type B
C AR-304.010	0.75	1.9	12	< 6	EC-3 Type B
C AR-304.011	0.53	1.1	12	< 6	EC-3 Type B
C AR-304.012	0.05	0.2	12	< 6	EC-3 Type B
C AR-304.013	0.55	1.0	12	< 6	EC-3 Type B
C AR-304.014	0.74	1.0	12	< 6	EC-3 Type B
C AR-304.015	0.58	0.9	12	< 6	EC-3 Type B
C AR-304.016	0.62	1.0	12	< 6	EC-3 Type B
C AR-304.017	0.74	1.1	12	< 6	EC-3 Type B
C AR-304.019	0.26	0.8	12	< 6	EC-3 Type B
C AR-304.020	0.65	1.4	12	< 6	EC-3 Type B
C AR-304.021	2.32	3.9	12	< 6	EC-3 Type B
C AR-304.022	1.02	1.5	12	< 6	EC-3 Type B
C AR-304.023	1.47	1.9	12	< 6	EC-3 Type B
C AR-304.024	0.37	0.6	12	< 6	EC-3 Type B
C AR-304.025	0.91	1.3	12	< 6	EC-3 Type B
C AR-304.026	0.94	1.5	12	< 6	EC-3 Type B
C AR-304.027	2.29	4.0	12	< 6	EC-3 Type B
C AR-304.028	1.39	2.2	12	< 6	EC-3 Type B
C AR-304.029	1.38	2.3	12	< 6	EC-3 Type B
C AR-304.030	1.26	2.1	12	< 6	EC-3 Type B
C AR-304.031	1.24	2.1	12	< 6	EC-3 Type B
C AR-304.032	0.74	1.6	12	< 6	EC-3 Type B
C AR-304.033	0.86	1.6	12	< 6	EC-3 Type B
C AR-304.034	0.31	0.4	12	< 6	EC-3 Type B
C AR-304.035	1.88	3.6	12	< 6	EC-3 Type B
C AR-304.036	0.66	1.4	12	< 6	EC-3 Type B
C AR-304.037	0.34	0.9	12	< 6	EC-3 Type B
C AR-304.038	0.59	1.9	12	< 6	EC-3 Type B
C AR-304.039	0.73	1.7	12	< 6	EC-3 Type B
C AR-304.040	0.70	1.7	12	< 6	EC-3 Type B
C AR-304.041	0.51	1.6	12	< 6	EC-3 Type B
C AR-304.042	1.70	2.2	12	< 6	EC-3 Type B
C AR-304.043	2.61	4.1	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Table 7.009 - Culvert Sizing - 36-014.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-304.044	3.40	0.0	12	< 6	EC-3 Type B
C AR-304.045	4.16	0.1	12	< 6	EC-3 Type B
C AR-304.046	2.33	0.0	12	< 6	EC-3 Type B
C AR-304.047	1.40	0.0	12	< 6	EC-3 Type B
C AR-304.048	0.97	0.0	12	< 6	EC-3 Type B
C AR-304.049	1.55	0.0	12	< 6	EC-3 Type B
C AR-304.050	2.81	0.0	12	< 6	EC-3 Type B
C AR-304.051	1.51	0.0	12	< 6	EC-3 Type B
C AR-304.052	2.43	0.0	12	< 6	EC-3 Type B
C AR-304.053	1.68	0.0	12	< 6	EC-3 Type B
C AR-304.054	0.76	0.0	12	< 6	EC-3 Type B
C AR-304.055	1.30	0.0	12	< 6	EC-3 Type B
C AR-304.056	1.23	0.0	12	< 6	EC-3 Type B
C AR-304.057	0.17	0.0	12	< 6	EC-3 Type B
C AR-304.058	0.47	0.0	12	< 6	EC-3 Type B
C AR-304.059	0.71	0.0	12	< 6	EC-3 Type B
C AR-304.060	0.93	0.0	12	< 6	EC-3 Type B
C AR-304.061	0.99	0.0	12	< 6	EC-3 Type B
C AR-304.062	1.10	0.1	12	< 6	EC-3 Type B
C AR-304.063	1.15	0.1	12	< 6	EC-3 Type B
C AR-304.064	0.37	0.1	12	< 6	EC-3 Type B
C AR-304.065	0.19	0.0	12	< 6	EC-3 Type B
C AR-304.066	0.82	0.0	12	< 6	EC-3 Type B
C AR-304.067	0.74	0.1	12	< 6	EC-3 Type B
C AR-304.068	0.79	0.0	12	< 6	EC-3 Type B
C AR-304.069	0.69	0.0	12	< 6	EC-3 Type B
C AR-304.070	0.45	0.0	12	< 6	EC-3 Type B
C AR-304.071	0.43	0.0	12	< 6	EC-3 Type B
C AR-304.072	0.63	0.0	12	< 6	EC-3 Type B
C AR-304.073	0.73	0.0	12	< 6	EC-3 Type B
C AR-304.074	0.88	0.0	12	< 6	EC-3 Type B
C AR-304.075	0.78	0.0	12	< 6	EC-3 Type B
C AR-304.076	0.90	0.0	12	< 6	EC-3 Type B
C AR-304.077	0.80	0.0	12	< 6	EC-3 Type B
C AR-304.078	0.34	0.0	12	< 6	EC-3 Type B
C AR-304.079	0.28	0.2	12	< 6	EC-3 Type B
C AR-304.080	0.52	0.0	12	< 6	EC-3 Type B
C AR-304.081	0.36	0.0	12	< 6	EC-3 Type B
C AR-304.082	0.20	0.2	12	< 6	EC-3 Type B
C AR-304.083	0.22	0.2	12	< 6	EC-3 Type B
C AR-304.084	1.13	0.0	12	< 6	EC-3 Type B
C AR-304.085	0.03	0.0	12	< 6	EC-3 Type B
C AR-304.086	1.12	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Table 7.009 - Culvert Sizing - 36-014.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-304.087	0.19	0.0	12	< 6	EC-3 Type B
C AR-304.088	0.50	0.0	12	< 6	EC-3 Type B
C AR-304.089	0.50	0.0	12	< 6	EC-3 Type B
C AR-304.090	0.31	0.9	12	< 6	EC-3 Type B
C AR-304.091	0.39	0.2	12	< 6	EC-3 Type B
C AR-304.092	0.59	0.2	12	< 6	EC-3 Type B
C AR-304.093	0.54	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.
Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.009 - Roadside Ditch Sizing - 36-014.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-304.001	0.0	0.5	0.09	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C AR-304.002	0.0	1.0	0.09	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C AR-304.003	0.0	0.4	0.13	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.004	0.0	0.9	0.02	Type I	1.0	0.1	0.4	Grass Lined
C AR-304.005	0.7	13.1	0.14	Type I	2.0	3.4	4.8	See Note 3
C AR-304.006	0.1	5.2	0.09	Type I	1.5	1.2	4.8	Riprap (D50 - 12 in)
C AR-304.007	0.1	2.3	0.11	Type I	1.5	1.2	4.8	Riprap (D50 - 12 in)
C AR-304.008	1.0	9.1	0.12	Type I	2.0	3.4	4.8	Riprap (D50 - 12 in)
C AR-304.009	0.5	3.0	0.19	Type I	1.5	4.1	4.8	Riprap (D50 - 12 in)
C AR-304.010	0.5	1.9	0.09	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-304.011	0.2	1.1	0.11	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-304.012	0.1	0.2	0.11	Type I	1.0	1.1	2.4	Riprap (D50 - 6 in)
C AR-304.013	0.2	1.0	0.04	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-304.014	0.1	1.0	0.03	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C AR-304.015	0.1	0.9	0.03	Type I	1.5	0.4	2.4	Riprap (D50 - 6 in)
C AR-304.016	0.1	1.0	0.11	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-304.017	0.1	1.1	0.05	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-304.019	0.2	0.8	0.02	Type I	1.0	0.3	0.4	Grass Lined
C AR-304.020	0.3	1.4	0.04	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-304.021	0.6	3.9	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-304.022	0.2	1.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-304.023	0.2	1.9	0.03	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C AR-304.024	0.1	0.6	0.03	Type I	1.0	0.4	2.4	Riprap (D50 - 6 in)
C AR-304.025	0.2	1.3	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-304.026	0.2	1.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-304.027	0.7	4.0	0.01	Type I	2.0	0.4	2.4	Riprap (D50 - 6 in)
C AR-304.028	0.3	2.2	0.04	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-304.029	0.4	2.3	0.08	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C AR-304.030	0.3	2.1	0.08	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-304.031	0.3	2.1	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.
Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.009 - Roadside Ditch Sizing - 36-014.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-304.032	0.4	1.6	0.09	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C AR-304.033	0.3	1.6	0.04	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-304.034	0.0	0.4	0.02	Type I	1.0	0.2	0.4	Grass Lined
C AR-304.035	0.6	3.6	0.10	Type I	1.5	2.6	4.8	Riprap (D50 - 12 in)
C AR-304.036	0.3	1.4	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-304.037	0.2	0.9	0.02	Type I	1.0	0.3	0.4	Grass Lined
C AR-304.038	0.6	1.9	0.02	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C AR-304.039	0.4	1.7	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-304.040	0.4	1.7	0.08	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C AR-304.041	0.5	1.6	0.06	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-304.042	0.3	2.2	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-304.043	0.7	4.1	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-304.044	0.0	0.0	0.13	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.045	0.0	0.1	0.08	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.046	0.0	0.0	0.10	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.047	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.048	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.049	0.0	0.0	0.06	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.050	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.051	0.0	0.0	0.20	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.052	0.0	0.0	0.09	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.053	0.0	0.0	0.11	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.054	0.0	0.0	0.14	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.055	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.056	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.057	0.0	0.0	0.02	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.058	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.059	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.060	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.061	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.062	0.0	0.1	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.063	0.0	0.1	0.02	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.009

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.
Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.009 - Roadside Ditch Sizing - 36-014.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-304.064	0.0	0.1	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.065	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.066	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.067	0.0	0.1	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.068	0.0	0.0	0.10	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.069	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.070	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.071	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.072	0.0	0.0	0.07	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.073	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.074	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.075	0.0	0.0	0.08	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.076	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.077	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.078	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.079	0.0	0.2	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.080	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.081	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.082	0.0	0.2	0.07	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.083	0.0	0.2	0.05	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-304.084	0.0	0.0	0.04	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.085	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.086	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.087	0.0	0.0	0.03	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-304.088	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.089	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.090	0.2	0.9	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-304.091	0.0	0.2	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.092	0.0	0.2	0.01	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-304.093	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.010

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-014.AR3	C AR-305.001	4	AR-305	Bath	Dry Run	137	25
36-014.AR3	C AR-305.002	4	AR-305	Bath	Dry Run	135	25
36-014.AR3	C AR-305.003	4	AR-305	Bath	Dry Run	135	25
36-014.AR3	C AR-305.004	4	AR-305	Bath	Dry Run	135	25
36-014.AR3	C AR-305.005	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C AR-305.006	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C AR-305.007	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C AR-305.008	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C AR-305.009	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C AR-305.010	4	AR-305	Bath	Dry Run	135	24, 25
36-014.AR3	C E127.001	4	127	Bath	Dry Run	135	22
36-014.AR3	C E127.002	4	127	Bath	Dry Run	135	22
36-014.AR3	C E127.003	4	127	Bath	Dry Run	135	22

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.010

Table 5.010 - Water Quantity - 36-014.AR3																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-305.001	1.39	2.5	3.0	5.0	9	52	0.0	0.0	1.4	9	54	0.0	0.1	1.7	0.0	0.1	0.3
C AR-305.002	1.47	2.5	3.0	5.0	8	50	0.0	0.0	1.3	8	52	0.0	0.0	1.5	0.0	0.0	0.3
C AR-305.003	1.08	2.5	3.0	5.0	8	48	0.0	0.0	0.7	8	51	0.0	0.0	1.0	0.0	0.0	0.3
C AR-305.004	0.86	2.5	3.0	5.0	8	44	0.0	0.0	0.3	9	48	0.0	0.0	0.5	0.0	0.0	0.3
C AR-305.005	1.73	2.5	3.0	5.0	9	47	0.0	0.0	0.9	10	49	0.0	0.0	1.2	0.0	0.0	0.2
C AR-305.006	2.87	2.5	3.0	5.0	11	50	0.0	0.0	2.2	12	51	0.0	0.1	2.3	0.0	0.0	0.1
C AR-305.007	2.26	2.5	3.0	5.0	13	47	0.0	0.0	1.0	14	49	0.0	0.0	1.3	0.0	0.0	0.3
C AR-305.008	1.56	2.5	3.0	5.0	10	43	0.0	0.0	0.3	10	45	0.0	0.0	0.5	0.0	0.0	0.2
C AR-305.009	2.60	2.5	3.0	5.0	10	46	0.0	0.0	1.1	10	47	0.0	0.0	1.3	0.0	0.0	0.2
C AR-305.010	2.21	2.5	3.0	5.0	12	50	0.0	0.0	1.6	12	50	0.0	0.0	1.6	0.0	0.0	0.0
C E127.001	0.48	2.5	3.0	5.0	14	37	0.0	0.0	0.0	15	30	0.0	0.0	0.0	0.0	0.0	0.0
C E127.002	2.09	2.5	3.0	5.0	10	31	0.0	0.0	0.0	11	30	0.0	0.0	0.0	0.0	0.0	0.0
C E127.003	4.39	2.5	3.0	5.0	12	30	0.0	0.0	0.0	12	30	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.010

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.010 - Energy Balance - 36-014.AR3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-305.001	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.002	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-305.003	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.005	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.006	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.007	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.008	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.009	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.010	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C E127.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E127.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E127.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.010

Table 7.010 - Culvert Sizing - 36-014.AR3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-305.001	1.39	1.7	12	< 6	EC-3 Type B
C AR-305.002	1.47	1.5	12	< 6	EC-3 Type B
C AR-305.003	1.08	1.0	12	< 6	EC-3 Type B
C AR-305.004	0.86	0.5	12	< 6	EC-3 Type B
C AR-305.005	1.73	1.2	12	< 6	EC-3 Type B
C AR-305.006	2.87	2.3	12	< 6	EC-3 Type B
C AR-305.007	2.26	1.3	12	< 6	EC-3 Type B
C AR-305.008	1.56	0.5	12	< 6	EC-3 Type B
C AR-305.009	2.60	1.3	12	< 6	EC-3 Type B
C AR-305.010	2.21	1.6	12	< 6	EC-3 Type B
C E127.001	0.48	0.0	12	< 6	EC-3 Type B
C E127.002	2.09	0.0	12	< 6	EC-3 Type B
C E127.003	4.39	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-014.AR3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.010

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.010 - Roadside Ditch Sizing - 36-014.AR3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-305.001	0.1	1.7	0.08	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-305.002	0.0	1.5	0.09	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-305.003	0.0	1.0	0.14	Type I	1.0	0.9	2.4	Riprap (D50 - 6 in)
C AR-305.004	0.0	0.5	0.09	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C AR-305.005	0.0	1.2	0.00	Type I	1.5	0.0	0.4	Grass Lined
C AR-305.006	0.1	2.3	0.00	Type I	1.5	0.1	0.4	Grass Lined
C AR-305.007	0.0	1.3	0.08	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C AR-305.008	0.0	0.5	0.04	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-305.009	0.0	1.3	0.03	Type I	1.5	0.2	2.4	Riprap (D50 - 6 in)
C AR-305.010	0.0	1.6	0.01	Type I	1.5	0.1	0.4	Grass Lined
C E127.001	0.0	0.0	0.08	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E127.002	0.0	0.0	0.02	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E127.003	0.0	0.0	0.03	See Note 2	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-018.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.011

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-018.AR1	C AR-305.011	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C AR-305.012	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C AR-305.013	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C AR-305.014	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C AR-305.015	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C AR-305.016	4	AR-305	Bath	Dry Run	136	26
36-018.AR1	C E128.001	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.002	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.003	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.004	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.005	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.006	4	128	Bath	Dry Run	136	26
36-018.AR1	C E128.007	4	128	Bath	Dry Run	136	26

Water Quantity for Culverts and Ditches
Access Road: 36-018.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.011

Table 5.011 - Water Quantity - 36-018.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-305.011	21.83	2.5	3.0	5.0	15	30	0.0	0.0	0.0	15	30	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.012	0.99	2.5	3.0	5.0	13	32	0.0	0.0	0.0	13	34	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.013	2.07	2.5	3.0	5.0	12	31	0.0	0.0	0.0	12	32	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.014	3.77	2.5	3.0	5.0	11	31	0.0	0.0	0.0	11	31	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.015	14.28	2.5	3.0	5.0	23	30	0.0	0.0	0.0	23	30	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.016	4.42	2.5	3.0	5.0	13	32	0.0	0.0	0.0	13	32	0.0	0.0	0.0	0.0	0.0	0.0
C E128.001	0.78	2.5	3.0	5.0	22	31	0.0	0.0	0.0	22	33	0.0	0.0	0.0	0.0	0.0	0.0
C E128.002	1.50	2.5	3.0	5.0	20	31	0.0	0.0	0.0	20	32	0.0	0.0	0.0	0.0	0.0	0.0
C E128.003	0.65	2.5	3.0	5.0	15	32	0.0	0.0	0.0	15	34	0.0	0.0	0.0	0.0	0.0	0.0
C E128.004	6.45	2.5	3.0	5.0	16	30	0.0	0.0	0.0	16	30	0.0	0.0	0.0	0.0	0.0	0.0
C E128.005	7.82	2.5	3.0	5.0	15	30	0.0	0.0	0.0	15	30	0.0	0.0	0.0	0.0	0.0	0.0
C E128.006	20.79	2.5	3.0	5.0	14	30	0.0	0.0	0.0	14	30	0.0	0.0	0.0	0.0	0.0	0.0
C E128.007	1.06	2.5	3.0	5.0	13	33	0.0	0.0	0.0	13	35	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-018.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.011

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.011 - Energy Balance - 36-018.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-305.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.012	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.013	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.014	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.015	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.016	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E128.007	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-018.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.011

Table 7.011 - Culvert Sizing - 36-018.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-305.011	21.83	0.0	12	< 6	EC-3 Type B
C AR-305.012	0.99	0.0	12	< 6	EC-3 Type B
C AR-305.013	2.07	0.0	12	< 6	EC-3 Type B
C AR-305.014	3.77	0.0	12	< 6	EC-3 Type B
C AR-305.015	14.28	0.0	12	< 6	EC-3 Type B
C AR-305.016	4.42	0.0	12	< 6	EC-3 Type B
C E128.001	0.78	0.0	12	< 6	EC-3 Type B
C E128.002	1.50	0.0	12	< 6	EC-3 Type B
C E128.003	0.65	0.0	12	< 6	EC-3 Type B
C E128.004	6.45	0.0	12	< 6	EC-3 Type B
C E128.005	7.82	0.0	12	< 6	EC-3 Type B
C E128.006	20.79	0.0	12	< 6	EC-3 Type B
C E128.007	1.06	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-018.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.011

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.011 - Roadside Ditch Sizing - 36-018.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-305.011	0.0	0.0	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.012	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.013	0.0	0.0	0.13	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.014	0.0	0.0	0.06	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.015	0.0	0.0	0.06	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.016	0.0	0.0	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C E128.001	0.0	0.0	0.14	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E128.002	0.0	0.0	0.08	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E128.003	0.0	0.0	0.19	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E128.004	0.0	0.0	0.26	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E128.005	0.0	0.0	0.07	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E128.006	0.0	0.0	0.07	Type I	1.0	See Note 1	0.4	Grass Lined
C E128.007	0.0	0.0	0.12	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-027.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.012

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-027.AR1	C AR-305.017	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.018	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.019	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.020	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.021	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.022	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.023	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.024	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.025	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.026	4	AR-305	Bath	Dry Run	138	28
36-027.AR1	C AR-305.027	4	AR-305	Bath	Dry Run	138	29
36-027.AR1	C AR-305.028	4	AR-305	Bath	Dry Run	138	29
36-027.AR1	C AR-305.029	4	AR-305	Bath	Dry Run	138	29
36-027.AR1	C AR-305.030	4	AR-305	Bath	Dry Run	138	29
36-027.AR1	C AR-305.031	4	AR-305	Bath	Dry Run	138	29
36-027.AR1	C E129.001	4	129	Bath	Dry Run	138	27
36-027.AR1	C E129.002	4	129	Bath	Dry Run	138	27
36-027.AR1	C E129.003	4	129	Bath	Dry Run	138	27
36-027.AR1	C E129.004	4	129	Bath	Dry Run	138	27
36-027.AR1	C E130.001	4	130	Bath	Dry Run	138	28, 29
36-027.AR1	C E130.002	4	130	Bath	Dry Run	138	28, 29
36-027.AR1	C E130.003	4	130	Bath	Dry Run	138	28, 29
36-027.AR1	C E130.004	4	130	Bath	Dry Run	138	28, 29
36-027.AR1	C E130.005	4	130	Bath	Dry Run	138	28, 29
36-027.AR1	C E130.006	4	130	Bath	Dry Run	138	27, 28, 29
36-027.AR1	C E130.007	4	130	Bath	Dry Run	138	27, 28, 29
36-027.AR1	C E130.008	4	130	Bath	Dry Run	138	28
36-027.AR1	C E130.009	4	130	Bath	Dry Run	138	28
36-027.AR1	C E130.010	4	130	Bath	Dry Run	138	28
36-027.AR1	C E130.011	4	130	Bath	Dry Run	138	28
36-027.AR1	C E130.012	4	130	Bath	Dry Run	138	28

Water Quantity for Culverts and Ditches
Access Road: 36-027.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.012

Table 5.012 - Water Quantity - 36-027.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-305.017	0.13	2.5	3.0	5.0	11	61	0.0	0.1	0.3	11	64	0.0	0.1	0.3	0.0	0.0	0.0
C AR-305.018	0.14	2.5	3.0	5.0	3	60	0.0	0.1	0.4	3	63	0.0	0.1	0.4	0.0	0.0	0.1
C AR-305.019	0.12	2.5	3.0	5.0	0	61	0.0	0.1	0.3	0	65	0.1	0.1	0.4	0.0	0.0	0.1
C AR-305.020	0.54	2.5	3.0	5.0	9	52	0.0	0.0	0.6	9	54	0.0	0.0	0.7	0.0	0.0	0.1
C AR-305.021	0.65	2.5	3.0	5.0	9	44	0.0	0.0	0.2	9	46	0.0	0.0	0.3	0.0	0.0	0.1
C AR-305.022	0.60	2.5	3.0	5.0	9	43	0.0	0.0	0.1	9	45	0.0	0.0	0.2	0.0	0.0	0.1
C AR-305.023	0.49	2.5	3.0	5.0	14	40	0.0	0.0	0.0	14	43	0.0	0.0	0.1	0.0	0.0	0.1
C AR-305.024	0.54	2.5	3.0	5.0	11	39	0.0	0.0	0.0	11	41	0.0	0.0	0.1	0.0	0.0	0.0
C AR-305.025	6.30	2.5	3.0	5.0	16	48	0.0	0.0	2.7	16	47	0.0	0.0	2.3	0.0	0.0	-0.4
C AR-305.026	5.48	2.5	3.0	5.0	13	32	0.0	0.0	0.0	13	33	0.0	0.0	0.0	0.0	0.0	0.0
C AR-305.027	1.27	2.5	3.0	5.0	15	50	0.0	0.0	0.8	15	51	0.0	0.0	0.9	0.0	0.0	0.1
C AR-305.028	1.38	2.5	3.0	5.0	17	53	0.0	0.0	1.1	17	55	0.0	0.1	1.4	0.0	0.1	0.2
C AR-305.029	1.19	2.5	3.0	5.0	17	58	0.0	0.2	1.5	17	59	0.1	0.2	1.6	0.0	0.0	0.1
C AR-305.030	0.52	2.5	3.0	5.0	16	56	0.0	0.1	0.6	16	57	0.0	0.1	0.6	0.0	0.0	0.1
C AR-305.031	0.55	2.5	3.0	5.0	20	60	0.0	0.1	0.7	20	61	0.1	0.1	0.8	0.0	0.0	0.1
C E129.001	0.54	2.5	3.0	5.0	11	63	0.1	0.3	1.2	11	65	0.2	0.3	1.3	0.1	0.1	0.1
C E129.002	0.88	2.5	3.0	5.0	10	59	0.1	0.2	1.5	10	59	0.1	0.2	1.5	0.0	0.0	0.0
C E129.003	72.10	2.5	3.0	5.0	22	36	0.0	0.0	0.8	22	36	0.0	0.0	0.8	0.0	0.0	0.0
C E129.004	0.51	2.5	3.0	5.0	10	68	0.2	0.4	1.5	10	70	0.3	0.5	1.6	0.1	0.1	0.1
C E130.001	1.25	2.5	3.0	5.0	17	47	0.0	0.0	0.5	17	48	0.0	0.0	0.5	0.0	0.0	0.1
C E130.002	0.87	2.5	3.0	5.0	9	41	0.0	0.0	0.1	9	42	0.0	0.0	0.1	0.0	0.0	0.1
C E130.003	0.84	2.5	3.0	5.0	9	32	0.0	0.0	0.0	9	33	0.0	0.0	0.0	0.0	0.0	0.0
C E130.004	4.04	2.5	3.0	5.0	18	50	0.0	0.1	2.2	18	51	0.0	0.1	2.5	0.0	0.0	0.3
C E130.005	1.34	2.5	3.0	5.0	14	36	0.0	0.0	0.0	14	37	0.0	0.0	0.0	0.0	0.0	0.0
C E130.006	1.95	2.5	3.0	5.0	14	36	0.0	0.0	0.0	14	37	0.0	0.0	0.0	0.0	0.0	0.0
C E130.007	1.25	2.5	3.0	5.0	14	36	0.0	0.0	0.0	14	37	0.0	0.0	0.0	0.0	0.0	0.0
C E130.008	2.32	2.5	3.0	5.0	14	41	0.0	0.0	0.2	14	41	0.0	0.0	0.2	0.0	0.0	0.0
C E130.009	2.02	2.5	3.0	5.0	14	39	0.0	0.0	0.1	14	38	0.0	0.0	0.1	0.0	0.0	0.0
C E130.010	2.23	2.5	3.0	5.0	20	37	0.0	0.0	0.0	20	36	0.0	0.0	0.0	0.0	0.0	0.0
C E130.011	0.71	2.5	3.0	5.0	12	32	0.0	0.0	0.0	12	33	0.0	0.0	0.0	0.0	0.0	0.0
C E130.012	1.37	2.5	3.0	5.0	12	32	0.0	0.0	0.0	12	33	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-027.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.012

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.012 - Energy Balance - 36-027.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-305.017	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-305.018	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-305.019	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-305.020	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.021	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.022	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.023	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.024	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.025	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.026	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-305.027	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.028	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-305.029	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-305.030	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C AR-305.031	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C E129.001	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C E129.002	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C E129.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E129.004	0.2	0.01	0.3	0.02	0.2	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C E130.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.004	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C E130.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.007	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.008	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.009	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.010	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.011	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E130.012	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-027.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.012

Table 7.012 - Culvert Sizing - 36-027.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-305.017	0.13	0.3	12	< 6	EC-3 Type B
C AR-305.018	0.14	0.4	12	< 6	EC-3 Type B
C AR-305.019	0.12	0.4	12	< 6	EC-3 Type B
C AR-305.020	0.54	0.7	12	< 6	EC-3 Type B
C AR-305.021	0.65	0.3	12	< 6	EC-3 Type B
C AR-305.022	0.60	0.2	12	< 6	EC-3 Type B
C AR-305.023	0.49	0.1	12	< 6	EC-3 Type B
C AR-305.024	0.54	0.1	12	< 6	EC-3 Type B
C AR-305.025	6.30	2.3	12	< 6	EC-3 Type B
C AR-305.026	5.48	0.0	12	< 6	EC-3 Type B
C AR-305.027	1.27	0.9	12	< 6	EC-3 Type B
C AR-305.028	1.38	1.4	12	< 6	EC-3 Type B
C AR-305.029	1.19	1.6	12	< 6	EC-3 Type B
C AR-305.030	0.52	0.6	12	< 6	EC-3 Type B
C AR-305.031	0.55	0.8	12	< 6	EC-3 Type B
C E129.001	0.54	1.3	12	< 6	EC-3 Type B
C E129.002	0.88	1.5	12	< 6	EC-3 Type B
C E129.003	72.10	0.8	12	< 6	EC-3 Type B
C E129.004	0.51	1.6	12	< 6	EC-3 Type B
C E130.001	1.25	0.5	12	< 6	EC-3 Type B
C E130.002	0.87	0.1	12	< 6	EC-3 Type B
C E130.003	0.84	0.0	12	< 6	EC-3 Type B
C E130.004	4.04	2.5	12	< 6	EC-3 Type B
C E130.005	1.34	0.0	12	< 6	EC-3 Type B
C E130.006	1.95	0.0	12	< 6	EC-3 Type B
C E130.007	1.25	0.0	12	< 6	EC-3 Type B
C E130.008	2.32	0.2	12	< 6	EC-3 Type B
C E130.009	2.02	0.1	12	< 6	EC-3 Type B
C E130.010	2.23	0.0	12	< 6	EC-3 Type B
C E130.011	0.71	0.0	12	< 6	EC-3 Type B
C E130.012	1.37	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-027.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.012

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.012 - Roadside Ditch Sizing - 36-027.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-305.017	0.1	0.3	0.13	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C AR-305.018	0.1	0.4	0.04	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C AR-305.019	0.1	0.4	0.12	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-305.020	0.0	0.7	0.18	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-305.021	0.0	0.3	0.11	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-305.022	0.0	0.2	0.13	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-305.023	0.0	0.1	0.09	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C AR-305.024	0.0	0.1	0.05	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.025	0.0	2.3	0.04	Type I	1.5	0.4	2.4	Riprap (D50 - 6 in)
C AR-305.026	0.0	0.0	0.08	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-305.027	0.0	0.9	0.09	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C AR-305.028	0.1	1.4	0.08	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-305.029	0.2	1.6	0.07	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C AR-305.030	0.1	0.6	0.12	Type I	1.0	1.2	2.4	Riprap (D50 - 6 in)
C AR-305.031	0.1	0.8	0.08	Type I	1.0	1.2	2.4	Riprap (D50 - 6 in)
C E129.001	0.3	1.3	0.05	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C E129.002	0.2	1.5	0.06	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C E129.003	0.0	0.8	0.07	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E129.004	0.5	1.6	0.10	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)
C E130.001	0.0	0.5	0.11	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C E130.002	0.0	0.1	0.13	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E130.003	0.0	0.0	0.13	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E130.004	0.1	2.5	0.11	Type I	1.5	1.2	4.8	Riprap (D50 - 12 in)
C E130.005	0.0	0.0	0.07	Type I	1.0	See Note 1	0.4	Grass Lined
C E130.006	0.0	0.0	0.09	Type I	1.0	See Note 1	0.4	Grass Lined
C E130.007	0.0	0.0	0.12	Type I	1.0	See Note 1	0.4	Grass Lined
C E130.008	0.0	0.2	0.15	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E130.009	0.0	0.1	0.12	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E130.010	0.0	0.0	0.16	Type I	1.0	See Note 1	2.4	Riprap (D50 - 6 in)
C E130.011	0.0	0.0	0.17	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E130.012	0.0	0.0	0.16	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 36-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.013

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-001.AR1	C AR-306.001	4	AR-306	Bath	Lick Run-Stuart Run	335	33
36-001.AR1	C AR-306.002	4	AR-306	Bath	Lick Run-Stuart Run	335	33
36-001.AR1	C AR-306.003	4	AR-306	Bath	Lick Run-Stuart Run	335	33
36-001.AR1	C AR-306.004	4	AR-306	Bath	Lick Run-Stuart Run	335	33
36-001.AR1	C AR-306.005	4	AR-306	Bath	Lick Run-Stuart Run	335	33
36-001.AR1	C AR-306.006	4	AR-306	Bath	Lick Run-Stuart Run	335	32, 33
36-001.AR1	C AR-306.007	4	AR-306	Bath	Lick Run-Stuart Run	335	32, 33
36-001.AR1	C AR-306.008	4	AR-306	Bath	Lick Run-Stuart Run	335	32, 33
36-001.AR1	C AR-306.009	4	AR-306	Bath	Lick Run-Stuart Run	335	32
36-001.AR1	C AR-306.010	4	AR-306	Bath	Lick Run-Stuart Run	335	32
36-001.AR1	C AR-306.011	4	AR-306	Bath	Lick Run-Stuart Run	335	32
36-001.AR1	C AR-306.012	4	AR-306	Bath	Lick Run-Stuart Run	335	32
36-001.AR1	C AR-306.013	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.014	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.015	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.016	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.017	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.018	4	AR-306	Bath	Lick Run-Stuart Run	335	30, 31
36-001.AR1	C AR-306.019	4	AR-306	Bath	Lick Run-Stuart Run	335	30, 31
36-001.AR1	C AR-306.020	4	AR-306	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C AR-306.021	4	AR-306	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C AR-306.022	4	AR-306	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C AR-306.023	4	AR-306	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C AR-306.024	4	AR-306	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C AR-306.025	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.026	4	AR-306	Bath	Lick Run-Stuart Run	335	31
36-001.AR1	C AR-306.027	4	AR-306	Bath	Lick Run-Stuart Run	335	30, 31
36-001.AR1	C AR-306.028	4	AR-306	Bath	Lick Run-Stuart Run	335	30, 31
36-001.AR1	C E135.001	4	135	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C E135.002	4	135	Bath	Lick Run-Stuart Run	335	30
36-001.AR1	C E135.003	4	135	Bath	Lick Run-Stuart Run	335	30, 31
36-001.AR1	C E135.004	4	135	Bath	Lick Run-Stuart Run	335	30

Water Quantity for Culverts and Ditches
Access Road: 36-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.013

Table 5.013 - Water Quantity - 36-001.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-306.001	0.67	2.5	3.0	5.0	13	66	0.2	0.4	1.6	13	67	0.2	0.5	1.6	0.0	0.0	0.1
C AR-306.002	3.88	2.5	3.0	5.0	10	69	2.0	3.6	11.4	10	69	2.0	3.6	11.4	0.0	0.0	0.0
C AR-306.003	1.90	2.5	3.0	5.0	10	69	1.0	1.7	5.5	10	69	1.0	1.7	5.5	0.0	0.0	0.0
C AR-306.004	5.54	2.5	3.0	5.0	10	71	3.6	6.0	17.6	10	71	3.6	6.0	17.6	0.0	0.0	0.0
C AR-306.005	3.64	2.5	3.0	5.0	12	72	2.4	4.0	11.5	12	72	2.4	4.0	11.5	0.0	0.0	0.0
C AR-306.006	2.66	2.5	3.0	5.0	11	71	1.6	2.7	8.2	11	71	1.6	2.7	8.2	0.0	0.0	0.0
C AR-306.007	4.18	2.5	3.0	5.0	9	68	2.0	3.7	12.3	9	68	2.0	3.7	12.3	0.0	0.0	0.0
C AR-306.008	31.24	2.5	3.0	5.0	17	66	7.9	16.2	62.8	17	66	7.9	16.2	62.8	0.0	0.0	0.0
C AR-306.009	5.25	2.5	3.0	5.0	13	66	1.6	3.2	12.2	13	66	1.6	3.2	12.2	0.0	0.0	0.0
C AR-306.010	3.14	2.5	3.0	5.0	13	70	1.7	2.9	8.9	13	70	1.7	2.9	8.9	0.0	0.0	0.0
C AR-306.011	2.47	2.5	3.0	5.0	12	74	2.0	3.1	8.4	12	75	2.2	3.3	8.7	0.2	0.2	0.3
C AR-306.012	1.53	2.5	3.0	5.0	11	76	1.5	2.2	5.7	11	76	1.5	2.2	5.7	0.0	0.0	0.0
C AR-306.013	2.04	2.5	3.0	5.0	10	76	2.1	3.1	7.9	10	77	2.2	3.3	8.1	0.2	0.2	0.3
C AR-306.014	2.02	2.5	3.0	5.0	10	75	1.9	2.9	7.5	10	75	1.9	2.9	7.5	0.0	0.0	0.0
C AR-306.015	1.43	2.5	3.0	5.0	14	75	1.2	1.8	4.7	14	75	1.2	1.8	4.7	0.0	0.0	0.0
C AR-306.016	2.88	2.5	3.0	5.0	14	76	2.5	3.8	9.8	14	76	2.5	3.8	9.8	0.0	0.0	0.0
C AR-306.017	1.86	2.5	3.0	5.0	14	76	1.6	2.5	6.4	14	76	1.6	2.5	6.4	0.0	0.0	0.0
C AR-306.018	9.01	2.5	3.0	5.0	10	77	9.6	14.2	35.2	10	77	9.6	14.2	35.2	0.0	0.0	0.0
C AR-306.019	1.35	2.5	3.0	5.0	9	77	1.5	2.2	5.5	9	77	1.5	2.2	5.5	0.0	0.0	0.0
C AR-306.020	1.57	2.5	3.0	5.0	9	76	1.6	2.4	6.2	9	76	1.6	2.4	6.2	0.0	0.0	0.0
C AR-306.021	2.68	2.5	3.0	5.0	9	76	2.8	4.2	10.6	9	76	2.8	4.2	10.6	0.0	0.0	0.0
C AR-306.022	1.62	2.5	3.0	5.0	10	75	1.5	2.3	6.1	10	76	1.7	2.5	6.3	0.1	0.2	0.2
C AR-306.023	6.16	2.5	3.0	5.0	10	76	6.1	9.2	23.3	10	76	6.1	9.2	23.3	0.0	0.0	0.0
C AR-306.024	0.65	2.5	3.0	5.0	19	76	0.5	0.7	1.9	19	76	0.5	0.7	1.9	0.0	0.0	0.0
C AR-306.025	0.98	2.5	3.0	5.0	11	65	0.3	0.6	2.3	11	65	0.3	0.6	2.3	0.0	0.0	0.0
C AR-306.026	1.20	2.5	3.0	5.0	13	63	0.2	0.5	2.4	13	64	0.3	0.6	2.6	0.1	0.1	0.1
C AR-306.027	65.70	2.5	3.0	5.0	25	74	33.2	52.9	148.0	25	74	33.2	52.9	148.0	0.0	0.0	0.0
C AR-306.028	2.02	2.5	3.0	5.0	10	59	0.1	0.5	3.5	10	59	0.1	0.5	3.5	0.0	0.0	0.0
C E135.001	0.67	2.5	3.0	5.0	18	77	0.5	0.8	2.1	18	76	0.5	0.8	2.0	0.0	0.0	-0.1
C E135.002	0.46	2.5	3.0	5.0	18	76	0.3	0.5	1.4	18	75	0.3	0.5	1.3	0.0	0.0	-0.1
C E135.003	1.21	2.5	3.0	5.0	21	62	0.1	0.3	1.7	21	63	0.2	0.4	1.8	0.0	0.0	0.1
C E135.004	3.50	2.5	3.0	5.0	18	70	1.5	2.6	8.3	18	69	1.3	2.4	8.0	-0.2	-0.2	-0.4

Water Quantity for Culverts and Ditches
Access Road: 36-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.013

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.013 - Energy Balance - 36-001.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-306.001	0.2	0.02	0.2	0.02	0.2	0.01	0.2	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-306.002	2.0	0.12	2.0	0.12	2.0	0.12	2.0	met	n/a	not exceeded	n/a	2.0	exceeded	0.0
C AR-306.003	1.0	0.06	1.0	0.06	0.9	0.05	1.0	met	n/a	not exceeded	n/a	0.8	exceeded	0.2
C AR-306.004	3.6	0.20	3.6	0.20	3.2	0.18	3.6	met	n/a	not exceeded	n/a	3.0	exceeded	0.6
C AR-306.005	2.4	0.14	2.4	0.14	2.4	0.14	2.4	met	n/a	not exceeded	n/a	2.4	exceeded	0.0
C AR-306.006	1.6	0.10	1.6	0.10	1.6	0.10	1.6	met	n/a	not exceeded	n/a	1.6	exceeded	0.0
C AR-306.007	2.0	0.12	2.0	0.12	2.0	0.12	2.0	met	n/a	not exceeded	n/a	2.0	exceeded	0.0
C AR-306.008	7.9	0.72	7.9	0.72	7.9	0.72	7.9	met	n/a	not exceeded	n/a	7.9	exceeded	0.0
C AR-306.009	1.6	0.12	1.6	0.12	1.6	0.12	1.6	met	n/a	not exceeded	n/a	1.6	exceeded	0.0
C AR-306.010	1.7	0.10	1.7	0.10	1.7	0.10	1.7	met	n/a	not exceeded	n/a	1.7	exceeded	0.0
C AR-306.011	2.0	0.11	2.2	0.12	2.0	0.11	1.8	not met	0.3	exceeded	0.2	1.8	exceeded	0.3
C AR-306.012	1.5	0.08	1.5	0.08	1.4	0.07	1.5	met	n/a	not exceeded	n/a	1.3	exceeded	0.2
C AR-306.013	2.1	0.11	2.2	0.11	2.1	0.11	1.9	not met	0.3	exceeded	0.2	1.9	exceeded	0.3
C AR-306.014	1.9	0.10	1.9	0.10	1.9	0.10	1.9	met	n/a	not exceeded	n/a	1.9	exceeded	0.0
C AR-306.015	1.2	0.07	1.2	0.07	1.1	0.06	1.2	met	n/a	not exceeded	n/a	1.0	exceeded	0.2
C AR-306.016	2.5	0.15	2.5	0.15	2.5	0.15	2.5	met	n/a	not exceeded	n/a	2.5	exceeded	0.0
C AR-306.017	1.6	0.10	1.6	0.10	1.5	0.09	1.6	met	n/a	not exceeded	n/a	1.4	exceeded	0.2
C AR-306.018	9.6	0.50	9.6	0.50	8.9	0.47	9.6	met	n/a	not exceeded	n/a	8.3	exceeded	1.3
C AR-306.019	1.5	0.08	1.5	0.08	1.4	0.07	1.5	met	n/a	not exceeded	n/a	1.3	exceeded	0.2
C AR-306.020	1.6	0.08	1.6	0.08	1.6	0.08	1.6	met	n/a	not exceeded	n/a	1.6	exceeded	0.0
C AR-306.021	2.8	0.14	2.8	0.14	2.6	0.13	2.8	met	n/a	not exceeded	n/a	2.4	exceeded	0.4
C AR-306.022	1.5	0.08	1.7	0.08	1.5	0.08	1.4	not met	0.2	exceeded	0.1	1.4	exceeded	0.2
C AR-306.023	6.1	0.32	6.1	0.32	6.1	0.32	6.1	met	n/a	not exceeded	n/a	6.1	exceeded	0.0
C AR-306.024	0.5	0.03	0.5	0.03	0.5	0.03	0.5	met	n/a	not exceeded	n/a	0.5	exceeded	0.0
C AR-306.025	0.3	0.02	0.3	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-306.026	0.2	0.02	0.3	0.02	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.2	exceeded	0.1
C AR-306.027	33.2	2.93	33.2	2.93	33.2	2.93	33.2	met	n/a	not exceeded	n/a	33.2	exceeded	0.0
C AR-306.028	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C E135.001	0.5	0.04	0.5	0.03	0.5	0.03	0.6	met	n/a	not exceeded	n/a	0.5	exceeded	0.0
C E135.002	0.3	0.02	0.3	0.02	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.4	not exceeded	n/a
C E135.003	0.1	0.02	0.2	0.02	0.1	0.02	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0
C E135.004	1.5	0.12	1.3	0.11	1.5	0.12	1.6	met	n/a	not exceeded	n/a	1.6	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 36-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.013

Table 7.013 - Culvert Sizing - 36-001.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-306.001	0.67	1.6	12	< 6	EC-3 Type B
C AR-306.002	3.88	11.4	18	< 8	EC-1 Class A1
C AR-306.003	1.90	5.5	18	< 8	EC-1 Class A1
C AR-306.004	5.54	17.6	24	< 8	EC-1 Class A1
C AR-306.005	3.64	11.5	18	< 8	EC-1 Class A1
C AR-306.006	2.66	8.2	18	< 8	EC-1 Class A1
C AR-306.007	4.18	12.3	18	< 8	EC-1 Class A1
C AR-306.008	31.24	62.8	42	< 8	EC-1 Class A1
C AR-306.009	5.25	12.2	18	< 8	EC-1 Class A1
C AR-306.010	3.14	8.9	18	< 8	EC-1 Class A1
C AR-306.011	2.47	8.7	18	< 8	EC-1 Class A1
C AR-306.012	1.53	5.7	18	< 8	EC-1 Class A1
C AR-306.013	2.04	8.1	18	< 8	EC-1 Class A1
C AR-306.014	2.02	7.5	18	< 8	EC-1 Class A1
C AR-306.015	1.43	4.7	18	< 8	EC-1 Class A1
C AR-306.016	2.88	9.8	18	< 8	EC-1 Class A1
C AR-306.017	1.86	6.4	18	< 8	EC-1 Class A1
C AR-306.018	9.01	35.2	30	< 8	EC-1 Class A1
C AR-306.019	1.35	5.5	18	< 8	EC-1 Class A1
C AR-306.020	1.57	6.2	18	< 8	EC-1 Class A1
C AR-306.021	2.68	10.6	18	< 8	EC-1 Class A1
C AR-306.022	1.62	6.3	18	< 8	EC-1 Class A1
C AR-306.023	6.16	23.3	30	< 8	EC-1 Class A1
C AR-306.024	0.65	1.9	12	< 6	EC-3 Type B
C AR-306.025	0.98	2.3	12	< 6	EC-3 Type B
C AR-306.026	1.20	2.6	12	< 6	EC-3 Type B
C AR-306.027	65.70	148.0	multiple	< 8	EC-1 Class A1
C AR-306.028	2.02	3.5	12	< 6	EC-3 Type B
C E135.001	0.67	2.0	12	< 6	EC-3 Type B
C E135.002	0.46	1.3	12	< 6	EC-3 Type B
C E135.003	1.21	1.8	12	< 6	EC-3 Type B
C E135.004	3.50	8.0	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 36-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.013

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.013 - Roadside Ditch Sizing - 36-001.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-306.001	0.5	1.6	0.02	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-306.002	3.6	11.4	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)
C AR-306.003	1.7	5.5	0.04	Type I	2.0	1.6	2.4	Riprap (D50 - 6 in)
C AR-306.004	6.0	17.6	0.05	Type II	2.0	2.2	2.4	Riprap (D50 - 6 in)
C AR-306.005	4.0	11.5	0.03	Type I	2.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-306.006	2.7	8.2	0.03	Type I	2.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-306.007	3.7	12.3	0.09	Type I	2.0	4.7	4.8	Riprap (D50 - 12 in)
C AR-306.008	16.2	62.8	0.08	Type III	2.5	3.9	4.8	Riprap (D50 - 12 in)
C AR-306.009	3.2	12.2	0.04	Type I	2.0	1.9	2.4	Riprap (D50 - 6 in)
C AR-306.010	2.9	8.9	0.06	Type I	2.0	3.0	4.8	Riprap (D50 - 12 in)
C AR-306.011	3.3	8.7	0.10	Type I	2.0	4.8	See Note 1	See Note 1
C AR-306.012	2.2	5.7	0.15	Type I	1.5	5.6	See Note 1	See Note 1
C AR-306.013	3.3	8.1	0.18	Type I	1.5	7.7	See Note 1	See Note 1
C AR-306.014	2.9	7.5	0.02	Type I	2.0	1.2	2.4	Riprap (D50 - 6 in)
C AR-306.015	1.8	4.7	0.04	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C AR-306.016	3.8	9.8	0.02	Type II	2.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-306.017	2.5	6.4	0.02	Type I	2.0	1.1	2.4	Riprap (D50 - 6 in)
C AR-306.018	14.2	35.2	0.05	Type III	2.0	2.2	2.4	Riprap (D50 - 6 in)
C AR-306.019	2.2	5.5	0.03	Type I	2.0	1.3	2.4	Riprap (D50 - 6 in)
C AR-306.020	2.4	6.2	0.03	Type I	2.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-306.021	4.2	10.6	0.04	Type I	2.0	2.2	2.4	Riprap (D50 - 6 in)
C AR-306.022	2.5	6.3	0.03	Type I	2.0	1.6	2.4	Riprap (D50 - 6 in)
C AR-306.023	9.2	23.3	0.04	Type II	2.0	2.0	2.4	Riprap (D50 - 6 in)
C AR-306.024	0.7	1.9	0.04	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C AR-306.025	0.6	2.3	0.06	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-306.026	0.6	2.6	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-306.027	52.9	148.0	0.05	Type III	3.5	5.0	See Note 1	See Note 1
C AR-306.028	0.5	3.5	0.01	Type I	1.5	0.3	0.4	Grass Lined
C E135.001	0.8	2.0	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C E135.002	0.5	1.3	0.05	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C E135.003	0.4	1.8	0.02	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C E135.004	2.4	8.0	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 36-016.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.014

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-016.AR2	C AR-307.001	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.002	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.003	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.004	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.005	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.006	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.007	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.008	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.009	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.010	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.011	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.012	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.013	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.014	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.015	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C AR-307.016	4	AR-307	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C E136.001	4	136	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C E136.002	4	136	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C E136.003	4	136	Bath	Lick Run-Stuart Run	338	34
36-016.AR2	C E136.004	4	136	Bath	Lick Run-Stuart Run	338	34

Water Quantity for Culverts and Ditches
Access Road: 36-016.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.014

Table 5.014 - Water Quantity - 36-016.AR2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-307.001	1.70	2.5	3.0	5.0	12	76	1.6	2.4	6.1	12	77	1.7	2.5	6.3	0.1	0.2	0.2
C AR-307.002	0.52	2.5	3.0	5.0	16	78	0.5	0.7	1.8	16	79	0.5	0.8	1.8	0.0	0.0	0.1
C AR-307.003	1.68	2.5	3.0	5.0	13	77	1.6	2.4	6.0	13	77	1.6	2.4	6.0	0.0	0.0	0.0
C AR-307.004	0.71	2.5	3.0	5.0	13	78	0.7	1.1	2.6	13	78	0.7	1.1	2.6	0.0	0.0	0.0
C AR-307.005	0.17	2.5	3.0	5.0	8	79	0.2	0.3	0.8	8	80	0.3	0.4	0.8	0.0	0.0	0.0
C AR-307.006	12.65	2.5	3.0	5.0	13	73	8.9	14.3	40.1	13	73	8.9	14.3	40.1	0.0	0.0	0.0
C AR-307.007	3.29	2.5	3.0	5.0	21	68	1.0	1.9	6.5	21	67	0.9	1.7	6.2	-0.1	-0.2	-0.3
C AR-307.008	1.12	2.5	3.0	5.0	10	75	1.0	1.6	4.1	10	75	1.0	1.6	4.1	0.0	0.0	0.0
C AR-307.009	5.99	2.5	3.0	5.0	15	74	4.3	6.7	18.3	15	74	4.3	6.7	18.3	0.0	0.0	0.0
C AR-307.010	0.31	2.5	3.0	5.0	11	77	0.3	0.5	1.2	11	77	0.3	0.5	1.2	0.0	0.0	0.0
C AR-307.011	0.15	2.5	3.0	5.0	6	77	0.2	0.3	0.7	6	79	0.2	0.3	0.7	0.0	0.0	0.0
C AR-307.012	0.11	2.5	3.0	5.0	6	74	0.1	0.2	0.5	6	76	0.1	0.2	0.5	0.0	0.0	0.0
C AR-307.013	0.85	2.5	3.0	5.0	12	74	0.7	1.1	2.9	12	74	0.7	1.1	2.9	0.0	0.0	0.0
C AR-307.014	0.05	2.5	3.0	5.0	12	72	0.0	0.1	0.2	12	77	0.1	0.1	0.2	0.0	0.0	0.0
C AR-307.015	0.00	2.5	3.0	5.0	16	71	0.0	0.0	0.0	16	74	0.0	0.0	0.0	0.0	0.0	0.0
C AR-307.016	0.69	2.5	3.0	5.0	14	71	0.4	0.6	1.9	14	71	0.4	0.6	1.9	0.0	0.0	0.0
C E136.001	0.13	2.5	3.0	5.0	7	74	0.1	0.2	0.5	7	76	0.2	0.2	0.6	0.0	0.0	0.0
C E136.002	0.06	2.5	3.0	5.0	10	73	0.1	0.1	0.2	10	74	0.1	0.1	0.2	0.0	0.0	0.0
C E136.003	0.59	2.5	3.0	5.0	12	71	0.4	0.6	1.8	12	72	0.4	0.6	1.8	0.0	0.1	0.1
C E136.004	0.60	2.5	3.0	5.0	13	71	0.4	0.6	1.8	13	71	0.4	0.6	1.8	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-016.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.014

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.014 - Energy Balance - 36-016.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-307.001	1.6	0.09	1.7	0.09	1.6	0.09	1.5	not met	0.2	exceeded	0.1	1.5	exceeded	0.2
C AR-307.002	0.5	0.03	0.5	0.03	0.5	0.03	0.5	not met	0.1	exceeded	0.0	0.4	exceeded	0.1
C AR-307.003	1.6	0.09	1.6	0.09	1.6	0.09	1.6	met	n/a	not exceeded	n/a	1.6	exceeded	0.0
C AR-307.004	0.7	0.04	0.7	0.04	0.7	0.04	0.7	met	n/a	not exceeded	n/a	0.6	exceeded	0.1
C AR-307.005	0.2	0.01	0.3	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-307.006	8.9	0.53	8.9	0.53	8.1	0.49	8.9	met	n/a	not exceeded	n/a	7.6	exceeded	1.4
C AR-307.007	1.0	0.09	0.9	0.08	1.0	0.09	1.1	met	n/a	not exceeded	n/a	1.1	not exceeded	n/a
C AR-307.008	1.0	0.05	1.0	0.05	1.0	0.05	1.0	met	n/a	not exceeded	n/a	0.9	exceeded	0.2
C AR-307.009	4.3	0.27	4.3	0.27	3.9	0.25	4.3	met	n/a	not exceeded	n/a	3.6	exceeded	0.6
C AR-307.010	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.0
C AR-307.011	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-307.012	0.1	0.01	0.1	0.01	0.1	0.00	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C AR-307.013	0.7	0.04	0.7	0.04	0.6	0.04	0.7	met	n/a	not exceeded	n/a	0.6	exceeded	0.1
C AR-307.014	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-307.015	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-307.016	0.4	0.03	0.4	0.03	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.3	exceeded	0.1
C E136.001	0.1	0.01	0.2	0.01	0.1	0.00	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C E136.002	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C E136.003	0.4	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.1	exceeded	0.0	0.3	exceeded	0.1
C E136.004	0.4	0.02	0.4	0.02	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.3	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 36-016.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.014

Table 7.014 - Culvert Sizing - 36-016.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-307.001	1.70	6.3	18	< 8	EC-1 Class A1
C AR-307.002	0.52	1.8	12	< 6	EC-3 Type B
C AR-307.003	1.68	6.0	18	< 8	EC-1 Class A1
C AR-307.004	0.71	2.6	12	< 6	EC-3 Type B
C AR-307.005	0.17	0.8	12	< 6	EC-3 Type B
C AR-307.006	12.65	40.1	36	< 8	EC-1 Class A1
C AR-307.007	3.29	6.2	18	< 8	EC-1 Class A1
C AR-307.008	1.12	4.1	18	< 8	EC-1 Class A1
C AR-307.009	5.99	18.3	24	< 8	EC-1 Class A1
C AR-307.010	0.31	1.2	12	< 6	EC-3 Type B
C AR-307.011	0.15	0.7	12	< 6	EC-3 Type B
C AR-307.012	0.11	0.5	12	< 6	EC-3 Type B
C AR-307.013	0.85	2.9	12	< 6	EC-3 Type B
C AR-307.014	0.05	0.2	12	< 6	EC-3 Type B
C AR-307.015	0.00	0.0	12	< 6	EC-3 Type B
C AR-307.016	0.69	1.9	12	< 6	EC-3 Type B
C E136.001	0.13	0.6	12	< 6	EC-3 Type B
C E136.002	0.06	0.2	12	< 6	EC-3 Type B
C E136.003	0.59	1.8	12	< 6	EC-3 Type B
C E136.004	0.60	1.8	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-016.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.014

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.
Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.014 - Roadside Ditch Sizing - 36-016.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-307.001	2.5	6.3	0.27	Type I	1.5	9.6	See Note 3	See Note 3
C AR-307.002	0.8	1.8	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-307.003	2.4	6.0	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-307.004	1.1	2.6	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-307.005	0.4	0.8	0.10	Type I	1.0	1.9	2.4	Riprap (D50 - 6 in)
C AR-307.006	14.3	40.1	0.01	Type III	2.5	0.3	0.4	Grass Lined
C AR-307.007	1.7	6.2	0.01	Type I	2.0	0.2	0.4	Grass Lined
C AR-307.008	1.6	4.1	0.35	Type I	1.5	9.9	See Note 3	See Note 3
C AR-307.009	6.7	18.3	0.21	Type I	2.0	11.1	See Note 3	See Note 3
C AR-307.010	0.5	1.2	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-307.011	0.3	0.7	0.10	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C AR-307.012	0.2	0.5	0.08	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-307.013	1.1	2.9	0.05	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C AR-307.014	0.1	0.2	0.08	Type I	1.0	0.9	2.4	Riprap (D50 - 6 in)
C AR-307.015	0.0	0.0	0.04	See Note 2	1.0	See Note 1	0.4	Grass Lined
C AR-307.016	0.6	1.9	0.05	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C E136.001	0.2	0.6	0.16	Type I	1.0	2.4	2.4	Riprap (D50 - 6 in)
C E136.002	0.1	0.2	0.14	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C E136.003	0.6	1.8	0.10	Type I	1.5	2.5	2.4	Riprap (D50 - 6 in)
C E136.004	0.6	1.8	0.09	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches

Access Road: 36-039.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.015

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-039.AR1	C AR-307.017	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C AR-307.018	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C AR-307.019	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C AR-307.020	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C AR-307.021	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C AR-307.022	4	AR-307	Bath	Lick Run-Stuart Run	338	T-5
36-039.AR1	C E137.001	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.002	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.003	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.004	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.005	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.006	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.007	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.008	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.009	4	137	Bath	Lick Run-Stuart Run	338	35
36-039.AR1	C E137.010	4	137	Bath	Lick Run-Stuart Run	338	35

Water Quantity for Culverts and Ditches
Access Road: 36-039.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.015

Table 5.015 - Water Quantity - 36-039.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-307.017	0.93	2.5	3.0	5.0	8	61	0.1	0.4	2.0	8	62	0.2	0.5	2.2	0.0	0.1	0.1
C AR-307.018	0.04	2.5	3.0	5.0	3	67	0.0	0.0	0.1	3	73	0.0	0.1	0.2	0.0	0.0	0.0
C AR-307.019	0.04	2.5	3.0	5.0	3	65	0.0	0.0	0.1	3	68	0.0	0.1	0.2	0.0	0.0	0.0
C AR-307.020	0.17	2.5	3.0	5.0	5	63	0.1	0.1	0.5	5	65	0.1	0.1	0.5	0.0	0.0	0.1
C AR-307.021	0.41	2.5	3.0	5.0	5	61	0.1	0.2	1.0	5	63	0.1	0.3	1.1	0.0	0.1	0.1
C AR-307.022	0.23	2.5	3.0	5.0	9	56	0.0	0.0	0.3	9	58	0.0	0.1	0.4	0.0	0.0	0.1
C E137.001	1.67	2.5	3.0	5.0	22	74	0.9	1.5	4.1	22	73	0.8	1.4	4.0	-0.1	-0.1	-0.2
C E137.002	2.54	2.5	3.0	5.0	22	77	1.8	2.8	7.0	22	77	1.8	2.8	7.0	0.0	0.0	0.0
C E137.003	0.21	2.5	3.0	5.0	10	77	0.2	0.3	0.8	10	78	0.3	0.4	0.9	0.0	0.0	0.0
C E137.004	1.16	2.5	3.0	5.0	11	78	1.3	1.9	4.6	11	78	1.3	1.9	4.6	0.0	0.0	0.0
C E137.005	0.52	2.5	3.0	5.0	9	80	0.7	1.0	2.3	9	80	0.7	1.0	2.3	0.0	0.0	0.0
C E137.006	1.53	2.5	3.0	5.0	11	77	1.6	2.4	5.9	11	78	1.7	2.5	6.1	0.1	0.1	0.2
C E137.007	0.77	2.5	3.0	5.0	11	77	0.8	1.2	3.0	11	76	0.8	1.1	2.9	-0.1	-0.1	-0.1
C E137.008	0.37	2.5	3.0	5.0	18	77	0.3	0.5	1.1	18	76	0.3	0.4	1.1	0.0	0.0	0.0
C E137.009	1.08	2.5	3.0	5.0	22	79	0.9	1.3	3.2	22	79	0.9	1.3	3.2	0.0	0.0	0.0
C E137.010	0.32	2.5	3.0	5.0	12	78	0.3	0.5	1.2	12	78	0.3	0.5	1.2	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-039.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.015

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.015 - Energy Balance - 36-039.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-307.017	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-307.018	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-307.019	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-307.020	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-307.021	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C AR-307.022	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C E137.001	0.9	0.08	0.8	0.07	0.8	0.07	1.0	met	n/a	not exceeded	n/a	0.8	exceeded	0.0
C E137.002	1.8	0.14	1.8	0.14	1.8	0.14	1.8	met	n/a	not exceeded	n/a	1.8	exceeded	0.0
C E137.003	0.2	0.01	0.3	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.0
C E137.004	1.3	0.07	1.3	0.07	1.3	0.07	1.3	met	n/a	not exceeded	n/a	1.3	exceeded	0.0
C E137.005	0.7	0.04	0.7	0.04	0.6	0.03	0.7	met	n/a	not exceeded	n/a	0.6	exceeded	0.2
C E137.006	1.6	0.08	1.7	0.09	1.6	0.08	1.5	not met	0.2	exceeded	0.1	1.5	exceeded	0.2
C E137.007	0.8	0.04	0.8	0.04	0.8	0.04	0.9	met	n/a	not exceeded	n/a	0.9	not exceeded	n/a
C E137.008	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.3	not exceeded	n/a
C E137.009	0.9	0.07	0.9	0.07	0.8	0.06	0.9	met	n/a	not exceeded	n/a	0.8	exceeded	0.1
C E137.010	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 36-039.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.015

Table 7.015 - Culvert Sizing - 36-039.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-307.017	0.93	2.2	12	< 6	EC-3 Type B
C AR-307.018	0.04	0.2	12	< 6	EC-3 Type B
C AR-307.019	0.04	0.2	12	< 6	EC-3 Type B
C AR-307.020	0.17	0.5	12	< 6	EC-3 Type B
C AR-307.021	0.41	1.1	12	< 6	EC-3 Type B
C AR-307.022	0.23	0.4	12	< 6	EC-3 Type B
C E137.001	1.67	4.0	12	< 6	EC-3 Type B
C E137.002	2.54	7.0	18	< 8	EC-1 Class A1
C E137.003	0.21	0.9	12	< 6	EC-3 Type B
C E137.004	1.16	4.6	18	< 8	EC-1 Class A1
C E137.005	0.52	2.3	12	< 6	EC-3 Type B
C E137.006	1.53	6.1	18	< 8	EC-1 Class A1
C E137.007	0.77	2.9	12	< 6	EC-3 Type B
C E137.008	0.37	1.1	12	< 6	EC-3 Type B
C E137.009	1.08	3.2	12	< 6	EC-3 Type B
C E137.010	0.32	1.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-039.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.015

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.015 - Roadside Ditch Sizing - 36-039.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-307.017	0.5	2.2	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-307.018	0.1	0.2	0.13	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C AR-307.019	0.1	0.2	0.17	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-307.020	0.1	0.5	0.24	Type I	1.0	2.9	4.8	Riprap (D50 - 12 in)
C AR-307.021	0.3	1.1	0.33	Type I	1.0	4.9	See Note 1	See Note 1
C AR-307.022	0.1	0.4	0.26	Type I	1.0	2.1	4.8	Riprap (D50 - 12 in)
C E137.001	1.4	4.0	0.04	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C E137.002	2.8	7.0	0.05	Type I	2.0	2.5	2.4	Riprap (D50 - 6 in)
C E137.003	0.4	0.9	0.05	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C E137.004	1.9	4.6	0.03	Type I	2.0	1.4	2.4	Riprap (D50 - 6 in)
C E137.005	1.0	2.3	0.04	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C E137.006	2.5	6.1	0.07	Type I	2.0	3.3	4.8	Riprap (D50 - 12 in)
C E137.007	1.1	2.9	0.06	Type I	1.5	2.1	2.4	Riprap (D50 - 6 in)
C E137.008	0.4	1.1	0.06	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C E137.009	1.3	3.2	0.04	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C E137.010	0.5	1.2	0.06	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)

Tables 4.016-026 to 8.016-026

Permanent Access Roads, Spread 4A

Tables 4.016-026 Culvert List

Tables 5.016-026 Water Quantity

Tables 6.016-026 Energy Balance

Tables 7.016-026 Culvert Sizing

Tables 8.016-026 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 36-091.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.016

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
36-091.AR1	C E145.001	4A	145	Bath	Cabin Creek-Mill Creek	333	36
36-091.AR1	C E145.002	4A	145	Bath	Cabin Creek-Mill Creek	333	36
36-091.AR1	C E145.003	4A	145	Bath	Cabin Creek-Mill Creek	333	36
36-091.AR1	C E145.004	4A	145	Bath	Cabin Creek-Mill Creek	333	36
36-091.AR1	C E145.005	4A	145	Bath	Cabin Creek-Mill Creek	333	36
36-091.AR1	C E145.006	4A	145	Bath	Cabin Creek-Mill Creek	333	36

Water Quantity for Culverts and Ditches
Access Road: 36-091.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.016

Table 5.016 - Water Quantity - 36-091.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E145.001	2.12	2.5	3.0	5.0	11	34	0.0	0.0	0.0	11	34	0.0	0.0	0.0	0.0	0.0	0.0
C E145.002	2.40	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	32	0.0	0.0	0.0	0.0	0.0	0.0
C E145.003	0.99	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	32	0.0	0.0	0.0	0.0	0.0	0.0
C E145.004	2.30	2.5	3.0	5.0	10	31	0.0	0.0	0.0	10	31	0.0	0.0	0.0	0.0	0.0	0.0
C E145.005	0.47	2.5	3.0	5.0	9	32	0.0	0.0	0.0	9	34	0.0	0.0	0.0	0.0	0.0	0.0
C E145.006	0.23	2.5	3.0	5.0	9	34	0.0	0.0	0.0	9	38	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 36-091.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.016

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.016 - Energy Balance - 36-091.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E145.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E145.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E145.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E145.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E145.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E145.006	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches
Access Road: 36-091.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.016

Table 7.016 - Culvert Sizing - 36-091.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E145.001	2.12	0.0	12	< 6	EC-3 Type B
C E145.002	2.40	0.0	12	< 6	EC-3 Type B
C E145.003	0.99	0.0	12	< 6	EC-3 Type B
C E145.004	2.30	0.0	12	< 6	EC-3 Type B
C E145.005	0.47	0.0	12	< 6	EC-3 Type B
C E145.006	0.23	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 36-091.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.016

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.
Note 2: Some ditches associated with this access road have a 10-year, 24-hour peak discharge of less than 0.005 cfs. In these cases, a Type I Grass Lined Channel with a minimum depth of 1.0 feet will be used.

Table 8.016 - Roadside Ditch Sizing - 36-091.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E145.001	0.0	0.0	0.12	Type I	1.0	See Note 1	0.4	Grass Lined
C E145.002	0.0	0.0	0.14	Type I	1.0	See Note 1	0.4	Grass Lined
C E145.003	0.0	0.0	0.12	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E145.004	0.0	0.0	0.13	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E145.005	0.0	0.0	0.13	See Note 2	1.0	See Note 1	0.4	Grass Lined
C E145.006	0.0	0.0	0.13	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.017

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-F002.AR1	C AR-308.001	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.002	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.003	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.004	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.005	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.006	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.007	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.008	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.009	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.010	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C AR-308.011	4A	AR-308	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C E146.009	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C E146.010	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C E146.011	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR1	C E146.012	4A	146	Augusta	Hamilton Branch	319	38

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.017

Table 5.017 - Water Quantity - 07-001-F002.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-308.001	0.38	3.0	3.5	5.5	7	71	0.5	0.7	1.6	7	71	0.5	0.7	1.6	0.0	0.0	0.0
C AR-308.002	0.78	3.0	3.5	5.5	11	59	0.2	0.4	1.6	11	59	0.2	0.4	1.6	0.0	0.0	0.0
C AR-308.003	0.86	3.0	3.5	5.5	11	56	0.1	0.3	1.5	11	57	0.1	0.4	1.6	0.0	0.1	0.1
C AR-308.004	0.62	3.0	3.5	5.5	11	63	0.3	0.5	1.6	11	63	0.3	0.5	1.6	0.0	0.0	0.0
C AR-308.005	1.46	3.0	3.5	5.5	16	56	0.1	0.4	2.1	16	57	0.2	0.5	2.3	0.0	0.1	0.2
C AR-308.006	0.38	3.0	3.5	5.5	10	57	0.1	0.2	0.7	10	58	0.1	0.2	0.8	0.0	0.0	0.0
C AR-308.007	0.43	3.0	3.5	5.5	9	57	0.1	0.2	0.9	9	58	0.1	0.2	0.9	0.0	0.0	0.1
C AR-308.008	0.74	3.0	3.5	5.5	9	56	0.1	0.3	1.4	9	57	0.1	0.3	1.5	0.0	0.1	0.1
C AR-308.009	1.42	3.0	3.5	5.5	17	56	0.1	0.4	2.0	17	56	0.1	0.4	2.0	0.0	0.0	0.0
C AR-308.010	1.40	3.0	3.5	5.5	15	56	0.1	0.4	2.1	15	56	0.1	0.4	2.1	0.0	0.0	0.0
C AR-308.011	1.92	3.0	3.5	5.5	13	55	0.2	0.5	2.9	13	55	0.2	0.5	2.9	0.0	0.0	0.0
C E146.009	5.87	3.0	3.5	5.5	11	55	0.5	1.7	9.7	11	54	0.4	1.3	9.0	-0.2	-0.3	-0.7
C E146.010	0.12	3.0	3.5	5.5	1	63	0.1	0.2	0.4	1	68	0.1	0.2	0.6	0.1	0.1	0.1
C E146.011	0.09	3.0	3.5	5.5	1	73	0.2	0.2	0.5	1	76	0.2	0.2	0.5	0.0	0.0	0.0
C E146.012	1.59	3.0	3.5	5.5	11	56	0.2	0.5	2.8	11	55	0.1	0.4	2.6	-0.1	-0.1	-0.2

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.017

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.017 - Energy Balance - 07-001-F002.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-308.001	0.5	0.02	0.5	0.02	0.4	0.02	0.5	met	n/a	not exceeded	n/a	0.4	exceeded	0.1
C AR-308.002	0.2	0.02	0.2	0.02	0.2	0.02	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C AR-308.003	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0
C AR-308.004	0.3	0.02	0.3	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-308.005	0.1	0.02	0.2	0.03	0.1	0.02	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C AR-308.006	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-308.007	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-308.008	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C AR-308.009	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C AR-308.010	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C AR-308.011	0.2	0.03	0.2	0.03	0.2	0.03	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C E146.009	0.5	0.08	0.4	0.07	0.5	0.08	0.6	met	n/a	not exceeded	n/a	0.6	not exceeded	n/a
C E146.010	0.1	0.00	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C E146.011	0.2	0.01	0.2	0.01	0.1	0.00	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1
C E146.012	0.2	0.02	0.1	0.02	0.2	0.02	0.2	met	n/a	not exceeded	n/a	0.2	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001-F002.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.017

Table 7.017 - Culvert Sizing - 07-001-F002.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-308.001	0.38	1.6	12	< 6	EC-3 Type B
C AR-308.002	0.78	1.6	12	< 6	EC-3 Type B
C AR-308.003	0.86	1.6	12	< 6	EC-3 Type B
C AR-308.004	0.62	1.6	12	< 6	EC-3 Type B
C AR-308.005	1.46	2.3	12	< 6	EC-3 Type B
C AR-308.006	0.38	0.8	12	< 6	EC-3 Type B
C AR-308.007	0.43	0.9	12	< 6	EC-3 Type B
C AR-308.008	0.74	1.5	12	< 6	EC-3 Type B
C AR-308.009	1.42	2.0	12	< 6	EC-3 Type B
C AR-308.010	1.40	2.1	12	< 6	EC-3 Type B
C AR-308.011	1.92	2.9	12	< 6	EC-3 Type B
C E146.009	5.87	9.0	18	< 8	EC-1 Class A1
C E146.010	0.12	0.6	12	< 6	EC-3 Type B
C E146.011	0.09	0.5	12	< 6	EC-3 Type B
C E146.012	1.59	2.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.017

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.017 - Roadside Ditch Sizing - 07-001-F002.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-308.001	0.7	1.6	0.10	Type I	1.5	2.4	2.4	Riprap (D50 - 6 in)
C AR-308.002	0.4	1.6	0.28	Type I	1.0	4.9	See Note 1	See Note 1
C AR-308.003	0.4	1.6	0.19	Type I	1.5	3.5	4.8	Riprap (D50 - 12 in)
C AR-308.004	0.5	1.6	0.19	Type I	1.5	4.0	4.8	Riprap (D50 - 12 in)
C AR-308.005	0.5	2.3	0.11	Type I	1.5	2.5	4.8	Riprap (D50 - 12 in)
C AR-308.006	0.2	0.8	0.12	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-308.007	0.2	0.9	0.11	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-308.008	0.3	1.5	0.10	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C AR-308.009	0.4	2.0	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-308.010	0.4	2.1	0.09	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-308.011	0.5	2.9	0.04	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C E146.009	1.3	9.0	0.08	Type I	2.0	2.8	4.8	Riprap (D50 - 12 in)
C E146.010	0.2	0.6	0.12	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C E146.011	0.2	0.5	0.12	Type I	1.0	1.9	2.4	Riprap (D50 - 6 in)
C E146.012	0.4	2.6	0.12	Type I	1.5	2.6	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.018

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-F002.AR2	C E146.001	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR2	C E146.002	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR2	C E146.003	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR2	C E146.004	4A	146	Augusta	Hamilton Branch	319	38
07-001-F002.AR2	C E146.005	4A	146	Augusta	Hamilton Branch	319	37, 38
07-001-F002.AR2	C E146.006	4A	146	Augusta	Hamilton Branch	319	37, 38
07-001-F002.AR2	C E146.007	4A	146	Augusta	Hamilton Branch	319	37
07-001-F002.AR2	C E146.008	4A	146	Augusta	Hamilton Branch	319	37

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.018

Table 5.018 - Water Quantity - 07-001-F002.AR2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E146.001	70.51	3.0	3.5	5.5	13	56	7.5	21.0	112.8	13	56	7.5	21.0	112.8	0.0	0.0	0.0
C E146.002	1.07	3.0	3.5	5.5	10	67	0.8	1.3	3.5	10	68	0.9	1.4	3.6	0.1	0.1	0.1
C E146.003	7.29	3.0	3.5	5.5	12	60	2.1	4.2	15.9	12	60	2.1	4.2	15.9	0.0	0.0	0.0
C E146.004	0.12	3.0	3.5	5.5	4	62	0.1	0.1	0.4	4	66	0.1	0.2	0.5	0.0	0.1	0.1
C E146.005	0.09	3.0	3.5	5.5	12	79	0.2	0.2	0.4	12	81	0.2	0.2	0.4	0.0	0.0	0.0
C E146.006	14.01	3.0	3.5	5.5	14	55	1.1	3.4	20.4	14	54	0.7	2.7	18.9	-0.3	-0.6	-1.5
C E146.007	0.32	3.0	3.5	5.5	9	65	0.2	0.3	1.0	9	66	0.2	0.4	1.0	0.0	0.0	0.0
C E146.008	0.96	3.0	3.5	5.5	9	58	0.2	0.5	2.1	9	59	0.3	0.6	2.2	0.1	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.018

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.018 - Energy Balance - 07-001-F002.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E146.001	7.5	1.05	7.5	1.05	7.5	1.05	7.5	met	n/a	not exceeded	n/a	7.5	exceeded	0.0
C E146.002	0.8	0.05	0.9	0.05	0.8	0.05	0.8	not met	0.1	exceeded	0.1	0.8	exceeded	0.1
C E146.003	2.1	0.17	2.1	0.17	2.1	0.17	2.1	met	n/a	not exceeded	n/a	2.1	exceeded	0.0
C E146.004	0.1	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C E146.005	0.2	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C E146.006	1.1	0.18	0.7	0.16	1.1	0.18	1.2	met	n/a	not exceeded	n/a	1.2	not exceeded	n/a
C E146.007	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C E146.008	0.2	0.02	0.3	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 07-001-F002.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.018

Table 7.018 - Culvert Sizing - 07-001-F002.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E146.001	70.51	112.8	multiple	< 8	EC-1 Class A1
C E146.002	1.07	3.6	12	< 6	EC-3 Type B
C E146.003	7.29	15.9	24	< 8	EC-1 Class A1
C E146.004	0.12	0.5	12	< 6	EC-3 Type B
C E146.005	0.09	0.4	12	< 6	EC-3 Type B
C E146.006	14.01	18.9	24	< 8	EC-1 Class A1
C E146.007	0.32	1.0	12	< 6	EC-3 Type B
C E146.008	0.96	2.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-F002.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.018

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.018 - Roadside Ditch Sizing - 07-001-F002.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E146.001	21.0	112.8	0.15	Type III	2.5	7.3	See Note 1	See Note 1
C E146.002	1.4	3.6	0.12	Type I	1.5	4.0	4.8	Riprap (D50 - 12 in)
C E146.003	4.2	15.9	0.04	Type II	2.0	1.3	2.4	Riprap (D50 - 6 in)
C E146.004	0.2	0.5	0.09	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C E146.005	0.2	0.4	0.04	Type I	1.0	0.8	2.4	Riprap (D50 - 6 in)
C E146.006	2.7	18.9	0.07	Type II	2.0	1.9	4.8	Riprap (D50 - 12 in)
C E146.007	0.4	1.0	0.15	Type I	1.0	2.7	2.4	Riprap (D50 - 6 in)
C E146.008	0.6	2.2	0.15	Type I	1.5	3.4	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-F009.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.019

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-F009.AR1	C E147.001	4A	147	Augusta	Hamilton Branch	319	39

Water Quantity for Culverts and Ditches
Access Road: 07-001-F009.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.019

Table 5.019 - Water Quantity - 07-001-F009.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E147.001	0.96	3.0	3.5	5.5	17	62	0.3	0.6	2.0	17	60	0.2	0.4	1.7	-0.1	-0.1	-0.2

Water Quantity for Culverts and Ditches

Access Road: 07-001-F009.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.019

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.019 - Energy Balance - 07-001-F009.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E147.001	0.3	0.03	0.2	0.02	0.3	0.03	0.4	met	n/a	not exceeded	n/a	0.3	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001-F009.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.019

Table 7.019 - Culvert Sizing - 07-001-F009.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E147.001	0.96	1.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-F009.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.019

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.019 - Roadside Ditch Sizing - 07-001-F009.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E147.001	0.4	1.7	0.11	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-F012.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.020

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-F012.AR1	C E147.002	4A	147	Augusta	Hamilton Branch	319	39
07-001-F012.AR1	C E147.003	4A	147	Augusta	Hamilton Branch	319	39
07-001-F012.AR1	C E147.004	4A	147	Augusta	Hamilton Branch	319	39

Water Quantity for Culverts and Ditches
Access Road: 07-001-F012.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.020

Table 5.020 - Water Quantity - 07-001-F012.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E147.002	47.20	3.0	3.5	5.5	21	36	0.0	0.0	1.3	21	36	0.0	0.0	1.3	0.0	0.0	0.0
C E147.003	0.66	3.0	3.5	5.5	12	65	0.4	0.6	1.8	12	63	0.3	0.5	1.7	-0.1	-0.1	-0.2
C E147.004	0.60	3.0	3.5	5.5	12	57	0.1	0.2	1.1	12	55	0.1	0.2	1.0	0.0	-0.1	-0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-F012.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.020

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.020 - Energy Balance - 07-001-F012.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E147.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C E147.003	0.4	0.02	0.3	0.02	0.3	0.02	0.5	met	n/a	not exceeded	n/a	0.4	not exceeded	n/a
C E147.004	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001-F012.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.020

Table 7.020 - Culvert Sizing - 07-001-F012.AR1

Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E147.002	47.20	1.3	12	< 6	EC-3 Type B
C E147.003	0.66	1.7	12	< 6	EC-3 Type B
C E147.004	0.60	1.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-F012.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.020

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Table 8.020 - Roadside Ditch Sizing - 07-001-F012.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E147.002	0.0	1.3	0.03	Type I	1.5	See Note 1	2.4	Riprap (D50 - 6 in)
C E147.003	0.5	1.7	0.09	Type I	1.5	2.1	2.4	Riprap (D50 - 6 in)
C E147.004	0.2	1.0	0.10	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-A017.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.021

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A017.AR1	C E-154.001	4A	154	Augusta	Holloway Draft-Calfpasture Rive	320	43

Water Quantity for Culverts and Ditches
Access Road: 07-001-A017.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.021

Table 5.021 - Water Quantity - 07-001-A017.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E-154.001	7.23	3.0	3.5	5.5	12	74	9.1	12.6	28.7	12	74	9.1	12.6	28.7	0.0	0.0	0.0

Water Quantity for Culverts and Ditches

Access Road: 07-001-A017.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.021

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.021 - Energy Balance - 07-001-A017.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E-154.001	9.1	0.49	9.1	0.49	9.1	0.49	9.1	met	n/a	not exceeded	n/a	9.1	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 07-001-A017.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.021

Table 7.021 - Culvert Sizing - 07-001-A017.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E-154.001	7.23	28.7	30	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 07-001-A017.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.021

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.021 - Roadside Ditch Sizing - 07-001-A017.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E-154.001	12.6	28.7	0.02	Type III	2.0	1.1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-F029.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.022

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-F029.AR1	C AR-309.001	4A	AR-309	Augusta	Hamilton Branch	319	42
07-001-F029.AR1	C AR-309.002	4A	AR-309	Augusta	Hamilton Branch	319	42
07-001-F029.AR1	C E150.001	4A	150	Augusta	Hamilton Branch	319	T-2
07-001-F029.AR1	C E150.002	4A	150	Augusta	Hamilton Branch	319	T-2
07-001-F029.AR1	C E150.003	4A	150	Augusta	Hamilton Branch	319	T-2
07-001-F029.AR1	C E150.004	4A	150	Augusta	Hamilton Branch	319	T-2
07-001-F029.AR1	C E150.005	4A	150	Augusta	Hamilton Branch	319	T-2

Water Quantity for Culverts and Ditches
Access Road: 07-001-F029.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.022

Table 5.022 - Water Quantity - 07-001-F029.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-309.001	0.94	3.0	3.5	5.5	11	76	1.4	1.9	4.1	11	76	1.4	1.9	4.1	0.0	0.0	0.0
C AR-309.002	0.32	3.0	3.5	5.5	12	78	0.5	0.7	1.4	12	79	0.5	0.7	1.5	0.0	0.0	0.0
C E150.001	0.29	3.0	3.5	5.5	8	77	0.5	0.7	1.4	8	79	0.6	0.7	1.5	0.1	0.1	0.1
C E150.002	0.18	3.0	3.5	5.5	1	72	0.3	0.4	1.0	1	76	0.4	0.5	1.1	0.1	0.1	0.1
C E150.003	0.14	3.0	3.5	5.5	1	78	0.3	0.4	0.9	1	82	0.4	0.5	1.0	0.1	0.1	0.1
C E150.004	0.17	3.0	3.5	5.5	2	73	0.3	0.4	0.9	2	77	0.4	0.5	1.0	0.1	0.1	0.1
C E150.005	0.19	3.0	3.5	5.5	2	72	0.3	0.4	1.0	2	74	0.3	0.5	1.0	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-F029.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.022

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.022 - Energy Balance - 07-001-F029.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-309.001	1.4	0.07	1.4	0.07	1.2	0.06	1.4	met	n/a	not exceeded	n/a	1.1	exceeded	0.3
C AR-309.002	0.5	0.03	0.5	0.03	0.5	0.03	0.5	not met	0.0	exceeded	0.0	0.4	exceeded	0.1
C E150.001	0.5	0.02	0.6	0.03	0.3	0.02	0.5	not met	0.1	exceeded	0.1	0.2	exceeded	0.4
C E150.002	0.3	0.01	0.4	0.01	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.3
C E150.003	0.3	0.01	0.4	0.02	0.2	0.01	0.3	not met	0.1	exceeded	0.1	0.1	exceeded	0.3
C E150.004	0.3	0.01	0.4	0.01	0.2	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.3
C E150.005	0.3	0.01	0.3	0.01	0.2	0.01	0.3	not met	0.1	exceeded	0.0	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 07-001-F029.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.022

Table 7.022 - Culvert Sizing - 07-001-F029.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-309.001	0.94	4.1	18	< 8	EC-1 Class A1
C AR-309.002	0.32	1.5	12	< 6	EC-3 Type B
C E150.001	0.29	1.5	12	< 6	EC-3 Type B
C E150.002	0.18	1.1	12	< 6	EC-3 Type B
C E150.003	0.14	1.0	12	< 6	EC-3 Type B
C E150.004	0.17	1.0	12	< 6	EC-3 Type B
C E150.005	0.19	1.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-F029.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.022

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.022 - Roadside Ditch Sizing - 07-001-F029.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-309.001	1.9	4.1	0.02	Type I	2.0	1.1	2.4	Riprap (D50 - 6 in)
C AR-309.002	0.7	1.5	0.01	Type I	1.5	0.3	0.4	Grass Lined
C E150.001	0.7	1.5	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C E150.002	0.5	1.1	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C E150.003	0.5	1.0	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C E150.004	0.5	1.0	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C E150.005	0.5	1.0	0.04	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-A055.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.023

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A055.AR2	C AR-310.001	4A	AR-310	Augusta	Chair Draft-Calfpasture River	311	45
07-001-A055.AR2	C AR-310.002	4A	AR-310	Augusta	Chair Draft-Calfpasture River	311	45
07-001-A055.AR2	C AR-310.003	4A	AR-310	Augusta	Chair Draft-Calfpasture River	311	44, 45
07-001-A055.AR2	C E-155B.001	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44, 45
07-001-A055.AR2	C E-155B.002	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.003	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.004	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.005	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.006	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.007	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.008	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.009	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44
07-001-A055.AR2	C E-155B.010	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44, 45
07-001-A055.AR2	C E-155B.011	4A	155B	Augusta	Chair Draft-Calfpasture River	311	44, 45

Water Quantity for Culverts and Ditches
Access Road: 07-001-A055.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.023

Table 5.023 - Water Quantity - 07-001-A055.AR2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-310.001	89.69	3.0	3.5	5.5	25	55	5.1	14.8	91.9	25	55	5.1	14.8	91.9	0.0	0.0	0.0
C AR-310.002	70.98	3.0	3.5	5.5	21	55	4.3	13.0	80.8	21	55	4.3	13.0	80.8	0.0	0.0	0.0
C AR-310.003	9.56	3.0	3.5	5.5	19	56	0.8	2.3	12.7	19	55	0.6	1.9	11.8	-0.2	-0.4	-0.9
C E-155B.001	1.02	3.0	3.5	5.5	11	57	0.2	0.4	2.0	11	58	0.2	0.5	2.1	0.1	0.1	0.1
C E-155B.002	0.89	3.0	3.5	5.5	7	57	0.2	0.5	2.0	7	59	0.3	0.6	2.3	0.1	0.1	0.3
C E-155B.003	0.60	3.0	3.5	5.5	9	57	0.1	0.3	1.2	9	58	0.1	0.3	1.3	0.0	0.1	0.1
C E-155B.004	0.55	3.0	3.5	5.5	9	58	0.1	0.3	1.2	9	59	0.2	0.3	1.2	0.0	0.0	0.1
C E-155B.005	0.73	3.0	3.5	5.5	8	56	0.1	0.3	1.4	8	56	0.1	0.3	1.4	0.0	0.0	0.0
C E-155B.006	0.49	3.0	3.5	5.5	9	56	0.1	0.2	1.0	9	57	0.1	0.2	1.0	0.0	0.0	0.1
C E-155B.007	0.27	3.0	3.5	5.5	6	57	0.1	0.1	0.6	6	58	0.1	0.2	0.7	0.0	0.0	0.0
C E-155B.008	0.18	3.0	3.5	5.5	7	57	0.0	0.1	0.4	7	59	0.1	0.1	0.5	0.0	0.0	0.1
C E-155B.009	0.09	3.0	3.5	5.5	6	58	0.0	0.1	0.2	6	60	0.0	0.1	0.2	0.0	0.0	0.0
C E-155B.010	0.24	3.0	3.5	5.5	10	58	0.1	0.1	0.5	10	60	0.1	0.2	0.6	0.0	0.0	0.1
C E-155B.011	2.37	3.0	3.5	5.5	14	56	0.2	0.7	3.6	16	57	0.3	0.7	3.7	0.1	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-A055.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.023

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.023 - Energy Balance - 07-001-A055.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-310.001	5.1	1.16	5.1	1.16	5.1	1.16	5.1	met	n/a	not exceeded	n/a	5.1	exceeded	0.0
C AR-310.002	4.3	0.92	4.3	0.92	4.3	0.92	4.3	met	n/a	not exceeded	n/a	4.3	exceeded	0.0
C AR-310.003	0.8	0.14	0.6	0.12	0.6	0.12	1.0	met	n/a	not exceeded	n/a	0.6	exceeded	0.0
C E-155B.001	0.2	0.02	0.2	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C E-155B.002	0.2	0.02	0.3	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C E-155B.003	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E-155B.004	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C E-155B.005	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C E-155B.006	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E-155B.007	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C E-155B.008	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E-155B.009	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C E-155B.010	0.1	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E-155B.011	0.2	0.04	0.3	0.04	0.2	0.03	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 07-001-A055.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.023

Table 7.023 - Culvert Sizing - 07-001-A055.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-310.001	89.69	91.9	multiple	< 8	EC-1 Class A1
C AR-310.002	70.98	80.8	48	< 8	EC-1 Class A1
C AR-310.003	9.56	11.8	18	< 8	EC-1 Class A1
C E-155B.001	1.02	2.1	12	< 6	EC-3 Type B
C E-155B.002	0.89	2.3	12	< 6	EC-3 Type B
C E-155B.003	0.60	1.3	12	< 6	EC-3 Type B
C E-155B.004	0.55	1.2	12	< 6	EC-3 Type B
C E-155B.005	0.73	1.4	12	< 6	EC-3 Type B
C E-155B.006	0.49	1.0	12	< 6	EC-3 Type B
C E-155B.007	0.27	0.7	12	< 6	EC-3 Type B
C E-155B.008	0.18	0.5	12	< 6	EC-3 Type B
C E-155B.009	0.09	0.2	12	< 6	EC-3 Type B
C E-155B.010	0.24	0.6	12	< 6	EC-3 Type B
C E-155B.011	2.37	3.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-A055.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.023

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.023 - Roadside Ditch Sizing - 07-001-A055.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-310.001	14.8	91.9	0.04	Type III	3.0	2.3	4.8	Riprap (D50 - 12 in)
C AR-310.002	13.0	80.8	0.04	Type III	3.0	2.1	4.8	Riprap (D50 - 12 in)
C AR-310.003	1.9	11.8	0.03	Type I	2.0	1.4	2.4	Riprap (D50 - 6 in)
C E-155B.001	0.5	2.1	0.05	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C E-155B.002	0.6	2.3	0.01	Type I	1.5	0.2	0.4	Grass Lined
C E-155B.003	0.3	1.3	0.12	Type I	1.0	2.2	2.4	Riprap (D50 - 6 in)
C E-155B.004	0.3	1.2	0.06	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C E-155B.005	0.3	1.4	0.05	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C E-155B.006	0.2	1.0	0.10	Type I	1.0	1.6	2.4	Riprap (D50 - 6 in)
C E-155B.007	0.2	0.7	0.11	Type I	1.0	1.6	2.4	Riprap (D50 - 6 in)
C E-155B.008	0.1	0.5	0.03	Type I	1.0	0.4	0.4	Grass Lined
C E-155B.009	0.1	0.2	0.04	Type I	1.0	0.3	0.4	Grass Lined
C E-155B.010	0.2	0.6	0.04	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)
C E-155B.011	0.7	3.7	0.16	Type I	1.5	3.9	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-A009-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.024

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A009-AR 1	C AR-500.001	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	46
07-001-A009-AR 1	C AR-500.002	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	46
07-001-A009-AR 1	C 157.001	4A	157	Augusta	Chair Draft-Calfpasture River	304	46
07-001-A009-AR 1	C 157.002	4A	157	Augusta	Chair Draft-Calfpasture River	304	46
07-001-A009-AR 1	C 157.003	4A	157	Augusta	Chair Draft-Calfpasture River	304	46

Water Quantity for Culverts and Ditches
Access Road: 07-001-A009-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.024

Table 5.024 - Water Quantity - 07-001-A009-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-500.001	0.90	3.0	3.5	5.5	6	50	0.0	0.1	1.2	6	52	0.0	0.2	1.5	0.0	0.1	0.2
C AR-500.002	0.49	3.0	3.5	5.5	11	45	0.0	0.0	0.3	11	48	0.0	0.0	0.4	0.0	0.0	0.2
C 157.001	0.18	3.0	3.5	5.5	24	37	0.0	0.0	0.0	24	41	0.0	0.0	0.0	0.0	0.0	0.0
C 157.002	0.35	3.0	3.5	5.5	22	34	0.0	0.0	0.0	22	37	0.0	0.0	0.0	0.0	0.0	0.0
C 157.003	0.28	3.0	3.5	5.5	21	33	0.0	0.0	0.0	21	37	0.0	0.0	0.0	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 07-001-A009-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.024

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.024 - Energy Balance - 07-001-A009-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-500.001	0.0	0.01	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.002	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C 157.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 157.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C 157.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001-A009-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.024

Table 7.024 - Culvert Sizing - 07-001-A009-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-500.001	0.90	1.5	12	< 6	EC-3 Type B
C AR-500.002	0.49	0.4	12	< 6	EC-3 Type B
C 157.001	0.18	0.0	12	< 6	EC-3 Type B
C 157.002	0.35	0.0	12	< 6	EC-3 Type B
C 157.003	0.28	0.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-A009-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.024

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Table 8.024 - Roadside Ditch Sizing - 07-001-A009-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-500.001	0.2	1.5	0.02	Type I	1.5	0.2	0.4	Grass Lined
C AR-500.002	0.0	0.4	0.10	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C 157.001	0.0	0.0	0.04	Type I	1.0	See Note 1	0.4	Grass Lined
C 157.002	0.0	0.0	0.03	Type I	1.0	See Note 1	0.4	Grass Lined
C 157.003	0.0	0.0	0.01	Type I	1.0	See Note 1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR 3	C AR-500.003	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.004	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.005	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.006	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.007	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.008	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.009	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.010	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.011	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C AR-500.012	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47, 48
07-001.AR 3	C AR-500.013	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47, 48
07-001.AR 3	C AR-500.014	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	47, 48
07-001.AR 3	C AR-500.015	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.016	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.017	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.018	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.019	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.020	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.021	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.022	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.023	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.024	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.025	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.026	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.027	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.028	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.029	4A	AR-500	Augusta	Jennings Branch	313	48
07-001.AR 3	C AR-500.030	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	48
07-001.AR 3	C AR-500.031	4A	AR-500	Augusta	Jennings Branch	313	49
07-001.AR 3	C AR-500.032	4A	AR-500	Augusta	Jennings Branch	313	49
07-001.AR 3	C AR-500.033	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR 3	C AR-500.034	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR 3	C AR-500.035	4A	AR-500	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR 3	C 158.001	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.002	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.003	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.004	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.005	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.006	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.007	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.008	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.009	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.010	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.011	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 158.012	4A	158	Augusta	Chair Draft-Calfpasture River	304	46, 47
07-001.AR 3	C 158.013	4A	158	Augusta	Chair Draft-Calfpasture River	304	46, 47
07-001.AR 3	C 158.014	4A	158	Augusta	Chair Draft-Calfpasture River	304	46, 47
07-001.AR 3	C 158.015	4A	158	Augusta	Chair Draft-Calfpasture River	304	46, 47
07-001.AR 3	C 158.016	4A	158	Augusta	Chair Draft-Calfpasture River	304	47
07-001.AR 3	C 159.001	4A	159	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR 3	C 159.008	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.009	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.010	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.011	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.012	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.013	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.014	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.015	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.016	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.017	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.018	4A	159	Augusta	Jennings Branch	313	49

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR 3	C 159.019	4A	159	Augusta	Jennings Branch	313	49
07-001.AR 3	C 159.020	4A	159	Augusta	Jennings Branch	313	49

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Table 5.025 - Water Quantity - 07-001.AR 3

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-500.003	233.50	3.0	3.5	5.5	26	54	9.5	30.3	210.7	26	54	9.5	30.3	210.7	0.0	0.0	0.0
C AR-500.004	0.43	3.0	3.5	5.5	9	56	0.1	0.2	0.8	9	57	0.1	0.2	0.9	0.0	0.0	0.1
C AR-500.005	0.58	3.0	3.5	5.5	8	55	0.1	0.2	1.1	8	57	0.1	0.3	1.3	0.1	0.1	0.2
C AR-500.006	0.56	3.0	3.5	5.5	8	56	0.1	0.2	1.1	8	57	0.1	0.3	1.2	0.0	0.0	0.1
C AR-500.007	0.67	3.0	3.5	5.5	10	56	0.1	0.2	1.2	10	57	0.1	0.3	1.3	0.0	0.0	0.1
C AR-500.008	0.58	3.0	3.5	5.5	8	57	0.1	0.3	1.2	8	58	0.1	0.3	1.3	0.0	0.0	0.1
C AR-500.009	0.54	3.0	3.5	5.5	4	64	0.4	0.7	2.0	4	65	0.5	0.7	2.0	0.0	0.0	0.1
C AR-500.010	1.00	3.0	3.5	5.5	8	59	0.3	0.6	2.4	8	59	0.3	0.6	2.4	0.0	0.0	0.0
C AR-500.011	1.05	3.0	3.5	5.5	10	56	0.1	0.4	2.0	10	56	0.1	0.4	2.0	0.0	0.0	0.0
C AR-500.012	0.90	3.0	3.5	5.5	9	56	0.1	0.3	1.7	9	56	0.1	0.3	1.7	0.0	0.0	0.0
C AR-500.013	0.50	3.0	3.5	5.5	14	56	0.1	0.2	0.8	14	56	0.1	0.2	0.8	0.0	0.0	0.0
C AR-500.014	0.83	3.0	3.5	5.5	10	57	0.2	0.4	1.7	10	58	0.2	0.4	1.8	0.0	0.1	0.1
C AR-500.015	0.74	3.0	3.5	5.5	28	56	0.1	0.1	0.8	28	57	0.1	0.2	0.8	0.0	0.0	0.1
C AR-500.016	0.33	3.0	3.5	5.5	10	58	0.1	0.2	0.7	10	59	0.1	0.2	0.7	0.0	0.0	0.1
C AR-500.017	0.06	3.0	3.5	5.5	2	60	0.0	0.1	0.2	2	63	0.1	0.1	0.2	0.0	0.0	0.0
C AR-500.018	0.40	3.0	3.5	5.5	12	58	0.1	0.2	0.8	12	60	0.1	0.2	0.9	0.0	0.1	0.1
C AR-500.019	0.40	3.0	3.5	5.5	21	59	0.1	0.1	0.6	21	62	0.1	0.2	0.7	0.1	0.1	0.1
C AR-500.020	0.25	3.0	3.5	5.5	4	65	0.2	0.3	1.0	4	67	0.3	0.4	1.0	0.1	0.1	0.1
C AR-500.021	0.31	3.0	3.5	5.5	4	65	0.3	0.4	1.2	4	66	0.3	0.4	1.2	0.0	0.0	0.0
C AR-500.022	0.33	3.0	3.5	5.5	8	60	0.1	0.2	0.9	8	62	0.2	0.3	0.9	0.0	0.1	0.1
C AR-500.023	0.19	3.0	3.5	5.5	12	58	0.0	0.1	0.4	12	60	0.1	0.1	0.4	0.0	0.0	0.0
C AR-500.024	0.14	3.0	3.5	5.5	12	58	0.0	0.1	0.3	12	60	0.0	0.1	0.3	0.0	0.0	0.0
C AR-500.025	0.56	3.0	3.5	5.5	5	58	0.2	0.4	1.4	5	60	0.2	0.5	1.6	0.1	0.1	0.2
C AR-500.026	0.26	3.0	3.5	5.5	4	59	0.1	0.2	0.7	4	61	0.1	0.2	0.8	0.0	0.1	0.1
C AR-500.027	0.10	3.0	3.5	5.5	5	61	0.1	0.1	0.3	5	66	0.1	0.1	0.4	0.0	0.1	0.1
C AR-500.028	0.39	3.0	3.5	5.5	7	59	0.1	0.3	1.0	7	61	0.2	0.3	1.1	0.1	0.1	0.1
C AR-500.029	0.19	3.0	3.5	5.5	0	60	0.1	0.2	0.6	0	64	0.2	0.3	0.8	0.1	0.1	0.1
C AR-500.030	0.29	3.0	3.5	5.5	16	59	0.1	0.1	0.5	16	61	0.1	0.2	0.6	0.0	0.0	0.1
C AR-500.031	0.08	3.0	3.5	5.5	1	62	0.1	0.1	0.3	1	66	0.1	0.1	0.3	0.0	0.0	0.1
C AR-500.032	0.23	3.0	3.5	5.5	10	58	0.1	0.1	0.5	10	60	0.1	0.1	0.5	0.0	0.0	0.1
C AR-500.033	0.31	3.0	3.5	5.5	12	58	0.1	0.1	0.6	12	59	0.1	0.2	0.6	0.0	0.0	0.0
C AR-500.034	0.37	3.0	3.5	5.5	12	57	0.1	0.1	0.7	12	58	0.1	0.2	0.7	0.0	0.0	0.0
C AR-500.035	0.33	3.0	3.5	5.5	9	57	0.1	0.1	0.7	9	59	0.1	0.2	0.8	0.0	0.1	0.1
C 158.001	0.59	3.0	3.5	5.5	8	64	0.4	0.6	1.8	8	65	0.4	0.7	1.9	0.0	0.1	0.1
C 158.002	0.89	3.0	3.5	5.5	9	58	0.2	0.5	2.0	9	58	0.2	0.5	2.0	0.0	0.0	0.0
C 158.003	1.43	3.0	3.5	5.5	9	60	0.5	0.9	3.4	9	61	0.6	1.0	3.6	0.1	0.1	0.2
C 158.004	0.74	3.0	3.5	5.5	9	60	0.3	0.5	1.8	9	59	0.2	0.4	1.7	0.0	-0.1	-0.1
C 158.005	126.09	3.0	3.5	5.5	22	54	5.4	18.2	128.2	22	54	5.4	18.2	128.2	0.0	0.0	0.0
C 158.006	0.62	3.0	3.5	5.5	7	61	0.3	0.5	1.7	7	63	0.4	0.6	1.9	0.1	0.1	0.2
C 158.007	0.35	3.0	3.5	5.5	6	63	0.2	0.4	1.1	6	65	0.3	0.4	1.2	0.1	0.1	0.1
C 158.008	0.80	3.0	3.5	5.5	10	65	0.5	0.8	2.4	10	67	0.6	1.0	2.6	0.1	0.1	0.2
C 158.009	0.52	3.0	3.5	5.5	5	68	0.6	0.8	2.1	5	69	0.6	0.9	2.2	0.0	0.1	0.1
C 158.010	1.17	3.0	3.5	5.5	9	63	0.6	1.1	3.4	9	61	0.5	0.9	3.1	-0.2	-0.2	-0.3
C 158.011	1.88	3.0	3.5	5.5	8	62	0.9	1.6	5.2	8	61	0.8	1.4	5.0	-0.1	-0.2	-0.3
C 158.012	1.90	3.0	3.5	5.5	21	57	0.2	0.5	2.5	21	57	0.2	0.5	2.5	0.0	0.0	0.0
C 158.013	1.46	3.0	3.5	5.5	19	58	0.2	0.5	2.2	19	57	0.2	0.4	2.1	0.0	-0.1	-0.1
C 158.014	1.38	3.0	3.5	5.5	19	59	0.2	0.5	2.2	19	59	0.2	0.5	2.2	0.0	0.0	0.0
C 158.015	1.03	3.0	3.5	5.5	9	64	0.6	1.0	3.0	9	64	0.6	1.0	3.0	0.0	0.0	0.0
C 158.016	438.47	3.0	3.5	5.5	46	42	0.2	1.8	55.6	46	42	0.2	1.8	55.6	0.0	0.0	0.0
C 159.001	0.15	3.0	3.5	5.5	1	61	0.1	0.2	0.5	1	65	0.1	0.2	0.6	0.1	0.1	0.1
C 159.008	2.26	3.0	3.5	5.5	9	55	0.2	0.7	4.1	9	55	0.2	0.7	4.1	0.0	0.0	0.0
C 159.009	0.70	3.0	3.5	5.5	8	54	0.1	0.2	1.2	8	55	0.1	0.2	1.3	0.0	0.0	0.1
C 159.010	2.37	3.0	3.5	5.5	14	54	0.1	0.5	3.2	14	54	0.1	0.5	3.2	0.0	0.0	0.0
C 159.011	3.15	3.0	3.5	5.5	9	55	0.3	1.0	5.6	9	54	0.2	0.8	5.2	-0.1	-0.2	-0.4
C 159.012	1.18	3.0	3.5	5.5	9	56	0.2	0.4	2.2	9	55	0.1	0.4	2.1	-0.1	-0.1	-0.2
C 159.013	1.18	3.0	3.5	5.5	8	70	1.3	1.9	4.6	8	70	1.3	1.9	4.6	0.0	0.0	0.0
C 159.014	3.37	3.0	3.5	5.5	8	65	2.3	3.7	10.7	8	64	2.0	3.4	10.3	-0.3	-0.3	-0.5
C 159.015	0.91	3.0	3.5	5.5	9	56	0.1	0.4	1.8	9	54	0.1	0.2	1.5	-0.1	-0.1	-0.2

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Table 5.025 - Water Quantity - 07-001.AR 3																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 159.016	0.62	3.0	3.5	5.5	18	67	0.4	0.6	1.5	18	67	0.4	0.6	1.5	0.0	0.0	0.0
C 159.017	1.97	3.0	3.5	5.5	10	67	1.5	2.3	6.3	10	65	1.2	2.0	5.8	-0.3	-0.3	-0.5
C 159.018	0.55	3.0	3.5	5.5	8	56	0.1	0.2	1.1	8	54	0.0	0.2	1.0	0.0	-0.1	-0.2
C 159.019	2.77	3.0	3.5	5.5	9	56	0.4	1.0	5.2	9	55	0.2	0.6	3.2	-0.2	-0.5	-2.1
C 159.020	0.00	3.0	3.5	5.5	9	0	0.0	0.0	0.0	9	56	0.1	0.4	1.9	0.1	0.4	1.9

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.025 - Energy Balance - 07-001.AR 3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-500.003	9.5	2.61	9.5	2.61	9.5	2.61	9.5	met	n/a	not exceeded	n/a	9.5	exceeded	0.0
C AR-500.004	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.005	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-500.006	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.007	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.008	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.009	0.4	0.02	0.5	0.02	0.3	0.01	0.4	not met	0.1	exceeded	0.0	0.2	exceeded	0.3
C AR-500.010	0.3	0.02	0.3	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-500.011	0.1	0.02	0.1	0.02	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C AR-500.012	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C AR-500.013	0.1	0.01	0.1	0.01	0.0	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR-500.014	0.2	0.01	0.2	0.02	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C AR-500.015	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.016	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.017	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.018	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.019	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-500.020	0.2	0.01	0.3	0.01	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C AR-500.021	0.3	0.01	0.3	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.1	exceeded	0.2
C AR-500.022	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C AR-500.023	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.024	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.025	0.2	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.2
C AR-500.026	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C AR-500.027	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C AR-500.028	0.1	0.01	0.2	0.01	0.0	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.2
C AR-500.029	0.1	0.01	0.2	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-500.030	0.1	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.031	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.032	0.1	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.033	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-500.034	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-500.035	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 158.001	0.4	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.1	exceeded	0.0	0.2	exceeded	0.2
C 158.002	0.2	0.02	0.2	0.02	0.2	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 158.003	0.5	0.03	0.6	0.04	0.4	0.03	0.4	not met	0.1	exceeded	0.1	0.3	exceeded	0.2
C 158.004	0.3	0.02	0.2	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 158.005	5.4	1.41	5.4	1.41	5.4	1.41	5.4	met	n/a	not exceeded	n/a	5.4	exceeded	0.0
C 158.006	0.3	0.02	0.4	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.0	exceeded	0.3
C 158.007	0.2	0.01	0.3	0.01	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 158.008	0.5	0.03	0.6	0.03	0.4	0.03	0.4	not met	0.2	exceeded	0.1	0.3	exceeded	0.3
C 158.009	0.6	0.02	0.6	0.03	0.4	0.02	0.5	not met	0.1	exceeded	0.0	0.3	exceeded	0.3
C 158.010	0.6	0.04	0.5	0.03	0.4	0.03	0.7	met	n/a	not exceeded	n/a	0.4	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.025 - Energy Balance - 07-001.AR 3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 158.011	0.9	0.05	0.8	0.05	0.8	0.05	0.9	met	n/a	not exceeded	n/a	0.8	exceeded	0.0
C 158.012	0.2	0.03	0.2	0.03	0.1	0.03	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 158.013	0.2	0.03	0.2	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 158.014	0.2	0.03	0.2	0.03	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.2
C 158.015	0.6	0.04	0.6	0.04	0.3	0.02	0.6	met	n/a	not exceeded	n/a	0.2	exceeded	0.4
C 158.016	0.2	0.01	0.2	0.01	0.2	0.01	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 159.001	0.1	0.00	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 159.008	0.2	0.03	0.2	0.03	0.2	0.03	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 159.009	0.1	0.01	0.1	0.01	0.1	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 159.010	0.1	0.03	0.1	0.03	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 159.011	0.3	0.04	0.2	0.04	0.2	0.04	0.4	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 159.012	0.2	0.02	0.1	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C 159.013	1.3	0.06	1.3	0.06	1.3	0.06	1.3	met	n/a	not exceeded	n/a	1.3	exceeded	0.0
C 159.014	2.3	0.12	2.0	0.11	2.0	0.11	2.5	met	n/a	not exceeded	n/a	2.0	exceeded	0.0
C 159.015	0.1	0.01	0.1	0.01	0.1	0.01	0.2	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a
C 159.016	0.4	0.03	0.4	0.03	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.3	exceeded	0.1
C 159.017	1.5	0.08	1.2	0.07	1.4	0.08	1.8	met	n/a	not exceeded	n/a	1.5	not exceeded	n/a
C 159.018	0.1	0.01	0.0	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a
C 159.019	0.4	0.04	0.2	0.02	0.2	0.02	0.6	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 159.020	0.0	0.00	0.1	0.01	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.1	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Table 7.025 - Culvert Sizing - 07-001.AR 3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-500.003	233.50	210.7	multiple	< 8	EC-1 Class A1
C AR-500.004	0.43	0.9	12	< 6	EC-3 Type B
C AR-500.005	0.58	1.3	12	< 6	EC-3 Type B
C AR-500.006	0.56	1.2	12	< 6	EC-3 Type B
C AR-500.007	0.67	1.3	12	< 6	EC-3 Type B
C AR-500.008	0.58	1.3	12	< 6	EC-3 Type B
C AR-500.009	0.54	2.0	12	< 6	EC-3 Type B
C AR-500.010	1.00	2.4	12	< 6	EC-3 Type B
C AR-500.011	1.05	2.0	12	< 6	EC-3 Type B
C AR-500.012	0.90	1.7	12	< 6	EC-3 Type B
C AR-500.013	0.50	0.8	12	< 6	EC-3 Type B
C AR-500.014	0.83	1.8	12	< 6	EC-3 Type B
C AR-500.015	0.74	0.8	12	< 6	EC-3 Type B
C AR-500.016	0.33	0.7	12	< 6	EC-3 Type B
C AR-500.017	0.06	0.2	12	< 6	EC-3 Type B
C AR-500.018	0.40	0.9	12	< 6	EC-3 Type B
C AR-500.019	0.40	0.7	12	< 6	EC-3 Type B
C AR-500.020	0.25	1.0	12	< 6	EC-3 Type B
C AR-500.021	0.31	1.2	12	< 6	EC-3 Type B
C AR-500.022	0.33	0.9	12	< 6	EC-3 Type B
C AR-500.023	0.19	0.4	12	< 6	EC-3 Type B
C AR-500.024	0.14	0.3	12	< 6	EC-3 Type B
C AR-500.025	0.56	1.6	12	< 6	EC-3 Type B
C AR-500.026	0.26	0.8	12	< 6	EC-3 Type B
C AR-500.027	0.10	0.4	12	< 6	EC-3 Type B
C AR-500.028	0.39	1.1	12	< 6	EC-3 Type B
C AR-500.029	0.19	0.8	12	< 6	EC-3 Type B
C AR-500.030	0.29	0.6	12	< 6	EC-3 Type B
C AR-500.031	0.08	0.3	12	< 6	EC-3 Type B
C AR-500.032	0.23	0.5	12	< 6	EC-3 Type B
C AR-500.033	0.31	0.6	12	< 6	EC-3 Type B
C AR-500.034	0.37	0.7	12	< 6	EC-3 Type B
C AR-500.035	0.33	0.8	12	< 6	EC-3 Type B
C 158.001	0.59	1.9	12	< 6	EC-3 Type B
C 158.002	0.89	2.0	12	< 6	EC-3 Type B
C 158.003	1.43	3.6	12	< 6	EC-3 Type B
C 158.004	0.74	1.7	12	< 6	EC-3 Type B
C 158.005	126.09	128.2	multiple	< 8	EC-1 Class A1
C 158.006	0.62	1.9	12	< 6	EC-3 Type B
C 158.007	0.35	1.2	12	< 6	EC-3 Type B
C 158.008	0.80	2.6	12	< 6	EC-3 Type B
C 158.009	0.52	2.2	12	< 6	EC-3 Type B
C 158.010	1.17	3.1	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Table 7.025 - Culvert Sizing - 07-001.AR 3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 158.011	1.88	5.0	18	< 8	EC-1 Class A1
C 158.012	1.90	2.5	12	< 6	EC-3 Type B
C 158.013	1.46	2.1	12	< 6	EC-3 Type B
C 158.014	1.38	2.2	12	< 6	EC-3 Type B
C 158.015	1.03	3.0	12	< 6	EC-3 Type B
C 158.016	438.47	55.6	42	< 8	EC-1 Class A1
C 159.001	0.15	0.6	12	< 6	EC-3 Type B
C 159.008	2.26	4.1	18	< 8	EC-1 Class A1
C 159.009	0.70	1.3	12	< 6	EC-3 Type B
C 159.010	2.37	3.2	12	< 6	EC-3 Type B
C 159.011	3.15	5.2	18	< 8	EC-1 Class A1
C 159.012	1.18	2.1	12	< 6	EC-3 Type B
C 159.013	1.18	4.6	18	< 8	EC-1 Class A1
C 159.014	3.37	10.3	18	< 8	EC-1 Class A1
C 159.015	0.91	1.5	12	< 6	EC-3 Type B
C 159.016	0.62	1.5	12	< 6	EC-3 Type B
C 159.017	1.97	5.8	18	< 8	EC-1 Class A1
C 159.018	0.55	1.0	12	< 6	EC-3 Type B
C 159.019	2.77	3.2	12	< 6	EC-3 Type B
C 159.020	0.00	1.9	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.025 - Roadside Ditch Sizing - 07-001.AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-500.003	30.3	210.7	0.01	Type III	5.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-500.004	0.2	0.9	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-500.005	0.3	1.3	0.08	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-500.006	0.3	1.2	0.18	Type I	1.0	2.9	4.8	Riprap (D50 - 12 in)
C AR-500.007	0.3	1.3	0.09	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C AR-500.008	0.3	1.3	0.10	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-500.009	0.7	2.0	0.23	Type I	1.5	5.3	See Note 1	See Note 1
C AR-500.010	0.6	2.4	0.14	Type I	1.5	3.3	4.8	Riprap (D50 - 12 in)
C AR-500.011	0.4	2.0	0.12	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-500.012	0.3	1.7	0.19	Type I	1.5	3.4	4.8	Riprap (D50 - 12 in)
C AR-500.013	0.2	0.8	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-500.014	0.4	1.8	0.14	Type I	1.5	2.9	4.8	Riprap (D50 - 12 in)
C AR-500.015	0.2	0.8	0.03	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C AR-500.016	0.2	0.7	0.00	Type I	1.5	0.1	0.4	Grass Lined
C AR-500.017	0.1	0.2	0.00	Type I	1.0	0.0	0.4	Grass Lined
C AR-500.018	0.2	0.9	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-500.019	0.2	0.7	0.00	Type I	1.5	0.0	0.4	Grass Lined
C AR-500.020	0.4	1.0	0.14	Type I	1.0	2.6	2.4	Riprap (D50 - 6 in)
C AR-500.021	0.4	1.2	0.07	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C AR-500.022	0.3	0.9	0.02	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-500.023	0.1	0.4	0.02	Type I	1.0	0.3	0.4	Grass Lined
C AR-500.024	0.1	0.3	0.02	Type I	1.0	0.2	0.4	Grass Lined
C AR-500.025	0.5	1.6	0.21	Type I	1.5	4.0	4.8	Riprap (D50 - 12 in)
C AR-500.026	0.2	0.8	0.05	Type I	1.0	1.0	2.4	Riprap (D50 - 6 in)
C AR-500.027	0.1	0.4	0.01	Type I	1.0	0.1	0.4	Grass Lined
C AR-500.028	0.3	1.1	0.06	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C AR-500.029	0.3	0.8	0.19	Type I	1.0	3.0	4.8	Riprap (D50 - 12 in)
C AR-500.030	0.2	0.6	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-500.031	0.1	0.3	0.05	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-500.032	0.1	0.5	0.07	Type I	1.0	1.0	2.4	Riprap (D50 - 6 in)
C AR-500.033	0.2	0.6	0.08	Type I	1.0	1.2	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.025 - Roadside Ditch Sizing - 07-001.AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-500.034	0.2	0.7	0.08	Type I	1.0	1.2	2.4	Riprap (D50 - 6 in)
C AR-500.035	0.2	0.8	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 158.001	0.7	1.9	0.04	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C 158.002	0.5	2.0	0.02	Type I	1.5	0.4	0.4	Grass Lined
C 158.003	1.0	3.6	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 158.004	0.4	1.7	0.08	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C 158.005	18.2	128.2	0.01	Type III	4.5	0.5	2.4	Riprap (D50 - 6 in)
C 158.006	0.6	1.9	0.07	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C 158.007	0.4	1.2	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 158.008	1.0	2.6	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 158.009	0.9	2.2	0.01	Type I	1.5	0.4	0.4	Grass Lined
C 158.010	0.9	3.1	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 158.011	1.4	5.0	0.02	Type I	2.0	0.8	2.4	Riprap (D50 - 6 in)
C 158.012	0.5	2.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 158.013	0.4	2.1	0.07	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C 158.014	0.5	2.2	0.08	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C 158.015	1.0	3.0	0.06	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C 158.016	1.8	55.6	0.01	Type III	2.5	0.1	0.4	Grass Lined
C 159.001	0.2	0.6	0.01	Type I	1.0	0.2	0.4	Grass Lined
C 159.008	0.7	4.1	0.11	Type I	1.5	2.8	4.8	Riprap (D50 - 12 in)
C 159.009	0.2	1.3	0.02	Type I	1.5	0.3	0.4	Grass Lined
C 159.010	0.5	3.2	0.01	Type I	1.5	0.1	0.4	Grass Lined
C 159.011	0.8	5.2	0.17	Type I	1.5	4.3	4.8	See Note 3
C 159.012	0.4	2.1	0.04	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C 159.013	1.9	4.6	0.09	Type I	1.5	3.4	4.8	Riprap (D50 - 12 in)
C 159.014	3.4	10.3	0.04	Type I	2.0	2.1	2.4	Riprap (D50 - 6 in)
C 159.015	0.2	1.5	0.02	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C 159.016	0.6	1.5	0.11	Type I	1.5	2.6	2.4	Riprap (D50 - 6 in)
C 159.017	2.0	5.8	0.11	Type I	1.5	4.2	4.8	Riprap (D50 - 12 in)
C 159.018	0.2	1.0	0.03	Type I	1.0	0.4	0.4	Grass Lined
C 159.019	0.6	3.2	0.01	Type I	1.5	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.025

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.025 - Roadside Ditch Sizing - 07-001.AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 159.020	0.4	1.9	0.08	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 6
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.026

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR1-AR 6	C 159.002	4A	159	Augusta	Jennings Branch	313	49
07-001.AR1-AR 6	C 159.003	4A	159	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR1-AR 6	C 159.004	4A	159	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR1-AR 6	C 159.005	4A	159	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR1-AR 6	C 159.006	4A	159	Augusta	Chair Draft-Calfpasture River	304	49
07-001.AR1-AR 6	C 159.007	4A	159	Augusta	Chair Draft-Calfpasture River	304	49

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 6
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.026

Table 5.026 - Water Quantity - 07-001.AR1-AR 6

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 159.002	0.65	3.0	3.5	5.5	7	57	0.1	0.3	1.4	7	58	0.2	0.4	1.5	0.0	0.1	0.1
C 159.003	1.70	3.0	3.5	5.5	9	55	0.2	0.5	3.0	9	55	0.2	0.5	3.0	0.0	0.0	0.0
C 159.004	4.25	3.0	3.5	5.5	10	53	0.2	0.8	6.3	10	53	0.2	0.8	6.3	0.0	0.0	0.0
C 159.005	2.85	3.0	3.5	5.5	11	55	0.3	0.8	4.8	11	55	0.3	0.8	4.8	0.0	0.0	0.0
C 159.006	1.75	3.0	3.5	5.5	11	55	0.2	0.5	2.8	11	54	0.1	0.4	2.6	-0.1	-0.1	-0.2
C 159.007	2.67	3.0	3.5	5.5	15	54	0.1	0.5	3.4	15	51	0.0	0.2	2.6	-0.1	-0.3	-0.8

Water Quantity for Culverts and Ditches

Access Road: 07-001.AR1-AR 6
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.026

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.026 - Energy Balance - 07-001.AR1-AR 6

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 159.002	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 159.003	0.2	0.02	0.2	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 159.004	0.2	0.04	0.2	0.04	0.2	0.04	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 159.005	0.3	0.04	0.3	0.04	0.3	0.04	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.0
C 159.006	0.2	0.02	0.1	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C 159.007	0.1	0.03	0.0	0.02	0.1	0.03	0.2	met	n/a	not exceeded	n/a	0.2	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001.AR1-AR 6
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.026

Table 7.026 - Culvert Sizing - 07-001.AR1-AR 6					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 159.002	0.65	1.5	12	< 6	EC-3 Type B
C 159.003	1.70	3.0	12	< 6	EC-3 Type B
C 159.004	4.25	6.3	18	< 8	EC-1 Class A1
C 159.005	2.85	4.8	18	< 8	EC-1 Class A1
C 159.006	1.75	2.6	12	< 6	EC-3 Type B
C 159.007	2.67	2.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 6
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.026

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.026 - Roadside Ditch Sizing - 07-001.AR1-AR 6

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 159.002	0.4	1.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 159.003	0.5	3.0	0.10	Type I	1.5	2.4	4.8	Riprap (D50 - 12 in)
C 159.004	0.8	6.3	0.10	Type I	1.5	2.8	4.8	Riprap (D50 - 12 in)
C 159.005	0.8	4.8	0.02	Type I	2.0	0.6	2.4	Riprap (D50 - 6 in)
C 159.006	0.4	2.6	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 159.007	0.2	2.6	0.00	Type I	1.5	0.1	0.4	Grass Lined

Tables 4.027 to 8.027

Temporary Access Road, Spread 4A

Table 4.027 Culvert List

Table 5.027 Water Quantity

Table 7.027 Culvert Sizing

Table 8.027 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 8
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.027

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR1-AR 8	C AR-501.014	4A	AR-501	Augusta	Jennings Branch	313	T-1
07-001.AR1-AR 8	C AR-501.015	4A	AR-501	Augusta	Jennings Branch	313	T-1
07-001.AR1-AR 8	C 161.001	4A	161	Augusta	Jennings Branch	313	T-1
07-001.AR1-AR 8	C 161.002	4A	161	Augusta	Jennings Branch	313	T-1
07-001.AR1-AR 8	C 161.003	4A	161	Augusta	Jennings Branch	313	T-1

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 8
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.027

Table 5.027 - Water Quantity - 07-001.AR1-AR 8									
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Construction Conditions				
					Tc (min)	Weighted CN	Q (cfs)		
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr
C AR-501.014	11.87	3.0	3.5	5.5	11	58	2.4	5.5	23.8
C AR-501.015	670.00	3.0	3.5	5.5	48	34	0.0	0.0	8.8
C 161.001	0.55	3.0	3.5	5.5	8	58	0.1	0.3	1.2
C 161.002	1.21	3.0	3.5	5.5	9	57	0.2	0.5	2.4
C 161.003	1.52	3.0	3.5	5.5	8	57	0.3	0.7	3.2

Water Quantity for Culverts and Ditches

Access Road: 07-001.AR1-AR 8
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.027

Table 7.027 - Culvert Sizing - 07-001.AR1-AR 8

Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-501.014	11.87	23.8	30	< 8	EC-1 Class A1
C AR-501.015	670.00	8.8	18	< 8	EC-1 Class A1
C 161.001	0.55	1.2	12	< 6	EC-3 Type B
C 161.002	1.21	2.4	12	< 6	EC-3 Type B
C 161.003	1.52	3.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 8
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.027

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Table 8.027 - Roadside Ditch Sizing - 07-001.AR1-AR 8

Relief Culvert ID	$Q_{2\text{-yr Dev.}}$ (cfs)	$Q_{10\text{-yr Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-501.014	5.5	23.8	0.01	Type III	2.0	0.2	0.4	Grass Lined
C AR-501.015	0.0	8.8	0.01	Type I	2.0	See Note 1	0.4	Grass Lined
C 161.001	0.3	1.2	0.09	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C 161.002	0.5	2.4	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 161.003	0.7	3.2	0.04	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)

Tables 4.028-032 to 8.028-032

Permanent Access Roads, Spread 4A

Tables 4.028-032 Culvert List

Tables 5.028-032 Water Quantity

Tables 6.028-032 Energy Balance

Tables 7.028-032 Culvert Sizing

Tables 8.028-032 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches

Access Road: 07-001.AR1-AR 9
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.028

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR1-AR 9	C AR-501.001	4A	AR-501	Augusta	Jennings Branch	313	51
07-001.AR1-AR 9	C AR-501.002	4A	AR-501	Augusta	Jennings Branch	313	51
07-001.AR1-AR 9	C AR-501.003	4A	AR-501	Augusta	Jennings Branch	313	51
07-001.AR1-AR 9	C AR-501.004	4A	AR-501	Augusta	Jennings Branch	313	51
07-001.AR1-AR 9	C AR-501.005	4A	AR-501	Augusta	Jennings Branch	313	51
07-001.AR1-AR 9	C AR-501.006	4A	AR-501	Augusta	Jennings Branch	313	50, 51
07-001.AR1-AR 9	C AR-501.007	4A	AR-501	Augusta	Jennings Branch	313	50, 51
07-001.AR1-AR 9	C AR-501.008	4A	AR-501	Augusta	Jennings Branch	313	50, 51
07-001.AR1-AR 9	C AR-501.009	4A	AR-501	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C AR-501.010	4A	AR-501	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C AR-501.011	4A	AR-501	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C AR-501.012	4A	AR-501	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C AR-501.013	4A	AR-501	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C 161.004	4A	161	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C 161.005	4A	161	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C 161.006	4A	161	Augusta	Jennings Branch	313	50
07-001.AR1-AR 9	C 161.007	4A	161	Augusta	Jennings Branch	313	50

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 9
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.028

Table 5.028 - Water Quantity - 07-001.AR1-AR 9																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-501.001	2200.87	3.0	3.5	5.5	62	39	0.0	2.3	120.0	62	39	0.0	2.3	120.0	0.0	0.0	0.0
C AR-501.002	2198.61	3.0	3.5	5.5	13	39	0.0	2.6	217.1	13	39	0.0	2.6	217.1	0.0	0.0	0.0
C AR-501.003	2194.57	3.0	3.5	5.5	13	39	0.0	2.6	216.0	13	39	0.0	2.6	216.0	0.0	0.0	0.0
C AR-501.004	2193.49	3.0	3.5	5.5	13	39	0.0	2.6	216.6	13	39	0.0	2.6	216.6	0.0	0.0	0.0
C AR-501.005	2191.20	3.0	3.5	5.5	12	39	0.0	2.6	217.6	12	39	0.0	2.6	217.6	0.0	0.0	0.0
C AR-501.006	0.72	3.0	3.5	5.5	19	66	0.3	0.6	1.6	19	66	0.3	0.6	1.6	0.0	0.0	0.0
C AR-501.007	3.08	3.0	3.5	5.5	30	60	0.5	1.0	3.8	30	60	0.5	1.0	3.8	0.0	0.0	0.0
C AR-501.008	0.70	3.0	3.5	5.5	10	62	0.3	0.5	1.8	10	62	0.3	0.5	1.8	0.0	0.0	0.0
C AR-501.009	0.56	3.0	3.5	5.5	10	57	0.1	0.2	1.1	10	58	0.1	0.3	1.2	0.0	0.0	0.1
C AR-501.010	0.56	3.0	3.5	5.5	10	59	0.2	0.3	1.2	10	59	0.2	0.3	1.2	0.0	0.0	0.0
C AR-501.011	9.94	3.0	3.5	5.5	29	55	0.5	1.5	9.1	29	56	0.7	1.8	9.8	0.2	0.3	0.7
C AR-501.012	0.66	3.0	3.5	5.5	11	62	0.3	0.5	1.7	11	62	0.3	0.5	1.7	0.0	0.0	0.0
C AR-501.013	1.04	3.0	3.5	5.5	10	58	0.2	0.5	2.2	10	59	0.3	0.6	2.3	0.1	0.1	0.1
C 161.004	1.19	3.0	3.5	5.5	9	58	0.3	0.6	2.5	9	58	0.3	0.6	2.5	0.0	0.0	0.0
C 161.005	2.34	3.0	3.5	5.5	12	56	0.3	0.8	4.0	12	56	0.3	0.8	4.0	0.0	0.0	0.0
C 161.006	3.58	3.0	3.5	5.5	16	56	0.4	1.0	5.3	16	55	0.3	0.8	4.9	-0.1	-0.2	-0.4
C 161.007	0.29	3.0	3.5	5.5	8	58	0.1	0.2	0.7	8	54	0.0	0.1	0.5	-0.1	-0.1	-0.2

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 9
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.028

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.028 - Energy Balance - 07-001.AR1-AR 9

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-501.001	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-501.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-501.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-501.004	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-501.005	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-501.006	0.3	0.03	0.3	0.03	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-501.007	0.5	0.07	0.5	0.07	0.4	0.06	0.5	met	n/a	not exceeded	n/a	0.4	exceeded	0.1
C AR-501.008	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-501.009	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C AR-501.010	0.2	0.01	0.2	0.01	0.1	0.01	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C AR-501.011	0.5	0.13	0.7	0.15	0.5	0.13	0.5	not met	0.2	exceeded	0.2	0.5	exceeded	0.2
C AR-501.012	0.3	0.02	0.3	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-501.013	0.2	0.02	0.3	0.02	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.2	exceeded	0.1
C 161.004	0.3	0.02	0.3	0.02	0.2	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C 161.005	0.3	0.04	0.3	0.04	0.3	0.04	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.0
C 161.006	0.4	0.05	0.3	0.05	0.4	0.05	0.4	met	n/a	not exceeded	n/a	0.4	not exceeded	n/a
C 161.007	0.1	0.01	0.0	0.00	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 07-001.AR1-AR 9
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.028

Table 7.028 - Culvert Sizing - 07-001.AR1-AR 9					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-501.001	2200.87	120.0	multiple	< 8	EC-1 Class A1
C AR-501.002	2198.61	217.1	multiple	< 8	EC-1 Class A1
C AR-501.003	2194.57	216.0	multiple	< 8	EC-1 Class A1
C AR-501.004	2193.49	216.6	multiple	< 8	EC-1 Class A1
C AR-501.005	2191.20	217.6	multiple	< 8	EC-1 Class A1
C AR-501.006	0.72	1.6	12	< 6	EC-3 Type B
C AR-501.007	3.08	3.8	12	< 6	EC-3 Type B
C AR-501.008	0.70	1.8	12	< 6	EC-3 Type B
C AR-501.009	0.56	1.2	12	< 6	EC-3 Type B
C AR-501.010	0.56	1.2	12	< 6	EC-3 Type B
C AR-501.011	9.94	9.8	18	< 8	EC-1 Class A1
C AR-501.012	0.66	1.7	12	< 6	EC-3 Type B
C AR-501.013	1.04	2.3	12	< 6	EC-3 Type B
C 161.004	1.19	2.5	12	< 6	EC-3 Type B
C 161.005	2.34	4.0	12	< 6	EC-3 Type B
C 161.006	3.58	4.9	18	< 8	EC-1 Class A1
C 161.007	0.29	0.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 9
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.028

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.028 - Roadside Ditch Sizing - 07-001.AR1-AR 9

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-501.001	2.3	120.0	0.09	Type III	3.0	1.5	4.8	See Note 3
C AR-501.002	2.6	217.1	0.01	Type III	5.5	0.2	2.4	Riprap (D50 - 6 in)
C AR-501.003	2.6	216.0	0.01	Type III	5.5	0.2	2.4	Riprap (D50 - 6 in)
C AR-501.004	2.6	216.6	0.01	Type III	5.5	0.2	2.4	Riprap (D50 - 6 in)
C AR-501.005	2.6	217.6	0.05	Type III	4.0	1.1	4.8	See Note 3
C AR-501.006	0.6	1.6	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-501.007	1.0	3.8	0.02	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-501.008	0.5	1.8	0.06	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-501.009	0.3	1.2	0.07	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-501.010	0.3	1.2	0.02	Type I	1.5	0.3	0.4	Grass Lined
C AR-501.011	1.8	9.8	0.01	Type II	2.0	0.1	0.4	Grass Lined
C AR-501.012	0.5	1.7	0.08	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C AR-501.013	0.6	2.3	0.02	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C 161.004	0.6	2.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 161.005	0.8	4.0	0.01	Type I	2.0	0.2	0.4	Grass Lined
C 161.006	0.8	4.9	0.01	Type I	2.0	0.2	0.4	Grass Lined
C 161.007	0.1	0.5	0.02	Type I	1.0	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 7
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.029

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001.AR1-AR 7	C 162.012	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.013	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.014	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.015	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.016	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.017	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.018	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.019	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.020	4A	162	Augusta	Jennings Branch	313	52
07-001.AR1-AR 7	C 162.021	4A	162	Augusta	Jennings Branch	313	52

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 7
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.029

Table 5.029 - Water Quantity - 07-001.AR1-AR 7

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 162.012	0.64	3.0	3.5	5.5	7	62	0.3	0.6	1.9	7	65	0.5	0.8	2.2	0.1	0.2	0.3
C 162.013	0.55	3.0	3.5	5.5	13	65	0.3	0.5	1.5	13	67	0.4	0.6	1.6	0.1	0.1	0.1
C 162.014	0.88	3.0	3.5	5.5	10	66	0.6	1.0	2.8	9	68	0.8	1.2	3.1	0.2	0.2	0.4
C 162.015	0.73	3.0	3.5	5.5	5	67	0.7	1.1	2.8	5	69	0.8	1.2	3.1	0.1	0.2	0.3
C 162.016	0.62	3.0	3.5	5.5	13	68	0.5	0.7	1.9	13	69	0.5	0.8	2.0	0.1	0.1	0.1
C 162.017	0.36	3.0	3.5	5.5	12	68	0.3	0.4	1.2	9	71	0.4	0.6	1.4	0.1	0.1	0.3
C 162.018	0.12	3.0	3.5	5.5	28	66	0.1	0.1	0.2	28	74	0.1	0.1	0.3	0.0	0.1	0.1
C 162.019	0.56	3.0	3.5	5.5	9	63	0.3	0.5	1.6	9	65	0.4	0.6	1.7	0.1	0.1	0.2
C 162.020	0.88	3.0	3.5	5.5	29	59	0.1	0.3	1.1	29	57	0.1	0.2	0.9	0.0	-0.1	-0.1
C 162.021	1.52	3.0	3.5	5.5	29	59	0.2	0.4	1.8	29	58	0.2	0.4	1.7	0.0	-0.1	-0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 7
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.029

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.029 - Energy Balance - 07-001.AR1-AR 7

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 162.012	0.3	0.02	0.5	0.02	0.2	0.01	0.3	not met	0.2	exceeded	0.1	0.1	exceeded	0.4
C 162.013	0.3	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.1	exceeded	0.1	0.2	exceeded	0.2
C 162.014	0.6	0.04	0.8	0.04	0.6	0.03	0.5	not met	0.2	exceeded	0.2	0.5	exceeded	0.3
C 162.015	0.7	0.03	0.8	0.04	0.6	0.03	0.6	not met	0.2	exceeded	0.1	0.4	exceeded	0.4
C 162.016	0.5	0.03	0.5	0.03	0.4	0.02	0.4	not met	0.1	exceeded	0.1	0.3	exceeded	0.2
C 162.017	0.3	0.02	0.4	0.02	0.2	0.01	0.2	not met	0.2	exceeded	0.1	0.1	exceeded	0.3
C 162.018	0.1	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 162.019	0.3	0.02	0.4	0.02	0.2	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 162.020	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C 162.021	0.2	0.03	0.2	0.03	0.1	0.03	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 7
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.029

Table 7.029 - Culvert Sizing - 07-001.AR1-AR 7					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 162.012	0.64	2.2	12	< 6	EC-3 Type B
C 162.013	0.55	1.6	12	< 6	EC-3 Type B
C 162.014	0.88	3.1	12	< 6	EC-3 Type B
C 162.015	0.73	3.1	12	< 6	EC-3 Type B
C 162.016	0.62	2.0	12	< 6	EC-3 Type B
C 162.017	0.36	1.4	12	< 6	EC-3 Type B
C 162.018	0.12	0.3	12	< 6	EC-3 Type B
C 162.019	0.56	1.7	12	< 6	EC-3 Type B
C 162.020	0.88	0.9	12	< 6	EC-3 Type B
C 162.021	1.52	1.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001.AR1-AR 7
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.029

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.029 - Roadside Ditch Sizing - 07-001.AR1-AR 7

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 162.012	0.8	2.2	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 162.013	0.6	1.6	0.11	Type I	1.5	2.5	2.4	Riprap (D50 - 6 in)
C 162.014	1.2	3.1	0.09	Type I	1.5	2.7	2.4	Riprap (D50 - 6 in)
C 162.015	1.2	3.1	0.06	Type I	1.5	2.0	2.4	Riprap (D50 - 6 in)
C 162.016	0.8	2.0	0.11	Type I	1.5	2.7	2.4	Riprap (D50 - 6 in)
C 162.017	0.6	1.4	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 162.018	0.1	0.3	0.07	Type I	1.0	1.0	2.4	Riprap (D50 - 6 in)
C 162.019	0.6	1.7	0.15	Type I	1.5	3.5	4.8	Riprap (D50 - 12 in)
C 162.020	0.2	0.9	0.09	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C 162.021	0.4	1.7	0.08	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-A011.AR-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.030

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A011.AR-AR 1	C 162.001	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.002	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.003	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.004	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.005	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.006	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.007	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.008	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.009	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.010	4A	162	Augusta	Jennings Branch	313	52
07-001-A011.AR-AR 1	C 162.011	4A	162	Augusta	Jennings Branch	313	52

Water Quantity for Culverts and Ditches
Access Road: 07-001-A011.AR-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.030

Table 5.030 - Water Quantity - 07-001-A011.AR-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 162.001	0.38	3.0	3.5	5.5	14	57	0.1	0.1	0.6	14	58	0.1	0.2	0.7	0.0	0.0	0.1
C 162.002	0.20	3.0	3.5	5.5	14	57	0.0	0.1	0.4	14	58	0.0	0.1	0.4	0.0	0.0	0.0
C 162.003	0.53	3.0	3.5	5.5	14	57	0.1	0.2	0.9	14	59	0.1	0.2	1.0	0.0	0.1	0.1
C 162.004	0.92	3.0	3.5	5.5	10	56	0.1	0.3	1.7	10	56	0.1	0.3	1.7	0.0	0.0	0.0
C 162.005	1.01	3.0	3.5	5.5	11	58	0.2	0.5	2.0	11	59	0.3	0.5	2.1	0.1	0.1	0.1
C 162.006	0.58	3.0	3.5	5.5	11	57	0.1	0.2	1.1	11	59	0.2	0.3	1.3	0.1	0.1	0.1
C 162.007	0.30	3.0	3.5	5.5	9	64	0.2	0.3	0.9	9	65	0.2	0.3	1.0	0.0	0.0	0.0
C 162.008	0.38	3.0	3.5	5.5	15	58	0.1	0.2	0.7	15	60	0.1	0.2	0.7	0.0	0.0	0.1
C 162.009	0.15	3.0	3.5	5.5	19	57	0.0	0.0	0.2	19	59	0.0	0.1	0.2	0.0	0.0	0.0
C 162.010	0.67	3.0	3.5	5.5	14	57	0.1	0.2	1.1	14	58	0.1	0.3	1.2	0.0	0.0	0.1
C 162.011	0.64	3.0	3.5	5.5	18	56	0.1	0.2	0.9	18	56	0.1	0.2	0.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 07-001-A011.AR-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.030

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.030 - Energy Balance - 07-001-A011.AR-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 162.001	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 162.002	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 162.003	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 162.004	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 162.005	0.2	0.02	0.3	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 162.006	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 162.007	0.2	0.01	0.2	0.01	0.1	0.01	0.2	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C 162.008	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 162.009	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 162.010	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 162.011	0.1	0.01	0.1	0.01	0.0	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 07-001-A011.AR-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.030

Table 7.030 - Culvert Sizing - 07-001-A011.AR-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 162.001	0.38	0.7	12	< 6	EC-3 Type B
C 162.002	0.20	0.4	12	< 6	EC-3 Type B
C 162.003	0.53	1.0	12	< 6	EC-3 Type B
C 162.004	0.92	1.7	12	< 6	EC-3 Type B
C 162.005	1.01	2.1	12	< 6	EC-3 Type B
C 162.006	0.58	1.3	12	< 6	EC-3 Type B
C 162.007	0.30	1.0	12	< 6	EC-3 Type B
C 162.008	0.38	0.7	12	< 6	EC-3 Type B
C 162.009	0.15	0.2	12	< 6	EC-3 Type B
C 162.010	0.67	1.2	12	< 6	EC-3 Type B
C 162.011	0.64	0.9	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-A011.AR-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.030

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.030 - Roadside Ditch Sizing - 07-001-A011.AR-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 162.001	0.2	0.7	0.07	Type I	1.0	1.0	2.4	Riprap (D50 - 6 in)
C 162.002	0.1	0.4	0.03	Type I	1.0	0.3	0.4	Grass Lined
C 162.003	0.2	1.0	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 162.004	0.3	1.7	0.11	Type I	1.5	2.1	2.4	Riprap (D50 - 6 in)
C 162.005	0.5	2.1	0.14	Type I	1.5	3.0	4.8	Riprap (D50 - 12 in)
C 162.006	0.3	1.3	0.06	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C 162.007	0.3	1.0	0.07	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C 162.008	0.2	0.7	0.12	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C 162.009	0.1	0.2	0.01	Type I	1.0	0.1	0.4	Grass Lined
C 162.010	0.3	1.2	0.10	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C 162.011	0.2	0.9	0.07	Type I	1.0	1.1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 07-001-A029.AR-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.031

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A029.AR-AR 1	C 166.001	4A	166	Augusta	Moffett Creek	308	53
07-001-A029.AR-AR 1	C 166.002	4A	166	Augusta	Moffett Creek	308	53
07-001-A029.AR-AR 1	C 166.003	4A	166	Augusta	Moffett Creek	308	53

Water Quantity for Culverts and Ditches
Access Road: 07-001-A029.AR-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.031

Table 5.031 - Water Quantity - 07-001-A029.AR-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 166.001	1.76	3.0	3.5	5.5	12	61	0.6	1.1	4.1	12	62	0.7	1.2	4.2	0.1	0.1	0.1
C 166.002	0.94	3.0	3.5	5.5	19	62	0.3	0.5	1.8	19	63	0.3	0.6	1.9	0.1	0.1	0.1
C 166.003	0.72	3.0	3.5	5.5	40	61	0.1	0.2	0.8	41	63	0.1	0.3	0.9	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-A029.AR-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.031

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.031 - Energy Balance - 07-001-A029.AR-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 166.001	0.6	0.05	0.7	0.05	0.6	0.05	0.5	not met	0.1	exceeded	0.1	0.5	exceeded	0.1
C 166.002	0.3	0.03	0.3	0.03	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.2	exceeded	0.2
C 166.003	0.1	0.02	0.1	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 07-001-A029.AR-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.031

Table 7.031 - Culvert Sizing - 07-001-A029.AR-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 166.001	1.76	4.2	18	< 8	EC-1 Class A1
C 166.002	0.94	1.9	12	< 6	EC-3 Type B
C 166.003	0.72	0.9	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-A029.AR-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.031

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.031 - Roadside Ditch Sizing - 07-001-A029.AR-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 166.001	1.2	4.2	0.07	Type I	1.5	2.4	2.4	Riprap (D50 - 6 in)
C 166.002	0.6	1.9	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 166.003	0.3	0.9	0.00	Type I	1.5	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 07-001-A030-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.032

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A030-AR 2	C 166.004	4A	166	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 166.005	4A	166	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 166.006	4A	166	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 166.007	4A	166	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.001	5	167	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.002	5	167	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.003	5	167	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.004	5	167	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.005	5	167	Augusta	Moffett Creek	308	53
07-001-A030-AR 2	C 167.006	5	167	Augusta	Moffett Creek	308	53

Water Quantity for Culverts and Ditches
Access Road: 07-001-A030-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.032

Table 5.032 - Water Quantity - 07-001-A030-AR 2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 166.004	0.49	3.0	3.5	5.5	6	63	0.3	0.5	1.6	6	66	0.4	0.6	1.8	0.1	0.1	0.2
C 166.005	0.56	3.0	3.5	5.5	28	60	0.1	0.2	0.7	29	62	0.1	0.2	0.8	0.0	0.0	0.1
C 166.006	0.67	3.0	3.5	5.5	28	61	0.1	0.3	0.9	28	62	0.2	0.3	1.0	0.0	0.0	0.0
C 166.007	1.80	3.0	3.5	5.5	8	61	0.7	1.4	4.8	9	62	0.8	1.5	5.0	0.1	0.1	0.2
C 167.001	1.03	3.0	3.5	5.5	15	61	0.3	0.6	2.1	15	62	0.4	0.7	2.2	0.1	0.1	0.1
C 167.002	1.28	3.0	3.5	5.5	15	61	0.4	0.7	2.7	15	62	0.4	0.8	2.8	0.1	0.1	0.1
C 167.003	1.18	3.0	3.5	5.5	14	61	0.4	0.7	2.5	15	62	0.4	0.8	2.6	0.1	0.1	0.1
C 167.004	1.04	3.0	3.5	5.5	14	61	0.3	0.6	2.2	15	63	0.4	0.7	2.4	0.1	0.1	0.2
C 167.005	0.51	3.0	3.5	5.5	15	61	0.2	0.3	1.0	15	63	0.2	0.4	1.2	0.1	0.1	0.1
C 167.006	0.77	3.0	3.5	5.5	19	61	0.2	0.4	1.4	20	63	0.3	0.4	1.5	0.1	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 07-001-A030-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.032

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.032 - Energy Balance - 07-001-A030-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 166.004	0.3	0.02	0.4	0.02	0.2	0.01	0.2	not met	0.2	exceeded	0.1	0.2	exceeded	0.3
C 166.005	0.1	0.01	0.1	0.02	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 166.006	0.1	0.02	0.2	0.02	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 166.007	0.7	0.05	0.8	0.05	0.7	0.05	0.7	not met	0.2	exceeded	0.1	0.7	exceeded	0.2
C 167.001	0.3	0.03	0.4	0.03	0.3	0.02	0.3	not met	0.1	exceeded	0.1	0.2	exceeded	0.1
C 167.002	0.4	0.03	0.4	0.04	0.4	0.03	0.4	not met	0.1	exceeded	0.1	0.4	exceeded	0.1
C 167.003	0.4	0.03	0.4	0.03	0.3	0.03	0.3	not met	0.1	exceeded	0.1	0.3	exceeded	0.2
C 167.004	0.3	0.03	0.4	0.03	0.3	0.02	0.3	not met	0.2	exceeded	0.1	0.2	exceeded	0.2
C 167.005	0.2	0.01	0.2	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 167.006	0.2	0.02	0.3	0.02	0.1	0.02	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 07-001-A030-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.032

Table 7.032 - Culvert Sizing - 07-001-A030-AR 2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 166.004	0.49	1.8	12	< 6	EC-3 Type B
C 166.005	0.56	0.8	12	< 6	EC-3 Type B
C 166.006	0.67	1.0	12	< 6	EC-3 Type B
C 166.007	1.80	5.0	18	< 8	EC-1 Class A1
C 167.001	1.03	2.2	12	< 6	EC-3 Type B
C 167.002	1.28	2.8	12	< 6	EC-3 Type B
C 167.003	1.18	2.6	12	< 6	EC-3 Type B
C 167.004	1.04	2.4	12	< 6	EC-3 Type B
C 167.005	0.51	1.2	12	< 6	EC-3 Type B
C 167.006	0.77	1.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 07-001-A030-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.032

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.032 - Roadside Ditch Sizing - 07-001-A030-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 166.004	0.6	1.8	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 166.005	0.2	0.8	0.10	Type I	1.0	1.6	2.4	Riprap (D50 - 6 in)
C 166.006	0.3	1.0	0.12	Type I	1.0	2.1	2.4	Riprap (D50 - 6 in)
C 166.007	1.5	5.0	0.06	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)
C 167.001	0.7	2.2	0.17	Type I	1.5	3.9	4.8	Riprap (D50 - 12 in)
C 167.002	0.8	2.8	0.03	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 167.003	0.8	2.6	0.09	Type I	1.5	2.4	2.4	Riprap (D50 - 6 in)
C 167.004	0.7	2.4	0.08	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)
C 167.005	0.4	1.2	0.07	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C 167.006	0.4	1.5	0.00	Type I	1.5	0.1	0.4	Grass Lined

Tables 4.033-043 to 8.033-043

Permanent Access Roads, Spread 5

Tables 4.033-043 Culvert List

Tables 5.033-043 Water Quantity

Tables 6.33-043 Energy Balance

Tables 7 033-043 Culvert Sizing

Tables 8.033-043 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 07-001-A138.AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.033

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
07-001-A138.AR 1	C AR-502.001	5	AR-502	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C AR-502.002	5	AR-502	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C AR-502.003	5	AR-502	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C AR-502.004	5	AR-502	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C AR-502.005	5	AR-502	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C 180.001	5	180	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C 180.002	5	180	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C 180.003	5	180	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C 180.004	5	180	Augusta	Folly Mills Creek-Christians Creek	331	54
07-001-A138.AR 1	C 180.005	5	180	Augusta	Folly Mills Creek-Christians Creek	331	54

Water Quantity for Culverts and Ditches
Access Road: 07-001-A138.AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.033

Table 5.033 - Water Quantity - 07-001-A138.AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-502.001	2.03	3.0	3.5	5.5	10	61	0.8	1.4	5.0	11	62	0.9	1.5	5.1	0.1	0.1	0.1
C AR-502.002	5.39	3.0	3.5	5.5	12	58	1.1	2.4	10.6	12	59	1.3	2.7	11.1	0.2	0.3	0.5
C AR-502.003	0.56	3.0	3.5	5.5	13	56	0.1	0.2	0.9	13	59	0.1	0.3	1.1	0.1	0.1	0.2
C AR-502.004	9.04	3.0	3.5	5.5	13	59	2.0	4.3	17.8	14	59	1.9	4.1	17.0	-0.1	-0.2	-0.8
C AR-502.005	7.90	3.0	3.5	5.5	12	58	1.5	3.4	15.1	13	59	1.8	3.7	15.4	0.3	0.3	0.3
C 180.001	2.31	3.0	3.5	5.5	12	59	0.5	1.2	4.8	12	60	0.6	1.3	5.0	0.1	0.1	0.2
C 180.002	3.92	3.0	3.5	5.5	12	58	0.8	1.7	7.6	12	59	0.9	1.9	7.9	0.2	0.2	0.3
C 180.003	2.04	3.0	3.5	5.5	13	62	0.8	1.4	4.7	14	63	0.8	1.5	4.7	0.1	0.1	0.1
C 180.004	4.67	3.0	3.5	5.5	13	65	2.6	4.2	12.6	14	65	2.4	4.0	12.0	-0.1	-0.2	-0.5
C 180.005	1.95	3.0	3.5	5.5	13	61	0.6	1.2	4.3	13	61	0.6	1.2	4.3	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 07-001-A138.AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.033

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.033 - Energy Balance - 07-001-A138.AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-502.001	0.8	0.05	0.9	0.06	0.8	0.05	0.7	not met	0.1	exceeded	0.1	0.7	exceeded	0.1
C AR-502.002	1.1	0.10	1.3	0.11	1.1	0.10	0.9	not met	0.3	exceeded	0.2	0.9	exceeded	0.3
C AR-502.003	0.1	0.01	0.1	0.01	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-502.004	2.0	0.19	1.9	0.19	2.0	0.19	2.0	met	n/a	not exceeded	n/a	2.0	not exceeded	n/a
C AR-502.005	1.5	0.15	1.8	0.17	1.5	0.15	1.3	not met	0.4	exceeded	0.3	1.3	exceeded	0.4
C 180.001	0.5	0.05	0.6	0.05	0.4	0.04	0.5	not met	0.2	exceeded	0.1	0.4	exceeded	0.3
C 180.002	0.8	0.07	0.9	0.08	0.8	0.07	0.7	not met	0.2	exceeded	0.2	0.7	exceeded	0.2
C 180.003	0.8	0.06	0.8	0.06	0.6	0.05	0.7	not met	0.1	exceeded	0.1	0.5	exceeded	0.3
C 180.004	2.6	0.17	2.4	0.17	2.6	0.17	2.6	met	n/a	not exceeded	n/a	2.6	not exceeded	n/a
C 180.005	0.6	0.05	0.6	0.05	0.6	0.05	0.6	met	n/a	not exceeded	n/a	0.6	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 07-001-A138.AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.033

Table 7.033 - Culvert Sizing - 07-001-A138.AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-502.001	2.03	5.1	18	< 8	EC-1 Class A1
C AR-502.002	5.39	11.1	18	< 8	EC-1 Class A1
C AR-502.003	0.56	1.1	12	< 6	EC-3 Type B
C AR-502.004	9.04	17.0	24	< 8	EC-1 Class A1
C AR-502.005	7.90	15.4	24	< 8	EC-1 Class A1
C 180.001	2.31	5.0	18	< 8	EC-1 Class A1
C 180.002	3.92	7.9	18	< 8	EC-1 Class A1
C 180.003	2.04	4.7	18	< 8	EC-1 Class A1
C 180.004	4.67	12.0	18	< 8	EC-1 Class A1
C 180.005	1.95	4.3	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 07-001-A138.AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.033

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.033 - Roadside Ditch Sizing - 07-001-A138.AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-502.001	1.5	5.1	0.06	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-502.002	2.7	11.1	0.05	Type I	2.0	2.6	4.8	Riprap (D50 - 12 in)
C AR-502.003	0.3	1.1	0.05	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-502.004	4.1	17.0	0.02	Type II	2.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-502.005	3.7	15.4	0.07	Type I	2.0	3.5	4.8	Riprap (D50 - 12 in)
C 180.001	1.3	5.0	0.10	Type I	1.5	3.4	4.8	Riprap (D50 - 12 in)
C 180.002	1.9	7.9	0.03	Type I	2.0	1.4	2.4	Riprap (D50 - 6 in)
C 180.003	1.5	4.7	0.03	Type I	2.0	1.3	2.4	Riprap (D50 - 6 in)
C 180.004	4.0	12.0	0.04	Type I	2.0	2.1	2.4	Riprap (D50 - 6 in)
C 180.005	1.2	4.3	0.08	Type I	1.5	2.6	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 08-001-B013-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.034

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-001-B013-AR 1	C AR-506.001	5	AR-506	Nelson	South Fork Rockfish River	355	55
08-001-B013-AR 1	C AR-506.002	5	AR-506	Nelson	South Fork Rockfish River	355	55
08-001-B013-AR 1	C AR-506.003	5	AR-506	Nelson	South Fork Rockfish River	355	55
08-001-B013-AR 1	C 202.001	5	202	Nelson	South Fork Rockfish River	355	55
08-001-B013-AR 1	C 202.002	5	202	Nelson	South Fork Rockfish River	355	55
08-001-B013-AR 1	C 202.003	5	202	Nelson	South Fork Rockfish River	355	55

Water Quantity for Culverts and Ditches
Access Road: 08-001-B013-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.034

Table 5.034 - Water Quantity - 08-001-B013-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-506.001	0.59	3.3	4.0	6.0	6	56	0.2	0.5	1.6	7	59	0.3	0.6	1.8	0.1	0.2	0.2
C AR-506.002	0.46	3.3	4.0	6.0	6	55	0.1	0.3	1.2	7	58	0.2	0.5	1.4	0.1	0.1	0.2
C AR-506.003	1.36	3.3	4.0	6.0	7	55	0.3	0.9	3.4	7	56	0.4	1.1	3.6	0.1	0.1	0.2
C 202.001	3.00	3.3	4.0	6.0	8	55	0.7	1.9	7.0	9	54	0.5	1.6	6.4	-0.2	-0.3	-0.6
C 202.002	2.41	3.3	4.0	6.0	7	55	0.6	1.6	5.8	8	53	0.3	1.1	5.1	-0.2	-0.5	-0.8
C 202.003	1.51	3.3	4.0	6.0	7	55	0.4	1.0	3.7	8	54	0.3	0.9	3.4	-0.1	-0.1	-0.3

Water Quantity for Culverts and Ditches
Access Road: 08-001-B013-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.034

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.034 - Energy Balance - 08-001-B013-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-506.001	0.2	0.01	0.3	0.02	0.2	0.01	0.1	not met	0.2	exceeded	0.1	0.1	exceeded	0.2
C AR-506.002	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C AR-506.003	0.3	0.03	0.4	0.03	0.3	0.03	0.3	not met	0.1	exceeded	0.1	0.3	exceeded	0.1
C 202.001	0.7	0.06	0.5	0.05	0.7	0.06	0.7	met	n/a	not exceeded	n/a	0.7	not exceeded	n/a
C 202.002	0.6	0.05	0.3	0.04	0.6	0.05	0.7	met	n/a	not exceeded	n/a	0.7	not exceeded	n/a
C 202.003	0.4	0.03	0.3	0.03	0.4	0.03	0.4	met	n/a	not exceeded	n/a	0.4	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-001-B013-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.034

Table 7.034 - Culvert Sizing - 08-001-B013-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-506.001	0.59	1.8	12	< 6	EC-3 Type B
C AR-506.002	0.46	1.4	12	< 6	EC-3 Type B
C AR-506.003	1.36	3.6	12	< 6	EC-3 Type B
C 202.001	3.00	6.4	18	< 8	EC-1 Class A1
C 202.002	2.41	5.1	18	< 8	EC-1 Class A1
C 202.003	1.51	3.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-001-B013-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.034

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.034 - Roadside Ditch Sizing - 08-001-B013-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-506.001	0.6	1.8	0.25	Type I	1.5	5.4	See Note 1	See Note 1
C AR-506.002	0.5	1.4	0.26	Type I	1.0	4.9	See Note 1	See Note 1
C AR-506.003	1.1	3.6	0.20	Type I	1.5	5.5	See Note 1	See Note 1
C 202.001	1.6	6.4	0.16	Type I	1.5	5.2	See Note 1	See Note 1
C 202.002	1.1	5.1	0.17	Type I	1.5	4.9	See Note 1	See Note 1
C 202.003	0.9	3.4	0.31	Type I	1.5	7.2	See Note 1	See Note 1

Water Quantity for Culverts and Ditches
Access Road: 08-001-B051-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.035

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-001-B051-AR 1	C AR-508.001	5	AR-508	Nelson	South Fork Rockfish River	355	56
08-001-B051-AR 1	C AR-508.002	5	AR-508	Nelson	South Fork Rockfish River	355	56
08-001-B051-AR 1	C AR-508.003	5	AR-508	Nelson	South Fork Rockfish River	355	56
08-001-B051-AR 1	C 206.001	5	206	Nelson	South Fork Rockfish River	355	56
08-001-B051-AR 1	C 206.002	5	206	Nelson	South Fork Rockfish River	355	56
08-001-B051-AR 1	C 206.003	5	206	Nelson	South Fork Rockfish River	355	56

Water Quantity for Culverts and Ditches
Access Road: 08-001-B051-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.035

Table 5.035 - Water Quantity - 08-001-B051-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-508.001	0.35	3.3	4.0	6.0	14	62	0.2	0.4	1.0	14	63	0.2	0.4	1.0	0.0	0.0	0.0
C AR-508.002	0.71	3.3	4.0	6.0	14	58	0.2	0.5	1.6	14	59	0.3	0.5	1.6	0.0	0.0	0.0
C AR-508.003	0.50	3.3	4.0	6.0	14	57	0.1	0.3	1.0	14	58	0.2	0.3	1.1	0.0	0.0	0.1
C 206.001	0.93	3.3	4.0	6.0	14	57	0.2	0.6	2.0	14	58	0.3	0.6	2.0	0.0	0.1	0.1
C 206.002	1.06	3.3	4.0	6.0	14	57	0.3	0.7	2.2	14	57	0.3	0.6	2.2	0.0	0.0	0.0
C 206.003	1.44	3.3	4.0	6.0	13	55	0.3	0.7	2.7	15	57	0.3	0.9	2.9	0.1	0.1	0.2

Water Quantity for Culverts and Ditches
Access Road: 08-001-B051-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.035

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.035 - Energy Balance - 08-001-B051-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-508.001	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.0
C AR-508.002	0.2	0.02	0.3	0.02	0.2	0.02	0.2	not met	0.1	exceeded	0.0	0.2	exceeded	0.1
C AR-508.003	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0
C 206.001	0.2	0.02	0.3	0.03	0.2	0.02	0.2	not met	0.1	exceeded	0.0	0.2	exceeded	0.1
C 206.002	0.3	0.03	0.3	0.03	0.3	0.03	0.3	met	n/a	not exceeded	n/a	0.3	not exceeded	n/a
C 206.003	0.3	0.03	0.3	0.03	0.3	0.03	0.2	not met	0.1	exceeded	0.1	0.2	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 08-001-B051-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.035

Table 7.035 - Culvert Sizing - 08-001-B051-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-508.001	0.35	1.0	12	< 6	EC-3 Type B
C AR-508.002	0.71	1.6	12	< 6	EC-3 Type B
C AR-508.003	0.50	1.1	12	< 6	EC-3 Type B
C 206.001	0.93	2.0	12	< 6	EC-3 Type B
C 206.002	1.06	2.2	12	< 6	EC-3 Type B
C 206.003	1.44	2.9	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-001-B051-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.035

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.035 - Roadside Ditch Sizing - 08-001-B051-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-508.001	0.4	1.0	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-508.002	0.5	1.6	0.02	Type I	1.5	0.4	0.4	Grass Lined
C AR-508.003	0.3	1.1	0.04	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 206.001	0.6	2.0	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 206.002	0.6	2.2	0.08	Type I	1.5	2.0	2.4	Riprap (D50 - 6 in)
C 206.003	0.9	2.9	0.00	Type I	1.5	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 08-113-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.036

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-113-AR 2	C AR-508.004	5	AR-508	Nelson	Buck Creek-Rockfish River	2	57
08-113-AR 2	C AR-508.005	5	AR-508	Nelson	Buck Creek-Rockfish River	2	57
08-113-AR 2	C AR-508.006	5	AR-508	Nelson	Buck Creek-Rockfish River	2	57
08-113-AR 2	C 209.001	5	209	Nelson	Buck Creek-Rockfish River	2	57
08-113-AR 2	C 209.002	5	209	Nelson	Buck Creek-Rockfish River	2	57
08-113-AR 2	C 209.003	5	209	Nelson	Buck Creek-Rockfish River	2	57

Water Quantity for Culverts and Ditches
Access Road: 08-113-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.036

Table 5.036 - Water Quantity - 08-113-AR 2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-508.004	0.55	3.3	4.0	6.0	7	64	0.5	0.9	2.1	8	68	0.7	1.1	2.4	0.2	0.2	0.3
C AR-508.005	0.41	3.3	4.0	6.0	7	57	0.2	0.4	1.1	7	61	0.3	0.5	1.4	0.1	0.2	0.2
C AR-508.006	0.55	3.3	4.0	6.0	7	57	0.2	0.5	1.5	7	61	0.4	0.7	1.8	0.2	0.2	0.3
C 209.001	0.38	3.3	4.0	6.0	7	57	0.1	0.3	1.1	7	58	0.2	0.4	1.1	0.0	0.0	0.1
C 209.002	0.09	3.3	4.0	6.0	7	55	0.0	0.1	0.2	5	66	0.1	0.2	0.4	0.1	0.1	0.2
C 209.003	0.24	3.3	4.0	6.0	11	55	0.0	0.1	0.5	11	56	0.1	0.1	0.5	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 08-113-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.036

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.036 - Energy Balance - 08-113-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-508.004	0.5	0.03	0.7	0.03	0.5	0.03	0.4	not met	0.3	exceeded	0.2	0.4	exceeded	0.3
C AR-508.005	0.2	0.01	0.3	0.01	0.2	0.01	0.1	not met	0.2	exceeded	0.1	0.1	exceeded	0.2
C AR-508.006	0.2	0.01	0.4	0.02	0.2	0.01	0.1	not met	0.2	exceeded	0.2	0.1	exceeded	0.2
C 209.001	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0
C 209.002	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 209.003	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 08-113-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.036

Table 7.036 - Culvert Sizing - 08-113-AR 2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-508.004	0.55	2.4	12	< 6	EC-3 Type B
C AR-508.005	0.41	1.4	12	< 6	EC-3 Type B
C AR-508.006	0.55	1.8	12	< 6	EC-3 Type B
C 209.001	0.38	1.1	12	< 6	EC-3 Type B
C 209.002	0.09	0.4	12	< 6	EC-3 Type B
C 209.003	0.24	0.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-113-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.036

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.036 - Roadside Ditch Sizing - 08-113-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-508.004	1.1	2.4	0.02	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-508.005	0.5	1.4	0.04	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-508.006	0.7	1.8	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 209.001	0.4	1.1	0.12	Type I	1.0	2.3	2.4	Riprap (D50 - 6 in)
C 209.002	0.2	0.4	0.21	Type I	1.0	2.7	2.4	Riprap (D50 - 6 in)
C 209.003	0.1	0.5	0.17	Type I	1.0	2.1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 08-014-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.037

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-014-AR 1	C AR-509.001	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.002	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.003	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.004	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.005	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.006	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.007	5	AR-509	Nelson	Buck Creek-Rockfish River	2	59
08-014-AR 1	C AR-509.008	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.009	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.010	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.011	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.012	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.013	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C AR-509.014	5	AR-509	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C 210.001	5	210	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C 210.002	5	210	Nelson	Buck Creek-Rockfish River	2	58
08-014-AR 1	C 210.003	5	210	Nelson	Buck Creek-Rockfish River	2	58

Water Quantity for Culverts and Ditches
Access Road: 08-014-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.037

Table 5.037 - Water Quantity - 08-014-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-509.001	2.24	3.3	4.0	6.0	12	57	0.6	1.5	5.0	12	58	0.7	1.7	5.3	0.1	0.2	0.3
C AR-509.002	3.48	3.3	4.0	6.0	10	56	0.9	2.2	7.8	10	56	0.9	2.2	7.8	0.0	0.0	0.0
C AR-509.003	3.85	3.3	4.0	6.0	10	55	0.8	2.2	8.2	10	56	1.0	2.5	8.7	0.2	0.3	0.5
C AR-509.004	1.96	3.3	4.0	6.0	10	56	0.5	1.3	4.5	10	56	0.5	1.3	4.5	0.0	0.0	0.0
C AR-509.005	8.06	3.3	4.0	6.0	10	55	1.6	4.6	17.2	10	55	1.6	4.6	17.2	0.0	0.0	0.0
C AR-509.006	0.83	3.3	4.0	6.0	10	56	0.2	0.5	1.9	10	57	0.3	0.6	2.0	0.1	0.1	0.1
C AR-509.007	119.72	3.3	4.0	6.0	12	55	21.7	62.7	239.9	12	55	21.7	62.7	239.9	0.0	0.0	0.0
C AR-509.008	2.93	3.3	4.0	6.0	10	56	0.7	1.9	6.6	10	56	0.7	1.9	6.6	0.0	0.0	0.0
C AR-509.009	3.02	3.3	4.0	6.0	10	56	0.8	2.0	6.9	10	56	0.8	2.0	6.9	0.0	0.0	0.0
C AR-509.010	4.54	3.3	4.0	6.0	10	56	1.1	3.0	10.3	10	56	1.1	3.0	10.3	0.0	0.0	0.0
C AR-509.011	4.11	3.3	4.0	6.0	9	56	1.1	2.8	9.7	9	56	1.1	2.8	9.7	0.0	0.0	0.0
C AR-509.012	3.64	3.3	4.0	6.0	12	56	0.8	2.2	7.8	12	56	0.8	2.2	7.8	0.0	0.0	0.0
C AR-509.013	6.19	3.3	4.0	6.0	10	55	1.2	3.5	13.2	10	55	1.2	3.5	13.2	0.0	0.0	0.0
C AR-509.014	2.89	3.3	4.0	6.0	16	55	0.4	1.3	5.0	16	54	0.3	1.1	4.7	-0.1	-0.2	-0.3
C 210.001	0.31	3.3	4.0	6.0	7	57	0.1	0.3	0.9	7	57	0.1	0.3	0.9	0.0	0.0	0.0
C 210.002	0.24	3.3	4.0	6.0	7	59	0.1	0.3	0.7	7	59	0.1	0.3	0.7	0.0	0.0	0.0
C 210.003	0.13	3.3	4.0	6.0	7	56	0.0	0.1	0.4	7	52	0.0	0.1	0.3	0.0	0.0	-0.1

Water Quantity for Culverts and Ditches
Access Road: 08-014-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.037

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.037 - Energy Balance - 08-014-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-509.001	0.6	0.05	0.7	0.06	0.5	0.05	0.5	not met	0.2	exceeded	0.1	0.4	exceeded	0.3
C AR-509.002	0.9	0.08	0.9	0.08	0.7	0.07	0.9	met	n/a	not exceeded	n/a	0.6	exceeded	0.2
C AR-509.003	0.8	0.08	1.0	0.08	0.8	0.08	0.7	not met	0.3	exceeded	0.2	0.7	exceeded	0.3
C AR-509.004	0.5	0.04	0.5	0.04	0.4	0.04	0.5	met	n/a	not exceeded	n/a	0.4	exceeded	0.1
C AR-509.005	1.6	0.16	1.6	0.16	1.6	0.16	1.6	met	n/a	not exceeded	n/a	1.6	exceeded	0.0
C AR-509.006	0.2	0.02	0.3	0.02	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C AR-509.007	21.7	2.31	21.7	2.31	21.7	2.31	21.7	met	n/a	not exceeded	n/a	21.7	exceeded	0.0
C AR-509.008	0.7	0.06	0.7	0.06	0.6	0.06	0.7	met	n/a	not exceeded	n/a	0.5	exceeded	0.2
C AR-509.009	0.8	0.07	0.8	0.07	0.6	0.06	0.8	met	n/a	not exceeded	n/a	0.6	exceeded	0.2
C AR-509.010	1.1	0.10	1.1	0.10	0.9	0.09	1.1	met	n/a	not exceeded	n/a	0.8	exceeded	0.3
C AR-509.011	1.1	0.09	1.1	0.09	0.9	0.08	1.1	met	n/a	not exceeded	n/a	0.8	exceeded	0.3
C AR-509.012	0.8	0.08	0.8	0.08	0.7	0.07	0.8	met	n/a	not exceeded	n/a	0.6	exceeded	0.2
C AR-509.013	1.2	0.12	1.2	0.12	1.2	0.12	1.2	met	n/a	not exceeded	n/a	1.2	exceeded	0.0
C AR-509.014	0.4	0.06	0.3	0.05	0.4	0.06	0.5	met	n/a	not exceeded	n/a	0.5	not exceeded	n/a
C 210.001	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 210.002	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C 210.003	0.0	0.00	0.0	0.00	0.0	0.00	0.1	met	n/a	not exceeded	n/a	0.0	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-014-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.037

Table 7.037 - Culvert Sizing - 08-014-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-509.001	2.24	5.3	18	< 8	EC-1 Class A1
C AR-509.002	3.48	7.8	18	< 8	EC-1 Class A1
C AR-509.003	3.85	8.7	18	< 8	EC-1 Class A1
C AR-509.004	1.96	4.5	18	< 8	EC-1 Class A1
C AR-509.005	8.06	17.2	24	< 8	EC-1 Class A1
C AR-509.006	0.83	2.0	12	< 6	EC-3 Type B
C AR-509.007	119.72	239.9	multiple	< 8	EC-1 Class A1
C AR-509.008	2.93	6.6	18	< 8	EC-1 Class A1
C AR-509.009	3.02	6.9	18	< 8	EC-1 Class A1
C AR-509.010	4.54	10.3	18	< 8	EC-1 Class A1
C AR-509.011	4.11	9.7	18	< 8	EC-1 Class A1
C AR-509.012	3.64	7.8	18	< 8	EC-1 Class A1
C AR-509.013	6.19	13.2	24	< 8	EC-1 Class A1
C AR-509.014	2.89	4.7	18	< 8	EC-1 Class A1
C 210.001	0.31	0.9	12	< 6	EC-3 Type B
C 210.002	0.24	0.7	12	< 6	EC-3 Type B
C 210.003	0.13	0.3	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-014-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.037

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.037 - Roadside Ditch Sizing - 08-014-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-509.001	1.7	5.3	0.05	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C AR-509.002	2.2	7.8	0.01	Type I	2.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-509.003	2.5	8.7	0.02	Type I	2.0	1.0	2.4	Riprap (D50 - 6 in)
C AR-509.004	1.3	4.5	0.02	Type I	2.0	0.9	2.4	Riprap (D50 - 6 in)
C AR-509.005	4.6	17.2	0.08	Type I	2.0	4.3	4.8	Riprap (D50 - 12 in)
C AR-509.006	0.6	2.0	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-509.007	62.7	239.9	0.16	Type III	3.5	13.5	See Note 1	See Note 1
C AR-509.008	1.9	6.6	0.16	Type I	1.5	5.7	See Note 1	See Note 1
C AR-509.009	2.0	6.9	0.12	Type I	1.5	4.6	4.8	Riprap (D50 - 12 in)
C AR-509.010	3.0	10.3	0.18	Type I	2.0	7.4	See Note 1	See Note 1
C AR-509.011	2.8	9.7	0.24	Type I	1.5	9.1	See Note 1	See Note 1
C AR-509.012	2.2	7.8	0.24	Type I	1.5	8.2	See Note 1	See Note 1
C AR-509.013	3.5	13.2	0.11	Type I	2.0	5.2	See Note 1	See Note 1
C AR-509.014	1.1	4.7	0.01	Type I	2.0	0.2	0.4	Grass Lined
C 210.001	0.3	0.9	0.01	Type I	1.5	0.1	0.4	Grass Lined
C 210.002	0.3	0.7	0.56	Type I	1.0	7.3	See Note 1	See Note 1
C 210.003	0.1	0.3	0.01	Type I	1.0	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 08-086-A036.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.038

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A036.AR1	C 214.001	5	214	Nelson	Buck Creek-Rockfish River	5	60
08-086-A036.AR1	C 214.002	5	214	Nelson	Buck Creek-Rockfish River	5	60

Water Quantity for Culverts and Ditches
Access Road: 08-086-A036.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.038

Table 5.038 - Water Quantity - 08-086-A036.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 214.001	515.55	3.3	4.0	6.0	37	59	94.2	203.0	651.8	37	59	94.2	203.0	651.8	0.0	0.0	0.0
C 214.002	2.12	3.3	4.0	6.0	10	59	0.9	1.9	5.7	11	59	0.9	1.8	5.5	0.0	-0.1	-0.2

Water Quantity for Culverts and Ditches
Access Road: 08-086-A036.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.038

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.038 - Energy Balance - 08-086-A036.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 214.001	94.2	14.77	94.2	14.77	94.2	14.77	94.2	met	n/a	not exceeded	n/a	94.2	exceeded	0.0
C 214.002	0.9	0.06	0.9	0.06	0.9	0.06	0.9	met	n/a	not exceeded	n/a	0.9	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-086-A036.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.038

Table 7.038 - Culvert Sizing - 08-086-A036.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 214.001	515.55	651.8	multiple	< 8	EC-1 Class A1
C 214.002	2.12	5.5	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 08-086-A036.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.038

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.038 - Roadside Ditch Sizing - 08-086-A036.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 214.001	203.0	651.8	0.01	Type III	8.5	1.6	2.4	Riprap (D50 - 6 in)
C 214.002	1.8	5.5	0.07	Type I	1.5	2.6	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.039

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A045-AR 2	C 215.001	5	215	Nelson	Buck Creek-Rockfish River	5	61
08-086-A045-AR 2	C 215.002	5	215	Nelson	Buck Creek-Rockfish River	5	61

Water Quantity for Culverts and Ditches

Access Road: 08-086-A045-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.039

Table 5.039 - Water Quantity - 08-086-A045-AR 2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 215.001	0.45	3.3	4.0	6.0	12	58	0.2	0.3	1.1	12	59	0.2	0.4	1.1	0.0	0.0	0.0
C 215.002	0.72	3.3	4.0	6.0	11	55	0.1	0.4	1.5	12	55	0.1	0.4	1.5	0.0	0.0	0.0

Water Quantity for Culverts and Ditches

Access Road: 08-086-A045-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.039

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.039 - Energy Balance - 08-086-A045-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 215.001	0.2	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.1
C 215.002	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-086-A045-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.039

Table 7.039 - Culvert Sizing - 08-086-A045-AR 2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 215.001	0.45	1.1	12	< 6	EC-3 Type B
C 215.002	0.72	1.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.039

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.039 - Roadside Ditch Sizing - 08-086-A045-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 215.001	0.4	1.1	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 215.002	0.4	1.5	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.040

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A045-AR 3	C 215.003	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.004	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.005	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.006	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.007	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.008	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.009	5	215	Nelson	Dutch Creek-Rockfish River	6	61
08-086-A045-AR 3	C 215.010	5	215	Nelson	Dutch Creek-Rockfish River	6	61

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.040

Table 5.040 - Water Quantity - 08-086-A045-AR 3																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 215.003	0.41	3.3	4.0	6.0	10	55	0.1	0.2	0.9	10	57	0.1	0.3	1.0	0.1	0.1	0.1
C 215.004	0.45	3.3	4.0	6.0	12	55	0.1	0.2	0.9	13	58	0.1	0.3	1.1	0.1	0.1	0.2
C 215.005	0.15	3.3	4.0	6.0	8	55	0.0	0.1	0.3	9	65	0.1	0.2	0.6	0.1	0.1	0.2
C 215.006	0.22	3.3	4.0	6.0	12	55	0.0	0.1	0.4	12	60	0.1	0.2	0.6	0.1	0.1	0.1
C 215.007	0.19	3.3	4.0	6.0	10	55	0.0	0.1	0.4	10	61	0.1	0.2	0.6	0.1	0.1	0.2
C 215.008	0.11	3.3	4.0	6.0	7	55	0.0	0.1	0.3	5	62	0.1	0.2	0.4	0.1	0.1	0.2
C 215.009	0.11	3.3	4.0	6.0	7	55	0.0	0.1	0.3	7	64	0.1	0.2	0.4	0.1	0.1	0.2
C 215.010	0.15	3.3	4.0	6.0	8	55	0.0	0.1	0.4	8	59	0.1	0.2	0.4	0.0	0.1	0.1

Water Quantity for Culverts and Ditches

Access Road: 08-086-A045-AR 3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.040

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.040 - Energy Balance - 08-086-A045-AR 3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 215.003	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 215.004	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 215.005	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 215.006	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 215.007	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 215.008	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 215.009	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 215.010	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.040

Table 7.040 - Culvert Sizing - 08-086-A045-AR 3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 215.003	0.41	1.0	12	< 6	EC-3 Type B
C 215.004	0.45	1.1	12	< 6	EC-3 Type B
C 215.005	0.15	0.6	12	< 6	EC-3 Type B
C 215.006	0.22	0.6	12	< 6	EC-3 Type B
C 215.007	0.19	0.6	12	< 6	EC-3 Type B
C 215.008	0.11	0.4	12	< 6	EC-3 Type B
C 215.009	0.11	0.4	12	< 6	EC-3 Type B
C 215.010	0.15	0.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-086-A045-AR 3
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.040

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.040 - Roadside Ditch Sizing - 08-086-A045-AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 215.003	0.3	1.0	0.09	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C 215.004	0.3	1.1	0.16	Type I	1.0	3.0	4.8	Riprap (D50 - 12 in)
C 215.005	0.2	0.6	0.16	Type I	1.0	2.4	2.4	Riprap (D50 - 6 in)
C 215.006	0.2	0.6	0.14	Type I	1.0	2.0	2.4	Riprap (D50 - 6 in)
C 215.007	0.2	0.6	0.10	Type I	1.0	1.6	2.4	Riprap (D50 - 6 in)
C 215.008	0.2	0.4	0.12	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C 215.009	0.2	0.4	0.13	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C 215.010	0.2	0.4	0.25	Type I	1.0	3.2	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 08-086-A050-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.041

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A050-AR 1	C AR-510.001	5	AR-510	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C AR-510.002	5	AR-510	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C AR-510.003	5	AR-510	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C 217.001	5	217	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C 217.002	5	217	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C 217.003	5	217	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C 217.004	5	217	Nelson	Dutch Creek-Rockfish River	6	62
08-086-A050-AR 1	C 217.005	5	217	Nelson	Dutch Creek-Rockfish River	6	62

Water Quantity for Culverts and Ditches
Access Road: 08-086-A050-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.041

Table 5.041 - Water Quantity - 08-086-A050-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-510.001	0.29	3.3	4.0	6.0	11	59	0.1	0.3	0.8	11	63	0.2	0.4	0.9	0.1	0.1	0.2
C AR-510.002	0.27	3.3	4.0	6.0	10	55	0.1	0.2	0.6	11	63	0.2	0.3	0.9	0.1	0.2	0.3
C AR-510.003	19.25	3.3	4.0	6.0	16	60	7.3	15.0	44.2	16	60	7.1	14.9	43.9	-0.1	-0.1	-0.3
C 217.001	1.24	3.3	4.0	6.0	9	55	0.3	0.8	2.8	10	57	0.4	0.9	3.1	0.1	0.2	0.3
C 217.002	2.73	3.3	4.0	6.0	9	55	0.6	1.7	6.2	10	56	0.7	1.8	6.3	0.1	0.2	0.2
C 217.003	1.24	3.3	4.0	6.0	10	55	0.3	0.7	2.6	11	57	0.4	0.9	2.9	0.1	0.2	0.3
C 217.004	3.91	3.3	4.0	6.0	10	55	0.8	2.2	8.4	11	55	0.8	2.2	8.3	0.0	0.0	-0.1
C 217.005	10.21	3.3	4.0	6.0	14	55	1.6	4.8	18.5	15	54	1.2	3.9	16.7	-0.4	-0.8	-1.8

Water Quantity for Culverts and Ditches

Access Road: 08-086-A050-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.041

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.041 - Energy Balance - 08-086-A050-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-510.001	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.2
C AR-510.002	0.1	0.01	0.2	0.01	0.1	0.01	0.0	not met	0.2	exceeded	0.1	0.0	exceeded	0.2
C AR-510.003	7.3	0.61	7.1	0.61	7.3	0.61	7.3	met	n/a	not exceeded	n/a	7.3	not exceeded	n/a
C 217.001	0.3	0.02	0.4	0.03	0.3	0.02	0.2	not met	0.2	exceeded	0.1	0.2	exceeded	0.2
C 217.002	0.6	0.05	0.7	0.06	0.6	0.05	0.5	not met	0.2	exceeded	0.1	0.5	exceeded	0.2
C 217.003	0.3	0.02	0.4	0.03	0.3	0.02	0.2	not met	0.2	exceeded	0.1	0.2	exceeded	0.2
C 217.004	0.8	0.08	0.8	0.08	0.8	0.08	0.8	met	n/a	not exceeded	n/a	0.8	not exceeded	n/a
C 217.005	1.6	0.20	1.2	0.18	1.6	0.20	1.8	met	n/a	not exceeded	n/a	1.8	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-086-A050-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.041

Table 7.041 - Culvert Sizing - 08-086-A050-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-510.001	0.29	0.9	12	< 6	EC-3 Type B
C AR-510.002	0.27	0.9	12	< 6	EC-3 Type B
C AR-510.003	19.25	43.9	36	< 8	EC-1 Class A1
C 217.001	1.24	3.1	12	< 6	EC-3 Type B
C 217.002	2.73	6.3	18	< 8	EC-1 Class A1
C 217.003	1.24	2.9	12	< 6	EC-3 Type B
C 217.004	3.91	8.3	18	< 8	EC-1 Class A1
C 217.005	10.21	16.7	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 08-086-A050-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.041

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.041 - Roadside Ditch Sizing - 08-086-A050-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-510.001	0.4	0.9	0.05	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-510.002	0.3	0.9	0.09	Type I	1.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-510.003	14.9	43.9	0.02	Type III	2.5	1.4	2.4	Riprap (D50 - 6 in)
C 217.001	0.9	3.1	0.03	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 217.002	1.8	6.3	0.02	Type I	2.0	1.1	2.4	Riprap (D50 - 6 in)
C 217.003	0.9	2.9	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 217.004	2.2	8.3	0.10	Type I	2.0	4.1	4.8	Riprap (D50 - 12 in)
C 217.005	3.9	16.7	0.26	Type I	2.0	11.2	See Note 1	See Note 1

Water Quantity for Culverts and Ditches
Access Road: 08-086-A054.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.042

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A054.AR1	C AR-510.004	5	AR-510	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.001	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.002	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.003	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.004	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.005	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.006	5	218	Nelson	Dutch Creek-Rockfish River	6	63
08-086-A054.AR1	C 218.007	5	218	Nelson	Dutch Creek-Rockfish River	6	63

Water Quantity for Culverts and Ditches
Access Road: 08-086-A054.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.042

Table 5.042 - Water Quantity - 08-086-A054.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-510.004	0.45	3.3	4.0	6.0	13	60	0.2	0.4	1.1	14	66	0.4	0.6	1.5	0.2	0.2	0.3
C 218.001	0.27	3.3	4.0	6.0	0	58	0.2	0.3	1.0	1	64	0.3	0.5	1.3	0.1	0.2	0.3
C 218.002	0.26	3.3	4.0	6.0	5	62	0.2	0.4	1.0	4	67	0.4	0.6	1.3	0.1	0.2	0.3
C 218.003	0.47	3.3	4.0	6.0	5	60	0.3	0.6	1.6	6	63	0.4	0.7	1.8	0.1	0.1	0.2
C 218.004	0.26	3.3	4.0	6.0	13	55	0.1	0.1	0.5	13	59	0.1	0.2	0.6	0.1	0.1	0.1
C 218.005	0.38	3.3	4.0	6.0	13	55	0.1	0.2	0.7	13	58	0.1	0.3	0.9	0.1	0.1	0.1
C 218.006	0.89	3.3	4.0	6.0	13	55	0.2	0.4	1.7	14	57	0.2	0.6	1.9	0.1	0.1	0.2
C 218.007	0.82	3.3	4.0	6.0	12	55	0.2	0.4	1.6	13	57	0.2	0.5	1.8	0.1	0.1	0.2

Water Quantity for Culverts and Ditches
Access Road: 08-086-A054.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.042

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.042 - Energy Balance - 08-086-A054.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-510.004	0.2	0.01	0.4	0.02	0.1	0.01	0.1	not met	0.2	exceeded	0.2	0.1	exceeded	0.3
C 218.001	0.2	0.01	0.3	0.01	0.1	0.01	0.1	not met	0.2	exceeded	0.1	0.1	exceeded	0.2
C 218.002	0.2	0.01	0.4	0.01	0.2	0.01	0.2	not met	0.2	exceeded	0.1	0.1	exceeded	0.2
C 218.003	0.3	0.02	0.4	0.02	0.3	0.02	0.2	not met	0.2	exceeded	0.1	0.2	exceeded	0.2
C 218.004	0.1	0.01	0.1	0.01	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 218.005	0.1	0.01	0.1	0.01	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 218.006	0.2	0.02	0.2	0.02	0.2	0.02	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 218.007	0.2	0.02	0.2	0.02	0.2	0.02	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 08-086-A054.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.042

Table 7.042 - Culvert Sizing - 08-086-A054.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-510.004	0.45	1.5	12	< 6	EC-3 Type B
C 218.001	0.27	1.3	12	< 6	EC-3 Type B
C 218.002	0.26	1.3	12	< 6	EC-3 Type B
C 218.003	0.47	1.8	12	< 6	EC-3 Type B
C 218.004	0.26	0.6	12	< 6	EC-3 Type B
C 218.005	0.38	0.9	12	< 6	EC-3 Type B
C 218.006	0.89	1.9	12	< 6	EC-3 Type B
C 218.007	0.82	1.8	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-086-A054.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.042

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.042 - Roadside Ditch Sizing - 08-086-A054.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-510.004	0.6	1.5	0.10	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C 218.001	0.5	1.3	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 218.002	0.6	1.3	0.04	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 218.003	0.7	1.8	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 218.004	0.2	0.6	0.03	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C 218.005	0.3	0.9	0.07	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C 218.006	0.6	1.9	0.05	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C 218.007	0.5	1.8	0.05	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 08-086-A112.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.043

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-086-A112.AR1	C 219.001	5	219	Nelson	Dutch Creek-Rockfish River	6	64
08-086-A112.AR1	C 219.002	5	219	Nelson	Dutch Creek-Rockfish River	6	64
08-086-A112.AR1	C 219.003	5	219	Nelson	Dutch Creek-Rockfish River	6	64

Water Quantity for Culverts and Ditches
Access Road: 08-086-A112.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.043

Table 5.043 - Water Quantity - 08-086-A112.AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 219.001	0.57	3.3	4.0	6.0	12	67	0.5	0.9	2.0	12	66	0.5	0.8	2.0	-0.1	-0.1	-0.1
C 219.002	0.47	3.3	4.0	6.0	12	61	0.2	0.5	1.3	12	61	0.2	0.5	1.3	0.0	0.0	0.0
C 219.003	0.43	3.3	4.0	6.0	12	57	0.1	0.3	1.0	12	54	0.1	0.2	0.8	-0.1	-0.1	-0.2

Water Quantity for Culverts and Ditches

Access Road: 08-086-A112.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.043

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.043 - Energy Balance - 08-086-A112.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 219.001	0.5	0.03	0.5	0.03	0.4	0.02	0.6	met	n/a	not exceeded	n/a	0.3	exceeded	0.2
C 219.002	0.2	0.02	0.2	0.02	0.2	0.01	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 219.003	0.1	0.01	0.1	0.01	0.1	0.01	0.2	met	n/a	not exceeded	n/a	0.1	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 08-086-A112.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.043

Table 7.043 - Culvert Sizing - 08-086-A112.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 219.001	0.57	2.0	12	< 6	EC-3 Type B
C 219.002	0.47	1.3	12	< 6	EC-3 Type B
C 219.003	0.43	0.8	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-086-A112.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.043

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.043 - Roadside Ditch Sizing - 08-086-A112.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 219.001	0.8	2.0	0.15	Type I	1.5	3.8	4.8	Riprap (D50 - 12 in)
C 219.002	0.5	1.3	0.12	Type I	1.0	2.5	2.4	Riprap (D50 - 6 in)
C 219.003	0.2	0.8	0.15	Type I	1.0	2.2	2.4	Riprap (D50 - 6 in)

Tables 4.044-052 to 8.044-052

Permanent Access Roads, Spread 6

Tables 4.044-052 Culvert List

Tables 5.044-052 Water Quantity

Tables 6.044-052 Energy Balance

Tables 7.044-052 Culvert Sizing

Tables 8.044-052 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 08-214-B004-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.044

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-214-B004-AR 1	C AR-513.001	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.002	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.003	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.004	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.005	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.006	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.007	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.008	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.009	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C AR-513.010	6	AR-513	Nelson	Sycamore Creek-James River	11	65
08-214-B004-AR 1	C 227.001	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.002	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.003	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.004	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.005	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.006	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.007	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.008	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.009	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.010	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B004-AR 1	C 227.013	6	227	Nelson	Sycamore Creek-James River	11	65, 66

Water Quantity for Culverts and Ditches
Access Road: 08-214-B004-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.044

Table 5.044 - Water Quantity - 08-214-B004-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-513.001	1.13	3.3	4.0	6.0	13	71	1.4	2.1	4.5	13	71	1.4	2.1	4.5	0.0	0.0	0.0
C AR-513.002	0.72	3.3	4.0	6.0	12	77	1.3	1.9	3.5	12	77	1.3	1.9	3.5	0.0	0.0	0.0
C AR-513.003	0.70	3.3	4.0	6.0	12	77	1.3	1.8	3.5	12	77	1.3	1.8	3.5	0.0	0.0	0.0
C AR-513.004	1.29	3.3	4.0	6.0	13	70	1.5	2.3	5.0	13	71	1.6	2.4	5.2	0.1	0.1	0.2
C AR-513.005	1.33	3.3	4.0	6.0	13	69	1.4	2.3	5.0	13	69	1.4	2.3	5.0	0.0	0.0	0.0
C AR-513.006	0.80	3.3	4.0	6.0	12	74	1.2	1.8	3.6	12	74	1.2	1.8	3.6	0.0	0.0	0.0
C AR-513.007	13.37	3.3	4.0	6.0	15	68	12.1	19.5	44.5	15	68	12.1	19.5	44.5	0.0	0.0	0.0
C AR-513.008	0.17	3.3	4.0	6.0	16	63	0.1	0.2	0.4	16	68	0.2	0.2	0.5	0.1	0.1	0.1
C AR-513.009	0.82	3.3	4.0	6.0	15	57	0.2	0.5	1.7	15	57	0.2	0.5	1.7	0.0	0.0	0.0
C AR-513.010	0.38	3.3	4.0	6.0	7	61	0.3	0.5	1.3	7	62	0.3	0.5	1.3	0.0	0.0	0.1
C 227.001	0.55	3.3	4.0	6.0	10	73	0.8	1.3	2.5	10	72	0.8	1.2	2.5	0.0	-0.1	-0.1
C 227.002	1.35	3.3	4.0	6.0	15	74	1.9	2.7	5.6	15	72	1.6	2.5	5.2	-0.2	-0.3	-0.3
C 227.003	1.66	3.3	4.0	6.0	15	74	2.3	3.4	6.9	15	72	2.0	3.1	6.5	-0.3	-0.3	-0.4
C 227.004	0.77	3.3	4.0	6.0	15	75	1.1	1.7	3.3	15	74	1.1	1.6	3.2	-0.1	-0.1	-0.1
C 227.005	0.65	3.3	4.0	6.0	12	68	0.7	1.1	2.4	12	69	0.7	1.1	2.5	0.1	0.1	0.1
C 227.006	0.28	3.3	4.0	6.0	10	58	0.1	0.2	0.7	10	60	0.1	0.3	0.8	0.0	0.1	0.1
C 227.007	0.51	3.3	4.0	6.0	10	58	0.2	0.4	1.3	10	60	0.3	0.5	1.5	0.1	0.1	0.1
C 227.008	0.34	3.3	4.0	6.0	18	57	0.1	0.2	0.6	18	59	0.1	0.2	0.7	0.0	0.0	0.1
C 227.009	0.36	3.3	4.0	6.0	9	59	0.2	0.3	1.0	9	60	0.2	0.4	1.1	0.0	0.0	0.1
C 227.010	1.15	3.3	4.0	6.0	12	58	0.4	0.9	2.8	12	59	0.5	1.0	2.9	0.1	0.1	0.2
C 227.013	1.00	3.3	4.0	6.0	11	56	0.2	0.6	2.2	11	57	0.3	0.7	2.3	0.1	0.1	0.1

Water Quantity for Culverts and Ditches

Access Road: 08-214-B004-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.044

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.044 - Energy Balance - 08-214-B004-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-513.001	1.4	0.08	1.4	0.08	1.4	0.08	1.4	met	n/a	not exceeded	n/a	1.4	exceeded	0.0
C AR-513.002	1.3	0.07	1.3	0.07	1.2	0.07	1.3	met	n/a	not exceeded	n/a	1.2	exceeded	0.1
C AR-513.003	1.3	0.07	1.3	0.07	1.3	0.07	1.3	met	n/a	not exceeded	n/a	1.3	exceeded	0.0
C AR-513.004	1.5	0.09	1.6	0.09	1.5	0.09	1.4	not met	0.2	exceeded	0.1	1.4	exceeded	0.2
C AR-513.005	1.4	0.08	1.4	0.08	1.4	0.08	1.4	met	n/a	not exceeded	n/a	1.4	exceeded	0.0
C AR-513.006	1.2	0.07	1.2	0.07	1.2	0.07	1.2	met	n/a	not exceeded	n/a	1.2	exceeded	0.0
C AR-513.007	12.1	0.78	12.1	0.78	12.1	0.78	12.1	met	n/a	not exceeded	n/a	12.1	exceeded	0.0
C AR-513.008	0.1	0.01	0.2	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C AR-513.009	0.2	0.02	0.2	0.02	0.1	0.02	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C AR-513.010	0.3	0.01	0.3	0.02	0.2	0.01	0.2	not met	0.1	exceeded	0.0	0.1	exceeded	0.2
C 227.001	0.8	0.04	0.8	0.04	0.8	0.04	0.9	met	n/a	not exceeded	n/a	0.8	exceeded	0.0
C 227.002	1.9	0.11	1.6	0.10	1.7	0.11	2.1	met	n/a	not exceeded	n/a	1.8	not exceeded	n/a
C 227.003	2.3	0.14	2.0	0.12	2.2	0.13	2.6	met	n/a	not exceeded	n/a	2.3	not exceeded	n/a
C 227.004	1.1	0.07	1.1	0.06	1.1	0.07	1.2	met	n/a	not exceeded	n/a	1.2	not exceeded	n/a
C 227.005	0.7	0.04	0.7	0.04	0.6	0.03	0.6	not met	0.1	exceeded	0.1	0.5	exceeded	0.3
C 227.006	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 227.007	0.2	0.01	0.3	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 227.008	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 227.009	0.2	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 227.010	0.4	0.03	0.5	0.03	0.3	0.03	0.4	not met	0.1	exceeded	0.1	0.2	exceeded	0.3
C 227.013	0.2	0.02	0.3	0.02	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.2	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 08-214-B004-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.044

Table 7.044 - Culvert Sizing - 08-214-B004-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-513.001	1.13	4.5	18	< 8	EC-1 Class A1
C AR-513.002	0.72	3.5	12	< 6	EC-3 Type B
C AR-513.003	0.70	3.5	12	< 6	EC-3 Type B
C AR-513.004	1.29	5.2	18	< 8	EC-1 Class A1
C AR-513.005	1.33	5.0	18	< 8	EC-1 Class A1
C AR-513.006	0.80	3.6	12	< 6	EC-3 Type B
C AR-513.007	13.37	44.5	36	< 8	EC-1 Class A1
C AR-513.008	0.17	0.5	12	< 6	EC-3 Type B
C AR-513.009	0.82	1.7	12	< 6	EC-3 Type B
C AR-513.010	0.38	1.3	12	< 6	EC-3 Type B
C 227.001	0.55	2.5	12	< 6	EC-3 Type B
C 227.002	1.35	5.2	18	< 8	EC-1 Class A1
C 227.003	1.66	6.5	18	< 8	EC-1 Class A1
C 227.004	0.77	3.2	12	< 6	EC-3 Type B
C 227.005	0.65	2.5	12	< 6	EC-3 Type B
C 227.006	0.28	0.8	12	< 6	EC-3 Type B
C 227.007	0.51	1.5	12	< 6	EC-3 Type B
C 227.008	0.34	0.7	12	< 6	EC-3 Type B
C 227.009	0.36	1.1	12	< 6	EC-3 Type B
C 227.010	1.15	2.9	12	< 6	EC-3 Type B
C 227.013	1.00	2.3	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-214-B004-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.044

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.044 - Roadside Ditch Sizing - 08-214-B004-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-513.001	2.1	4.5	0.04	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-513.002	1.9	3.5	0.04	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-513.003	1.8	3.5	0.04	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)
C AR-513.004	2.4	5.2	0.05	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-513.005	2.3	5.0	0.04	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C AR-513.006	1.8	3.6	0.02	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-513.007	19.5	44.5	0.01	Type III	2.5	0.4	0.4	Grass Lined
C AR-513.008	0.2	0.5	0.08	Type I	1.0	1.4	2.4	Riprap (D50 - 6 in)
C AR-513.009	0.5	1.7	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-513.010	0.5	1.3	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 227.001	1.2	2.5	0.13	Type I	1.5	3.9	4.8	Riprap (D50 - 12 in)
C 227.002	2.5	5.2	0.05	Type I	1.5	2.2	2.4	Riprap (D50 - 6 in)
C 227.003	3.1	6.5	0.13	Type I	1.5	5.6	See Note 1	See Note 1
C 227.004	1.6	3.2	0.14	Type I	1.5	4.7	4.8	Riprap (D50 - 12 in)
C 227.005	1.1	2.5	0.05	Type I	1.5	1.7	2.4	Riprap (D50 - 6 in)
C 227.006	0.3	0.8	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C 227.007	0.5	1.5	0.06	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C 227.008	0.2	0.7	0.02	Type I	1.0	0.3	0.4	Grass Lined
C 227.009	0.4	1.1	0.06	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C 227.010	1.0	2.9	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 227.013	0.7	2.3	0.01	Type I	1.5	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 08-214-B007.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.045

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
08-214-B007.AR1	C 227.011	6	227	Nelson	Sycamore Creek-James River	11	66
08-214-B007.AR1	C 227.012	6	227	Nelson	Sycamore Creek-James River	11	66

Water Quantity for Culverts and Ditches
Access Road: 08-214-B007.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.045

Table 5.045 - Water Quantity - 08-214-B007.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 227.011	0.57	3.3	4.0	6.0	20	55	0.1	0.2	0.9	21	59	0.2	0.3	1.1	0.1	0.1	0.2
C 227.012	1.07	3.3	4.0	6.0	22	55	0.1	0.4	1.5	23	56	0.2	0.4	1.6	0.0	0.0	0.0

Water Quantity for Culverts and Ditches

Access Road: 08-214-B007.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.045

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.045 - Energy Balance - 08-214-B007.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 227.011	0.1	0.01	0.2	0.02	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 227.012	0.1	0.02	0.2	0.02	0.1	0.02	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 08-214-B007.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.045

Table 7.045 - Culvert Sizing - 08-214-B007.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 227.011	0.57	1.1	12	< 6	EC-3 Type B
C 227.012	1.07	1.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 08-214-B007.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.045

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.045 - Roadside Ditch Sizing - 08-214-B007.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 227.011	0.3	1.1	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 227.012	0.4	1.6	0.00	Type I	1.5	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 09-001-A001.AR2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.046

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-001-A001.AR2	C AR-514.001	6	AR-514	Buckingham	Sycamore Creek-James River	11	67, 68
09-001-A001.AR2	C AR-514.002	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.003	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.004	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.005	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.006	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.007	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.008	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.009	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C AR-514.010	6	AR-514	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C 228.001	6	228	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C 228.002	6	228	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C 228.003	6	228	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C 228.004	6	228	Buckingham	Sycamore Creek-James River	11	68
09-001-A001.AR2	C 228.005	6	228	Buckingham	Sycamore Creek-James River	11	68

Water Quantity for Culverts and Ditches
Access Road: 09-001-A001.AR2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.046

Table 5.046 - Water Quantity - 09-001-A001.AR2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-514.001	458.91	3.0	3.5	5.8	55	72	182.2	266.5	726.6	55	72	182.2	266.5	726.6	0.0	0.0	0.0
C AR-514.002	2.14	3.0	3.5	5.8	12	73	2.5	3.5	8.9	13	73	2.4	3.4	8.7	0.0	-0.1	-0.1
C AR-514.003	0.28	3.0	3.5	5.8	12	74	0.4	0.5	1.2	12	75	0.4	0.5	1.2	0.0	0.0	0.0
C AR-514.004	0.63	3.0	3.5	5.8	12	72	0.7	1.0	2.6	12	72	0.7	1.0	2.5	0.0	0.0	0.0
C AR-514.005	0.41	3.0	3.5	5.8	9	72	0.5	0.7	1.8	9	73	0.5	0.7	1.9	0.0	0.0	0.0
C AR-514.006	0.57	3.0	3.5	5.8	9	72	0.7	1.0	2.6	10	72	0.7	1.0	2.5	0.0	0.0	0.0
C AR-514.007	0.95	3.0	3.5	5.8	12	68	0.7	1.1	3.3	13	69	0.8	1.2	3.4	0.1	0.1	0.1
C AR-514.008	0.87	3.0	3.5	5.8	11	69	0.8	1.1	3.2	12	70	0.8	1.2	3.3	0.1	0.1	0.1
C AR-514.009	0.89	3.0	3.5	5.8	12	69	0.8	1.1	3.2	12	69	0.8	1.1	3.2	0.0	0.0	0.0
C AR-514.010	9.65	3.0	3.5	5.8	16	66	5.2	8.4	26.9	17	66	5.0	8.1	26.1	-0.2	-0.3	-0.8
C 228.001	0.78	3.0	3.5	5.8	8	72	1.0	1.4	3.6	9	72	0.9	1.3	3.5	0.0	0.0	-0.1
C 228.002	6.10	3.0	3.5	5.8	20	65	2.6	4.3	14.7	20	65	2.5	4.2	14.4	-0.1	-0.1	-0.3
C 228.003	1.37	3.0	3.5	5.8	15	67	0.9	1.4	4.2	16	67	0.8	1.3	4.1	0.0	0.0	-0.1
C 228.004	1.26	3.0	3.5	5.8	15	67	0.8	1.3	3.8	16	68	0.9	1.3	3.9	0.1	0.1	0.1
C 228.005	3.86	3.0	3.5	5.8	17	74	4.0	5.7	14.2	17	74	4.0	5.6	13.9	-0.1	-0.1	-0.3

Water Quantity for Culverts and Ditches
Access Road: 09-001-A001.AR2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.046

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.046 - Energy Balance - 09-001-A001.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-514.001	182.2	26.90	182.2	26.90	182.2	26.90	182.2	met	n/a	not exceeded	n/a	182.2	exceeded	0.0
C AR-514.002	2.5	0.14	2.4	0.14	2.5	0.14	2.5	met	n/a	not exceeded	n/a	2.5	not exceeded	n/a
C AR-514.003	0.4	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.0	exceeded	0.0	0.3	exceeded	0.1
C AR-514.004	0.7	0.04	0.7	0.04	0.7	0.04	0.7	met	n/a	not exceeded	n/a	0.7	not exceeded	n/a
C AR-514.005	0.5	0.02	0.5	0.03	0.5	0.02	0.5	not met	0.1	exceeded	0.0	0.4	exceeded	0.1
C AR-514.006	0.7	0.03	0.7	0.03	0.6	0.03	0.7	met	n/a	not exceeded	n/a	0.6	exceeded	0.1
C AR-514.007	0.7	0.04	0.8	0.05	0.7	0.04	0.7	not met	0.1	exceeded	0.1	0.6	exceeded	0.2
C AR-514.008	0.8	0.04	0.8	0.05	0.8	0.04	0.7	not met	0.1	exceeded	0.1	0.7	exceeded	0.1
C AR-514.009	0.8	0.04	0.8	0.04	0.7	0.04	0.8	met	n/a	not exceeded	n/a	0.7	exceeded	0.1
C AR-514.010	5.2	0.38	5.0	0.38	5.2	0.38	5.2	met	n/a	not exceeded	n/a	5.2	not exceeded	n/a
C 228.001	1.0	0.05	0.9	0.05	0.8	0.04	1.0	met	n/a	not exceeded	n/a	0.7	exceeded	0.2
C 228.002	2.6	0.22	2.5	0.22	2.6	0.22	2.6	met	n/a	not exceeded	n/a	2.6	not exceeded	n/a
C 228.003	0.9	0.06	0.8	0.06	0.8	0.05	0.9	met	n/a	not exceeded	n/a	0.7	exceeded	0.1
C 228.004	0.8	0.05	0.9	0.06	0.8	0.05	0.7	not met	0.1	exceeded	0.1	0.7	exceeded	0.1
C 228.005	4.0	0.26	4.0	0.26	3.8	0.25	4.0	met	n/a	not exceeded	n/a	3.5	exceeded	0.4

Water Quantity for Culverts and Ditches

Access Road: 09-001-A001.AR2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.046

Table 7.046 - Culvert Sizing - 09-001-A001.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-514.001	458.91	726.6	multiple	< 8	EC-1 Class A1
C AR-514.002	2.14	8.7	18	< 8	EC-1 Class A1
C AR-514.003	0.28	1.2	12	< 6	EC-3 Type B
C AR-514.004	0.63	2.5	12	< 6	EC-3 Type B
C AR-514.005	0.41	1.9	12	< 6	EC-3 Type B
C AR-514.006	0.57	2.5	12	< 6	EC-3 Type B
C AR-514.007	0.95	3.4	12	< 6	EC-3 Type B
C AR-514.008	0.87	3.3	12	< 6	EC-3 Type B
C AR-514.009	0.89	3.2	12	< 6	EC-3 Type B
C AR-514.010	9.65	26.1	30	< 8	EC-1 Class A1
C 228.001	0.78	3.5	12	< 6	EC-3 Type B
C 228.002	6.10	14.4	24	< 8	EC-1 Class A1
C 228.003	1.37	4.1	18	< 8	EC-1 Class A1
C 228.004	1.26	3.9	12	< 6	EC-3 Type B
C 228.005	3.86	13.9	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 09-001-A001.AR2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.046

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.046 - Roadside Ditch Sizing - 09-001-A001.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-514.001	266.5	726.6	0.01	Type III	9.0	1.7	2.4	Riprap (D50 - 6 in)
C AR-514.002	3.4	8.7	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR-514.003	0.5	1.2	0.26	Type I	1.0	5.2	See Note 1	See Note 1
C AR-514.004	1.0	2.5	0.04	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-514.005	0.7	1.9	0.09	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-514.006	1.0	2.5	0.08	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C AR-514.007	1.2	3.4	0.07	Type I	1.5	2.4	2.4	Riprap (D50 - 6 in)
C AR-514.008	1.2	3.3	0.08	Type I	1.5	2.5	2.4	Riprap (D50 - 6 in)
C AR-514.009	1.1	3.2	0.09	Type I	1.5	2.8	2.4	Riprap (D50 - 6 in)
C AR-514.010	8.1	26.1	0.08	Type II	2.0	3.7	4.8	Riprap (D50 - 12 in)
C 228.001	1.3	3.5	0.05	Type I	1.5	1.9	2.4	Riprap (D50 - 6 in)
C 228.002	4.2	14.4	0.06	Type I	2.0	3.3	4.8	Riprap (D50 - 12 in)
C 228.003	1.3	4.1	0.07	Type I	1.5	2.3	2.4	Riprap (D50 - 6 in)
C 228.004	1.3	3.9	0.08	Type I	1.5	2.5	2.4	Riprap (D50 - 6 in)
C 228.005	5.6	13.9	0.10	Type I	2.0	5.8	See Note 1	See Note 1

Water Quantity for Culverts and Ditches
Access Road: 09-001-A011-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.047

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-001-A011-AR 1	C AR-514.011	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C AR-514.012	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C AR-514.013	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C AR-514.014	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C AR-514.015	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C AR-514.016	6	AR-514	Buckingham	Sycamore Creek-James River	13	69
09-001-A011-AR 1	C 231.001	6	231	Buckingham	Sycamore Creek-James River	13	69

Water Quantity for Culverts and Ditches
Access Road: 09-001-A011-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.047

Table 5.047 - Water Quantity - 09-001-A011-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-514.011	0.17	3.0	3.5	5.8	1	76	0.3	0.5	1.1	1	79	0.4	0.5	1.2	0.1	0.1	0.1
C AR-514.012	26.05	3.0	3.5	5.8	15	65	13.2	21.8	72.6	15	65	13.2	21.8	72.6	0.0	0.0	0.0
C AR-514.013	4.41	3.0	3.5	5.8	18	75	4.7	6.6	16.2	18	75	4.7	6.6	16.2	0.0	0.0	0.0
C AR-514.014	0.14	3.0	3.5	5.8	1	86	0.5	0.6	1.1	1	86	0.5	0.6	1.1	0.0	0.0	0.0
C AR-514.015	0.13	3.0	3.5	5.8	1	86	0.5	0.6	1.1	1	86	0.5	0.6	1.1	0.0	0.0	0.0
C AR-514.016	0.10	3.0	3.5	5.8	1	86	0.3	0.4	0.8	1	85	0.3	0.4	0.8	0.0	0.0	0.0
C 231.001	6.46	3.0	3.5	5.8	9	70	6.6	9.7	26.5	9	70	6.6	9.7	26.5	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-001-A011-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.047

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.047 - Energy Balance - 09-001-A011-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-514.011	0.3	0.01	0.4	0.02	0.0	0.00	0.3	not met	0.1	exceeded	0.1	0.0	exceeded	0.4
C AR-514.012	13.2	0.95	13.2	0.95	11.7	0.88	13.2	met	n/a	not exceeded	n/a	10.8	exceeded	2.4
C AR-514.013	4.7	0.32	4.7	0.32	4.4	0.30	4.7	met	n/a	not exceeded	n/a	4.2	exceeded	0.6
C AR-514.014	0.5	0.02	0.5	0.02	0.0	0.00	0.5	met	n/a	not exceeded	n/a	0.0	exceeded	0.5
C AR-514.015	0.5	0.02	0.5	0.02	0.1	0.00	0.5	met	n/a	not exceeded	n/a	0.0	exceeded	0.4
C AR-514.016	0.3	0.01	0.3	0.01	0.0	0.00	0.4	met	n/a	not exceeded	n/a	0.0	exceeded	0.3
C 231.001	6.6	0.34	6.6	0.34	6.6	0.34	6.6	met	n/a	not exceeded	n/a	6.6	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 09-001-A011-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.047

Table 7.047 - Culvert Sizing - 09-001-A011-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-514.011	0.17	1.2	12	< 6	EC-3 Type B
C AR-514.012	26.05	72.6	48	< 8	EC-1 Class A1
C AR-514.013	4.41	16.2	24	< 8	EC-1 Class A1
C AR-514.014	0.14	1.1	12	< 6	EC-3 Type B
C AR-514.015	0.13	1.1	12	< 6	EC-3 Type B
C AR-514.016	0.10	0.8	12	< 6	EC-3 Type B
C 231.001	6.46	26.5	30	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 09-001-A011-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.047

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.047 - Roadside Ditch Sizing - 09-001-A011-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-514.011	0.5	1.2	0.07	Type I	1.5	1.6	2.4	Riprap (D50 - 6 in)
C AR-514.012	21.8	72.6	0.01	Type III	3.0	0.4	0.4	Grass Lined
C AR-514.013	6.6	16.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR-514.014	0.6	1.1	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-514.015	0.6	1.1	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-514.016	0.4	0.8	0.07	Type I	1.0	1.6	2.4	Riprap (D50 - 6 in)
C 231.001	9.7	26.5	0.07	Type II	2.0	3.4	4.8	Riprap (D50 - 12 in)

Water Quantity for Culverts and Ditches
Access Road: 09-005-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.048

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-005-AR 3	C 232.001	6	232	Buckingham	Ripley Creek-Walton Fork	14	70
09-005-AR 3	C 232.002	6	232	Buckingham	Ripley Creek-Walton Fork	14	70
09-005-AR 3	C 232.003	6	232	Buckingham	Ripley Creek-Walton Fork	14	70
09-005-AR 3	C 232.004	6	232	Buckingham	Ripley Creek-Walton Fork	14	70
09-005-AR 3	C 232.005	6	232	Buckingham	Ripley Creek-Walton Fork	14	70

Water Quantity for Culverts and Ditches
Access Road: 09-005-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.048

Table 5.048 - Water Quantity - 09-005-AR 3

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 232.001	0.13	3.0	3.5	5.8	0	70	0.2	0.3	0.7	0	72	0.2	0.3	0.8	0.0	0.0	0.1
C 232.002	0.27	3.0	3.5	5.8	5	70	0.3	0.5	1.3	5	72	0.4	0.6	1.4	0.1	0.1	0.1
C 232.003	0.63	3.0	3.5	5.8	6	62	0.3	0.6	2.1	6	63	0.4	0.7	2.2	0.0	0.1	0.1
C 232.004	0.99	3.0	3.5	5.8	29	53	0.0	0.1	0.9	29	54	0.0	0.1	1.0	0.0	0.0	0.1
C 232.005	0.56	3.0	3.5	5.8	37	57	0.0	0.1	0.6	37	59	0.1	0.1	0.7	0.0	0.0	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-005-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.048

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.048 - Energy Balance - 09-005-AR 3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 232.001	0.2	0.01	0.2	0.01	0.1	0.00	0.2	not met	0.0	exceeded	0.0	0.0	exceeded	0.2
C 232.002	0.3	0.01	0.4	0.02	0.2	0.01	0.3	not met	0.1	exceeded	0.1	0.1	exceeded	0.3
C 232.003	0.3	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.1	exceeded	0.0	0.2	exceeded	0.2
C 232.004	0.0	0.01	0.0	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 232.005	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-005-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.048

Table 7.048 - Culvert Sizing - 09-005-AR 3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 232.001	0.13	0.8	12	< 6	EC-3 Type B
C 232.002	0.27	1.4	12	< 6	EC-3 Type B
C 232.003	0.63	2.2	12	< 6	EC-3 Type B
C 232.004	0.99	1.0	12	< 6	EC-3 Type B
C 232.005	0.56	0.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 09-005-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.048

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.048 - Roadside Ditch Sizing - 09-005-AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 232.001	0.3	0.8	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 232.002	0.6	1.4	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 232.003	0.7	2.2	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 232.004	0.1	1.0	0.01	Type I	1.5	0.1	0.4	Grass Lined
C 232.005	0.1	0.7	0.01	Type I	1.5	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 09-040-A001-AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.049

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-040-A001-AR1	C 237.001	6	237	Buckingham	Meadow Creek-North River	17	71
09-040-A001-AR1	C 237.002	6	237	Buckingham	Meadow Creek-North River	17	71

Water Quantity for Culverts and Ditches
Access Road: 09-040-A001-AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.049

Table 5.049 - Water Quantity - 09-040-A001-AR1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 237.001	0.65	3.0	3.5	5.8	19	56	0.1	0.2	1.0	19	58	0.1	0.2	1.1	0.0	0.1	0.1
C 237.002	0.91	3.0	3.5	5.8	23	57	0.1	0.2	1.3	23	58	0.1	0.3	1.4	0.0	0.0	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-040-A001-AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.049

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.049 - Energy Balance - 09-040-A001-AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 237.001	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 237.002	0.1	0.02	0.1	0.02	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 09-040-A001-AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.049

Table 7.049 - Culvert Sizing - 09-040-A001-AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 237.001	0.65	1.1	12	< 6	EC-3 Type B
C 237.002	0.91	1.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 09-040-A001-AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.049

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.049 - Roadside Ditch Sizing - 09-040-A001-AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 237.001	0.2	1.1	0.02	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)
C 237.002	0.3	1.4	0.04	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 09-045.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.050

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-045.AR3	C AR-518.001	6	AR-518	Buckingham	Meadow Creek-North River	17	73
09-045.AR3	C AR-518.002	6	AR-518	Buckingham	Meadow Creek-North River	17	73
09-045.AR3	C 240.001	6	240	Buckingham	Meadow Creek-North River	17	73
09-045.AR3	C 240.002	6	240	Buckingham	Meadow Creek-North River	17	73

Water Quantity for Culverts and Ditches
Access Road: 09-045.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.050

Table 5.050 - Water Quantity - 09-045.AR3																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-518.001	0.24	3.0	3.5	5.8	7	80	0.5	0.7	1.4	7	82	0.5	0.7	1.5	0.1	0.0	0.1
C AR-518.002	1.08	3.0	3.5	5.8	26	75	0.9	1.3	3.2	26	76	1.0	1.4	3.3	0.1	0.1	0.1
C 240.001	1.99	3.0	3.5	5.8	25	76	1.9	2.6	6.2	25	77	2.0	2.7	6.4	0.1	0.1	0.2
C 240.002	60.17	3.0	3.5	5.8	31	79	59.3	79.4	180.6	31	79	59.3	79.4	180.6	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-045.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.050

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.050 - Energy Balance - 09-045.AR3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-518.001	0.5	0.02	0.5	0.03	0.4	0.02	0.4	not met	0.1	exceeded	0.1	0.4	exceeded	0.2
C AR-518.002	0.9	0.08	1.0	0.08	0.9	0.08	0.9	not met	0.1	exceeded	0.1	0.9	exceeded	0.1
C 240.001	1.9	0.15	2.0	0.16	1.9	0.15	1.8	not met	0.2	exceeded	0.1	1.8	exceeded	0.2
C 240.002	59.3	5.37	59.3	5.37	59.3	5.37	59.3	met	n/a	not exceeded	n/a	59.3	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-045.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.050

Table 7.050 - Culvert Sizing - 09-045.AR3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-518.001	0.24	1.5	12	< 6	EC-3 Type B
C AR-518.002	1.08	3.3	12	< 6	EC-3 Type B
C 240.001	1.99	6.4	18	< 8	EC-1 Class A1
C 240.002	60.17	180.6	multiple	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 09-045.AR3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.050

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.050 - Roadside Ditch Sizing - 09-045.AR3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-518.001	0.7	1.5	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-518.002	1.4	3.3	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 240.001	2.7	6.4	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C 240.002	79.4	180.6	0.01	Type III	5.0	1.0	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 09-048.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.051

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-048.AR1	C AR-519.001	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.002	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.003	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.004	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.005	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.006	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74
09-048.AR1	C AR-519.007	6	AR-519	Buckingham	Horsepen Creek-Slate River	18	74

Water Quantity for Culverts and Ditches
Access Road: 09-048.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.051

Table 5.051 - Water Quantity - 09-048.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-519.001	0.29	3.0	3.5	5.8	2	77	0.6	0.8	1.8	2	80	0.7	0.9	2.0	0.1	0.1	0.1
C AR-519.002	0.13	3.0	3.5	5.8	1	78	0.3	0.4	0.9	1	81	0.3	0.4	0.9	0.0	0.1	0.1
C AR-519.003	10.73	3.0	3.5	5.8	20	70	7.4	11.1	31.3	20	70	7.4	11.1	31.3	0.0	0.0	0.0
C AR-519.004	145.08	3.0	3.5	5.8	36	72	79.4	115.8	314.3	36	72	79.4	115.8	314.3	0.0	0.0	0.0
C AR-519.005	1.11	3.0	3.5	5.8	10	77	1.8	2.4	5.5	10	77	1.8	2.4	5.5	0.0	0.0	0.0
C AR-519.006	2.77	3.0	3.5	5.8	18	79	3.8	5.1	11.4	18	79	3.8	5.1	11.4	0.0	0.0	0.0
C AR-519.007	2.28	3.0	3.5	5.8	16	77	2.9	4.0	9.3	16	77	2.9	4.0	9.3	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-048.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.051

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.051 - Energy Balance - 09-048.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-519.001	0.6	0.02	0.7	0.03	0.4	0.02	0.5	not met	0.2	exceeded	0.1	0.2	exceeded	0.5
C AR-519.002	0.3	0.01	0.3	0.01	0.2	0.01	0.3	not met	0.1	exceeded	0.0	0.1	exceeded	0.2
C AR-519.003	7.4	0.56	7.4	0.56	7.4	0.56	7.4	met	n/a	not exceeded	n/a	7.4	exceeded	0.0
C AR-519.004	79.4	8.60	79.4	8.60	79.4	8.60	79.4	met	n/a	not exceeded	n/a	79.4	exceeded	0.0
C AR-519.005	1.8	0.09	1.8	0.09	1.7	0.09	1.8	met	n/a	not exceeded	n/a	1.6	exceeded	0.2
C AR-519.006	3.8	0.25	3.8	0.25	3.6	0.24	3.8	met	n/a	not exceeded	n/a	3.4	exceeded	0.4
C AR-519.007	2.9	0.18	2.9	0.18	2.9	0.18	2.9	met	n/a	not exceeded	n/a	2.9	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 09-048.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.051

Table 7.051 - Culvert Sizing - 09-048.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-519.001	0.29	2.0	12	< 6	EC-3 Type B
C AR-519.002	0.13	0.9	12	< 6	EC-3 Type B
C AR-519.003	10.73	31.3	30	< 8	EC-1 Class A1
C AR-519.004	145.08	314.3	multiple	< 8	EC-1 Class A1
C AR-519.005	1.11	5.5	18	< 8	EC-1 Class A1
C AR-519.006	2.77	11.4	18	< 8	EC-1 Class A1
C AR-519.007	2.28	9.3	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 09-048.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.051

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.051 - Roadside Ditch Sizing - 09-048.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-519.001	0.9	2.0	0.05	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-519.002	0.4	0.9	0.12	Type I	1.0	2.5	2.4	Riprap (D50 - 6 in)
C AR-519.003	11.1	31.3	0.05	Type II	2.0	2.6	2.4	Riprap (D50 - 6 in)
C AR-519.004	115.8	314.3	0.01	Type III	6.5	1.2	2.4	Riprap (D50 - 6 in)
C AR-519.005	2.4	5.5	0.11	Type I	1.5	4.4	4.8	Riprap (D50 - 12 in)
C AR-519.006	5.1	11.4	0.07	Type I	2.0	4.1	4.8	Riprap (D50 - 12 in)
C AR-519.007	4.0	9.3	0.03	Type I	2.0	1.8	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 09-080-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.052

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-080-AR 1	C 247.001	6	247	Buckingham	Bishop Creek-Willis River	20	76
09-080-AR 1	C 247.002	6	247	Buckingham	Bishop Creek-Willis River	20	76
09-080-AR 1	C 247.003	6	247	Buckingham	Bishop Creek-Willis River	20	76
09-080-AR 1	C 247.004	6	247	Buckingham	Bishop Creek-Willis River	20	76
09-080-AR 1	C 247.005	6	247	Buckingham	Bishop Creek-Willis River	20	76
09-080-AR 1	C 247.006	6	247	Buckingham	Bishop Creek-Willis River	20	76

Water Quantity for Culverts and Ditches
Access Road: 09-080-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.052

Table 5.052 - Water Quantity - 09-080-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 247.001	0.23	3.0	3.5	5.8	5	67	0.2	0.3	1.0	4	70	0.3	0.4	1.2	0.1	0.1	0.2
C 247.002	0.82	3.0	3.5	5.8	15	55	0.1	0.2	1.4	15	58	0.1	0.3	1.6	0.1	0.1	0.3
C 247.003	2.21	3.0	3.5	5.8	16	60	0.5	1.1	4.7	16	61	0.6	1.2	4.9	0.1	0.1	0.2
C 247.004	0.38	3.0	3.5	5.8	22	55	0.0	0.1	0.5	22	57	0.0	0.1	0.6	0.0	0.0	0.1
C 247.005	1.20	3.0	3.5	5.8	22	55	0.1	0.2	1.6	22	57	0.1	0.3	1.8	0.1	0.1	0.2
C 247.006	1.54	3.0	3.5	5.8	22	57	0.2	0.4	2.3	23	58	0.2	0.5	2.4	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-080-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.052

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.052 - Energy Balance - 09-080-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 247.001	0.2	0.01	0.3	0.01	0.2	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 247.002	0.1	0.01	0.1	0.02	0.1	0.01	0.0	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 247.003	0.5	0.05	0.6	0.06	0.5	0.05	0.5	not met	0.1	exceeded	0.1	0.5	exceeded	0.1
C 247.004	0.0	0.01	0.0	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 247.005	0.1	0.02	0.1	0.02	0.1	0.02	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 247.006	0.2	0.03	0.2	0.03	0.2	0.03	0.1	not met	0.1	exceeded	0.0	0.1	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-080-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.052

Table 7.052 - Culvert Sizing - 09-080-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 247.001	0.23	1.2	12	< 6	EC-3 Type B
C 247.002	0.82	1.6	12	< 6	EC-3 Type B
C 247.003	2.21	4.9	18	< 8	EC-1 Class A1
C 247.004	0.38	0.6	12	< 6	EC-3 Type B
C 247.005	1.20	1.8	12	< 6	EC-3 Type B
C 247.006	1.54	2.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 09-080-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.052

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.052 - Roadside Ditch Sizing - 09-080-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 247.001	0.4	1.2	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 247.002	0.3	1.6	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 247.003	1.2	4.9	0.03	Type I	2.0	1.2	2.4	Riprap (D50 - 6 in)
C 247.004	0.1	0.6	0.02	Type I	1.0	0.2	0.4	Grass Lined
C 247.005	0.3	1.8	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 247.006	0.5	2.4	0.01	Type I	1.5	0.3	0.4	Grass Lined

Tables 4.053 to 8.053

Temporary Access Road, Spread 6

Table 4.053 Culvert List

Table 5.053 Water Quantity

Table 7.053 Culvert Sizing

Table 8.053 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 09-094-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.053

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-094-AR 1	C AR-700.001	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.002	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.003	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.004	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.005	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.006	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.007	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.008	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.009	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C AR-700.010	6	AR-700	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C 249.012	6	249	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C 249.013	6	249	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C 249.014	6	249	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C 249.015	6	249	Buckingham	Bishop Creek-Willis River	20	T-2
09-094-AR 1	C 249.016	6	249	Buckingham	Bishop Creek-Willis River	20	T-2

Water Quantity for Culverts and Ditches

Access Road: 09-094-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.053

Table 5.053 - Water Quantity - 09-094-AR 1									
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Construction Conditions				
					Tc (min)	Weighted CN	Q (cfs)		
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr
C AR-700.001	0.46	3.0	3.5	5.8	36	72	0.3	0.4	1.0
C AR-700.002	0.22	3.0	3.5	5.8	15	74	0.2	0.3	0.9
C AR-700.003	0.57	3.0	3.5	5.8	22	72	0.4	0.6	1.7
C AR-700.004	0.69	3.0	3.5	5.8	23	72	0.5	0.7	2.0
C AR-700.005	0.92	3.0	3.5	5.8	31	73	0.6	0.9	2.3
C AR-700.006	0.33	3.0	3.5	5.8	21	80	0.4	0.6	1.3
C AR-700.007	13187.97	3.0	3.5	5.8	345	70	1145.2	1674.5	4757.6
C AR-700.008	0.60	3.0	3.5	5.8	7	73	0.8	1.2	3.0
C AR-700.009	0.58	3.0	3.5	5.8	10	75	0.8	1.1	2.7
C AR-700.010	0.17	3.0	3.5	5.8	7	80	0.4	0.5	1.0
C 249.012	0.27	3.0	3.5	5.8	28	71	0.2	0.2	0.7
C 249.013	0.17	3.0	3.5	5.8	9	77	0.3	0.4	0.9
C 249.014	0.90	3.0	3.5	5.8	17	72	0.8	1.2	3.1
C 249.015	0.29	3.0	3.5	5.8	20	72	0.2	0.3	0.9
C 249.016	31.25	3.0	3.5	5.8	25	70	18.8	28.2	80.2

Water Quantity for Culverts and Ditches

Access Road: 09-094-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.053

Table 7.053 - Culvert Sizing - 09-094-AR 1

Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-700.001	0.46	1.0	12	< 6	EC-3 Type B
C AR-700.002	0.22	0.9	12	< 6	EC-3 Type B
C AR-700.003	0.57	1.7	12	< 6	EC-3 Type B
C AR-700.004	0.69	2.0	12	< 6	EC-3 Type B
C AR-700.005	0.92	2.3	12	< 6	EC-3 Type B
C AR-700.006	0.33	1.3	12	< 6	EC-3 Type B
C AR-700.007	13187.97	4757.6	multiple	< 8	EC-1 Class A1
C AR-700.008	0.60	3.0	12	< 6	EC-3 Type B
C AR-700.009	0.58	2.7	12	< 6	EC-3 Type B
C AR-700.010	0.17	1.0	12	< 6	EC-3 Type B
C 249.012	0.27	0.7	12	< 6	EC-3 Type B
C 249.013	0.17	0.9	12	< 6	EC-3 Type B
C 249.014	0.90	3.1	12	< 6	EC-3 Type B
C 249.015	0.29	0.9	12	< 6	EC-3 Type B
C 249.016	31.25	80.2	48	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 09-094-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.053

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 3: Where the calculated shear stress exceeds 4.8lbs/sf, alternative lining materials will be considered, including, but not limited to grouted riprap, permanent turf reinforcement mats, and articulated concrete block.

Table 8.053 - Roadside Ditch Sizing - 09-094-AR 1

Relief Culvert ID	$Q_{2\text{-yr Dev.}}$ (cfs)	$Q_{10\text{-yr Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-700.001	0.4	1.0	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR-700.002	0.3	0.9	0.04	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-700.003	0.6	1.7	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-700.004	0.7	2.0	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-700.005	0.9	2.3	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-700.006	0.6	1.3	0.02	Type I	1.5	0.4	0.4	Grass Lined
C AR-700.007	1674.5	4757.6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
C AR-700.008	1.2	3.0	0.26	Type I	1.5	6.9	See Note 3	See Note 3
C AR-700.009	1.1	2.7	0.25	Type I	1.5	6.7	See Note 3	See Note 3
C AR-700.010	0.5	1.0	0.12	Type I	1.0	2.4	2.4	Riprap (D50 - 6 in)
C 249.012	0.2	0.7	0.04	Type I	1.0	0.8	2.4	Riprap (D50 - 6 in)
C 249.013	0.4	0.9	0.09	Type I	1.0	1.8	2.4	Riprap (D50 - 6 in)
C 249.014	1.2	3.1	0.06	Type I	1.5	2.1	2.4	Riprap (D50 - 6 in)
C 249.015	0.3	0.9	0.11	Type I	1.0	2.1	2.4	Riprap (D50 - 6 in)
C 249.016	28.2	80.2	0.01	Type III	3.0	0.6	2.4	Riprap (D50 - 6 in)

Tables 4.054-057 to 8.054-057

Permanent Access Roads, Spread 6

Tables 4.054-057 Culvert List

Tables 5.054-057 Water Quantity

Tables 6.054-057 Energy Balance

Tables 7.054-057 Culvert Sizing

Tables 8.054-057 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 09-103.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.054

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-103.AR2	C AR-700.012	6	AR-700	Buckingham	Bishop Creek-Willis River	21	77
09-103.AR2	C AR-700.013	6	AR-700	Buckingham	Bishop Creek-Willis River	21	77
09-103.AR2	C AR-700.014	6	AR-700	Buckingham	Bishop Creek-Willis River	21	77
09-103.AR2	C AR-700.015	6	AR-700	Buckingham	Bishop Creek-Willis River	21	77
09-103.AR2	C AR-700.016	6	AR-700	Buckingham	Bishop Creek-Willis River	21	77

Water Quantity for Culverts and Ditches
Access Road: 09-103.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.054

Table 5.054 - Water Quantity - 09-103.AR2

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-700.012	0.26	3.0	3.5	5.8	14	75	0.3	0.4	1.1	14	76	0.3	0.5	1.1	0.0	0.0	0.0
C AR-700.013	0.33	3.0	3.5	5.8	14	75	0.4	0.6	1.4	14	76	0.4	0.6	1.4	0.0	0.0	0.0
C AR-700.014	0.57	3.0	3.5	5.8	12	73	0.7	0.9	2.4	12	74	0.7	1.0	2.5	0.0	0.1	0.1
C AR-700.015	0.72	3.0	3.5	5.8	22	71	0.5	0.8	2.1	22	71	0.5	0.8	2.1	0.0	0.0	0.0
C AR-700.016	0.83	3.0	3.5	5.8	16	56	0.1	0.2	1.4	16	58	0.1	0.3	1.6	0.1	0.1	0.2

Water Quantity for Culverts and Ditches
Access Road: 09-103.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.054

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.054 - Energy Balance - 09-103.AR2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-700.012	0.3	0.02	0.3	0.02	0.3	0.02	0.3	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-700.013	0.4	0.02	0.4	0.03	0.4	0.02	0.4	not met	0.0	exceeded	0.0	0.3	exceeded	0.1
C AR-700.014	0.7	0.04	0.7	0.04	0.6	0.03	0.6	not met	0.1	exceeded	0.0	0.5	exceeded	0.2
C AR-700.015	0.5	0.04	0.5	0.04	0.5	0.04	0.5	met	n/a	not exceeded	n/a	0.4	exceeded	0.1
C AR-700.016	0.1	0.01	0.1	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-103.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.054

Table 7.054 - Culvert Sizing - 09-103.AR2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-700.012	0.26	1.1	12	< 6	EC-3 Type B
C AR-700.013	0.33	1.4	12	< 6	EC-3 Type B
C AR-700.014	0.57	2.5	12	< 6	EC-3 Type B
C AR-700.015	0.72	2.1	12	< 6	EC-3 Type B
C AR-700.016	0.83	1.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 09-103.AR2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.054

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.054 - Roadside Ditch Sizing - 09-103.AR2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-700.012	0.5	1.1	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-700.013	0.6	1.4	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-700.014	1.0	2.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-700.015	0.8	2.1	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-700.016	0.3	1.6	0.01	Type I	1.5	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 09-113-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.055

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-113-AR 1	C AR-700.017	6	AR-700	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C AR-700.018	6	AR-700	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C AR-700.019	6	AR-700	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C AR-700.020	6	AR-700	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.001	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.002	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.003	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.004	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.005	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.006	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.007	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.008	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.009	6	252	Buckingham	Bishop Creek-Willis River	24	78
09-113-AR 1	C 252.010	6	252	Buckingham	Bishop Creek-Willis River	24	78

Water Quantity for Culverts and Ditches
Access Road: 09-113-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.055

Table 5.055 - Water Quantity - 09-113-AR 1																	
09-113-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-700.017	1.76	3.0	3.5	5.8	14	73	1.9	2.7	6.9	14	73	1.9	2.7	6.9	0.0	0.0	0.0
C AR-700.018	8.07	3.0	3.5	5.8	11	64	4.3	7.3	24.8	11	64	4.3	7.3	24.8	0.0	0.0	0.0
C AR-700.019	0.62	3.0	3.5	5.8	15	71	0.6	0.8	2.2	15	72	0.6	0.9	2.3	0.0	0.0	0.1
C AR-700.020	4.42	3.0	3.5	5.8	27	64	1.3	2.3	8.3	27	64	1.3	2.3	8.3	0.0	0.0	0.0
C 252.001	3.18	3.0	3.5	5.8	10	60	1.0	2.0	8.3	10	60	1.0	2.0	8.3	0.0	0.0	0.0
C 252.002	0.16	3.0	3.5	5.8	13	62	0.1	0.1	0.4	13	66	0.1	0.2	0.5	0.0	0.1	0.1
C 252.003	0.41	3.0	3.5	5.8	7	57	0.1	0.2	1.1	7	59	0.1	0.3	1.2	0.1	0.1	0.1
C 252.004	0.76	3.0	3.5	5.8	11	57	0.1	0.3	1.6	11	59	0.2	0.4	1.8	0.1	0.1	0.2
C 252.005	0.84	3.0	3.5	5.8	12	61	0.3	0.6	2.2	12	62	0.3	0.6	2.3	0.1	0.1	0.1
C 252.006	0.53	3.0	3.5	5.8	14	58	0.1	0.2	1.1	14	59	0.1	0.3	1.2	0.0	0.0	0.1
C 252.007	0.24	3.0	3.5	5.8	7	58	0.1	0.1	0.7	7	60	0.1	0.2	0.7	0.0	0.0	0.1
C 252.008	0.14	3.0	3.5	5.8	6	60	0.1	0.1	0.4	6	62	0.1	0.1	0.5	0.0	0.0	0.0
C 252.009	0.19	3.0	3.5	5.8	9	59	0.1	0.1	0.5	9	62	0.1	0.2	0.6	0.0	0.0	0.1
C 252.010	0.83	3.0	3.5	5.8	12	58	0.2	0.4	1.8	12	59	0.2	0.4	1.9	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 09-113-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.055

Column Legend

09-113-AR 1	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.055 - Energy Balance - 09-113-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-700.017	1.9	0.11	1.9	0.11	1.6	0.10	1.9	met	n/a	not exceeded	n/a	1.4	exceeded	0.5
C AR-700.018	4.3	0.27	4.3	0.27	4.3	0.27	4.3	met	n/a	not exceeded	n/a	4.3	exceeded	0.0
C AR-700.019	0.6	0.04	0.6	0.04	0.6	0.04	0.5	not met	0.1	exceeded	0.0	0.5	exceeded	0.1
C AR-700.020	1.3	0.15	1.3	0.15	1.3	0.15	1.3	met	n/a	not exceeded	n/a	1.3	exceeded	0.0
C 252.001	1.0	0.07	1.0	0.07	0.8	0.07	1.0	met	n/a	not exceeded	n/a	0.8	exceeded	0.2
C 252.002	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 252.003	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 252.004	0.1	0.01	0.2	0.02	0.1	0.01	0.1	not met	0.1	exceeded	0.1	0.1	exceeded	0.1
C 252.005	0.3	0.02	0.3	0.02	0.2	0.02	0.3	not met	0.1	exceeded	0.1	0.2	exceeded	0.2
C 252.006	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 252.007	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 252.008	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 252.009	0.1	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 252.010	0.2	0.02	0.2	0.02	0.1	0.01	0.2	not met	0.0	exceeded	0.0	0.0	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 09-113-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.055

Table 7.055 - Culvert Sizing - 09-113-AR 1					
09-113-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-700.017	1.76	6.9	18	< 8	EC-1 Class A1
C AR-700.018	8.07	24.8	30	< 8	EC-1 Class A1
C AR-700.019	0.62	2.3	12	< 6	EC-3 Type B
C AR-700.020	4.42	8.3	18	< 8	EC-1 Class A1
C 252.001	3.18	8.3	18	< 8	EC-1 Class A1
C 252.002	0.16	0.5	12	< 6	EC-3 Type B
C 252.003	0.41	1.2	12	< 6	EC-3 Type B
C 252.004	0.76	1.8	12	< 6	EC-3 Type B
C 252.005	0.84	2.3	12	< 6	EC-3 Type B
C 252.006	0.53	1.2	12	< 6	EC-3 Type B
C 252.007	0.24	0.7	12	< 6	EC-3 Type B
C 252.008	0.14	0.5	12	< 6	EC-3 Type B
C 252.009	0.19	0.6	12	< 6	EC-3 Type B
C 252.010	0.83	1.9	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 09-113-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.055

Channel Types
09-113-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.055 - Roadside Ditch Sizing - 09-113-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-700.017	2.7	6.9	0.04	Type I	2.0	2.0	2.4	Riprap (D50 - 6 in)
C AR-700.018	7.3	24.8	0.03	Type II	2.0	1.6	2.4	Riprap (D50 - 6 in)
C AR-700.019	0.9	2.3	0.05	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C AR-700.020	2.3	8.3	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)
C 252.001	2.0	8.3	0.06	Type I	2.0	2.4	2.4	Riprap (D50 - 6 in)
C 252.002	0.2	0.5	0.08	Type I	1.0	1.2	2.4	Riprap (D50 - 6 in)
C 252.003	0.3	1.2	0.06	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C 252.004	0.4	1.8	0.16	Type I	1.5	3.1	4.8	Riprap (D50 - 12 in)
C 252.005	0.6	2.3	0.06	Type I	1.5	1.5	2.4	Riprap (D50 - 6 in)
C 252.006	0.3	1.2	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C 252.007	0.2	0.7	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C 252.008	0.1	0.5	0.04	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C 252.009	0.2	0.6	0.04	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C 252.010	0.4	1.9	0.08	Type I	1.5	1.8	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 09-129-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.056

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
09-129-AR 2	C AR-701.001	6	AR-701	Buckingham	Little Willis River	31	80
09-129-AR 2	C AR-701.002	6	AR-701	Buckingham	Little Willis River	31	80
09-129-AR 2	C AR-701.003	6	AR-701	Buckingham	Little Willis River	31	80
09-129-AR 2	C AR-701.004	6	AR-701	Buckingham	Little Willis River	31	79, 80
09-129-AR 2	C AR-701.005	6	AR-701	Buckingham	Little Willis River	31	79, 80
09-129-AR 2	C AR-701.006	6	AR-701	Buckingham	Little Willis River	31	79, 80
09-129-AR 2	C AR-701.007	6	AR-701	Buckingham	Little Willis River	31	79, 80
09-129-AR 2	C AR-701.008	6	AR-701	Buckingham	Little Willis River	31	79
09-129-AR 2	C AR-701.009	6	AR-701	Buckingham	Little Willis River	31	79
09-129-AR 2	C 255.001	6	255	Buckingham	Little Willis River	31	79
09-129-AR 2	C 255.002	6	255	Buckingham	Little Willis River	31	79
09-129-AR 2	C 255.003	6	255	Buckingham	Little Willis River	31	79

Water Quantity for Culverts and Ditches
Access Road: 09-129-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.056

Table 5.056 - Water Quantity - 09-129-AR 2																	
09-113-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-701.001	3.71	3.0	3.5	5.8	17	73	3.6	5.1	13.0	17	73	3.6	5.1	13.0	0.0	0.0	0.0
C AR-701.002	1.18	3.0	3.5	5.8	16	71	1.0	1.5	4.0	16	72	1.1	1.6	4.1	0.1	0.1	0.1
C AR-701.003	1.77	3.0	3.5	5.8	17	72	1.6	2.3	6.1	17	72	1.6	2.3	6.1	0.0	0.0	0.0
C AR-701.004	22.57	3.0	3.5	5.8	30	75	17.6	24.7	61.3	30	75	17.6	24.7	61.3	0.0	0.0	0.0
C AR-701.005	0.18	3.0	3.5	5.8	15	70	0.1	0.2	0.6	15	72	0.2	0.2	0.6	0.0	0.0	0.0
C AR-701.006	0.45	3.0	3.5	5.8	17	71	0.4	0.5	1.5	17	71	0.4	0.5	1.5	0.0	0.0	0.0
C AR-701.007	9.15	3.0	3.5	5.8	25	73	6.9	9.8	25.7	25	73	6.9	9.8	25.7	0.0	0.0	0.0
C AR-701.008	0.52	3.0	3.5	5.8	23	71	0.4	0.5	1.5	23	72	0.4	0.6	1.5	0.0	0.0	0.1
C AR-701.009	0.66	3.0	3.5	5.8	29	71	0.4	0.6	1.6	29	72	0.4	0.6	1.6	0.0	0.0	0.0
C 255.001	0.65	3.0	3.5	5.8	31	71	0.4	0.5	1.5	31	72	0.4	0.6	1.6	0.0	0.0	0.1
C 255.002	3.33	3.0	3.5	5.8	39	76	2.3	3.2	7.8	39	76	2.3	3.2	7.8	0.0	0.0	0.0
C 255.003	3.31	3.0	3.5	5.8	40	77	2.4	3.3	7.8	40	77	2.4	3.3	7.8	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 09-129-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.056

Column Legend

09-113-AR 1	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.056 - Energy Balance - 09-129-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-701.001	3.6	0.24	3.6	0.24	6.5	0.24	3.6	met	n/a	not exceeded	n/a	6.5	not exceeded	n/a
C AR-701.002	1.0	0.07	1.1	0.07	1.8	0.07	0.9	not met	0.2	exceeded	0.1	1.7	not exceeded	n/a
C AR-701.003	1.6	0.11	1.6	0.11	2.9	0.11	1.6	met	n/a	not exceeded	n/a	2.9	not exceeded	n/a
C AR-701.004	17.6	1.61	17.6	1.61	44.6	1.63	17.6	met	n/a	not exceeded	n/a	45.2	not exceeded	n/a
C AR-701.005	0.1	0.01	0.2	0.01	0.2	0.01	0.1	not met	0.1	exceeded	0.0	0.2	not exceeded	n/a
C AR-701.006	0.4	0.03	0.4	0.03	0.6	0.02	0.4	met	n/a	not exceeded	n/a	0.6	not exceeded	n/a
C AR-701.007	6.9	0.58	6.9	0.58	16.0	0.59	6.9	met	n/a	not exceeded	n/a	16.2	not exceeded	n/a
C AR-701.008	0.4	0.03	0.4	0.03	0.7	0.03	0.3	not met	0.1	exceeded	0.0	0.6	not exceeded	n/a
C AR-701.009	0.4	0.04	0.4	0.04	1.0	0.04	0.4	not met	0.1	exceeded	0.0	0.9	not exceeded	n/a
C 255.001	0.4	0.04	0.4	0.04	0.9	0.03	0.3	not met	0.1	exceeded	0.0	0.8	not exceeded	n/a
C 255.002	2.3	0.25	2.3	0.25	7.0	0.26	2.3	met	n/a	not exceeded	n/a	7.1	not exceeded	n/a
C 255.003	2.4	0.26	2.4	0.26	7.3	0.27	2.4	met	n/a	not exceeded	n/a	7.5	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 09-129-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.056

Table 7.056 - Culvert Sizing - 09-129-AR 2					
09-113-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-701.001	3.71	13.0	24	< 8	EC-1 Class A1
C AR-701.002	1.18	4.1	18	< 8	EC-1 Class A1
C AR-701.003	1.77	6.1	18	< 8	EC-1 Class A1
C AR-701.004	22.57	61.3	42	< 8	EC-1 Class A1
C AR-701.005	0.18	0.6	12	< 6	EC-3 Type B
C AR-701.006	0.45	1.5	12	< 6	EC-3 Type B
C AR-701.007	9.15	25.7	30	< 8	EC-1 Class A1
C AR-701.008	0.52	1.5	12	< 6	EC-3 Type B
C AR-701.009	0.66	1.6	12	< 6	EC-3 Type B
C 255.001	0.65	1.6	12	< 6	EC-3 Type B
C 255.002	3.33	7.8	18	< 8	EC-1 Class A1
C 255.003	3.31	7.8	18	< 8	EC-1 Class A1
#REF!					
#REF!					

Water Quantity for Culverts and Ditches
Access Road: 09-129-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.056

Channel Types
09-113-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.056 - Roadside Ditch Sizing - 09-129-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-701.001	5.1	13.0	0.03	Type I	2.0	2.2	2.4	Riprap (D50 - 6 in)
C AR-701.002	1.6	4.1	0.03	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-701.003	2.3	6.1	0.04	Type I	2.0	1.8	2.4	Riprap (D50 - 6 in)
C AR-701.004	24.7	61.3	0.01	Type III	3.0	0.4	0.4	Grass Lined
C AR-701.005	0.2	0.6	0.07	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C AR-701.006	0.5	1.5	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-701.007	9.8	25.7	0.01	Type III	2.0	0.3	0.4	Grass Lined
C AR-701.008	0.6	1.5	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-701.009	0.6	1.6	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C 255.001	0.6	1.6	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 255.002	3.2	7.8	0.02	Type I	2.0	1.0	2.4	Riprap (D50 - 6 in)
C 255.003	3.3	7.8	0.02	Type I	2.0	1.0	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches

Access Road: 10-007-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.057

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
10-007-AR 1	C 256.001	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.002	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.003	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.004	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.005	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.006	6	256	Cumberland	Little Willis River	33	81
10-007-AR 1	C 256.007	6	256	Cumberland	Little Willis River	33	81

Water Quantity for Culverts and Ditches
Access Road: 10-007-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.057

Table 5.057 - Water Quantity - 10-007-AR 1																	
09-113-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 256.001	3.79	3.0	3.5	5.8	39	72	2.0	2.8	7.7	39	72	2.0	2.9	7.7	0.0	0.0	0.0
C 256.002	4.33	3.0	3.5	5.8	25	67	1.9	3.1	9.8	25	66	1.7	2.8	9.4	-0.2	-0.3	-0.4
C 256.003	0.98	3.0	3.5	5.8	19	68	0.6	0.9	2.7	19	69	0.6	1.0	2.8	0.1	0.1	0.1
C 256.004	0.55	3.0	3.5	5.8	17	74	0.6	0.8	2.0	17	75	0.6	0.9	2.1	0.0	0.0	0.1
C 256.005	0.23	3.0	3.5	5.8	14	74	0.3	0.4	0.9	14	76	0.3	0.4	1.0	0.0	0.0	0.1
C 256.006	0.22	3.0	3.5	5.8	14	72	0.2	0.3	0.8	14	72	0.2	0.3	0.8	0.0	0.0	0.0
C 256.007	0.36	3.0	3.5	5.8	17	71	0.3	0.4	1.2	17	71	0.3	0.4	1.2	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 10-007-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.057

Column Legend

09-113-AR 1	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.057 - Energy Balance - 10-007-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 256.001	2.0	0.22	2.0	0.22	2.0	0.22	2.0	met	n/a	not exceeded	n/a	2.0	exceeded	0.0
C 256.002	1.9	0.18	1.7	0.17	1.9	0.18	2.1	met	n/a	not exceeded	n/a	2.1	not exceeded	n/a
C 256.003	0.6	0.05	0.6	0.05	0.6	0.05	0.5	not met	0.1	exceeded	0.1	0.5	exceeded	0.1
C 256.004	0.6	0.04	0.6	0.04	0.5	0.03	0.5	not met	0.1	exceeded	0.0	0.4	exceeded	0.2
C 256.005	0.3	0.02	0.3	0.02	0.2	0.01	0.2	not met	0.1	exceeded	0.0	0.2	exceeded	0.1
C 256.006	0.2	0.01	0.2	0.01	0.2	0.01	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.0
C 256.007	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 10-007-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.057

Table 7.057 - Culvert Sizing - 10-007-AR 1					
09-113-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 256.001	3.79	7.7	18	< 8	EC-1 Class A1
C 256.002	4.33	9.4	18	< 8	EC-1 Class A1
C 256.003	0.98	2.8	12	< 6	EC-3 Type B
C 256.004	0.55	2.1	12	< 6	EC-3 Type B
C 256.005	0.23	1.0	12	< 6	EC-3 Type B
C 256.006	0.22	0.8	12	< 6	EC-3 Type B
C 256.007	0.36	1.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 10-007-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.057

Channel Types
09-113-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.057 - Roadside Ditch Sizing - 10-007-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 256.001	2.9	7.7	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 256.002	2.8	9.4	0.01	Type II	2.0	0.5	2.4	Riprap (D50 - 6 in)
C 256.003	1.0	2.8	0.03	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C 256.004	0.9	2.1	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 256.005	0.4	1.0	0.04	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 256.006	0.3	0.8	0.02	Type I	1.0	0.4	0.4	Grass Lined
C 256.007	0.4	1.2	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)

Tables 4.058 to 8.058

Temporary Access Road, Spread 6

Table 4.058 Culvert List

Table 5.058 Water Quantity

Table 7.058 Culvert Sizing

Table 8.058 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 10-061.AR-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.058

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
10-061.AR-AR 1	C 262.001	6	262	Cumberland	Angola Creek-Appomattox River	199	T-3
10-061.AR-AR 1	C 262.002	6	262	Cumberland	Angola Creek-Appomattox River	199	T-3
10-061.AR-AR 1	C 262.003	6	262	Cumberland	Angola Creek-Appomattox River	199	T-3
10-061.AR-AR 1	C 262.004	6	262	Cumberland	Angola Creek-Appomattox River	199	T-3
10-061.AR-AR 1	C 262.005	6	262	Cumberland	Angola Creek-Appomattox River	199	T-3

Water Quantity for Culverts and Ditches

Access Road: 10-061.AR-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.058

Table 5.058 - Water Quantity - 10-061.AR-AR 1									
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Construction Conditions				
					Tc (min)	Weighted CN	Q (cfs)		
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr
C 262.001	0.18	3.0	3.5	5.8	5	69	0.2	0.3	0.8
C 262.002	0.07	3.0	3.5	5.8	6	70	0.1	0.1	0.3
C 262.003	0.18	3.0	3.5	5.8	6	68	0.2	0.3	0.8
C 262.004	0.35	3.0	3.5	5.8	18	61	0.1	0.2	0.7
C 262.005	0.11	3.0	3.5	5.8	27	57	0.0	0.0	0.1

Water Quantity for Culverts and Ditches

Access Road: 10-061.AR-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.058

Table 7.058 - Culvert Sizing - 10-061.AR-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 262.001	0.18	0.8	12	< 6	EC-3 Type B
C 262.002	0.07	0.3	12	< 6	EC-3 Type B
C 262.003	0.18	0.8	12	< 6	EC-3 Type B
C 262.004	0.35	0.7	12	< 6	EC-3 Type B
C 262.005	0.11	0.1	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches

Access Road: 10-061.AR-AR 1
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.058

Channel Types

Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft

Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft

Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies

Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.058 - Roadside Ditch Sizing - 10-061.AR-AR 1

Relief Culvert ID	$Q_{2\text{-yr Dev.}}$ (cfs)	$Q_{10\text{-yr Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 262.001	0.3	0.8	0.04	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 262.002	0.1	0.3	0.01	Type I	1.0	0.1	0.4	Grass Lined
C 262.003	0.3	0.8	0.12	Type I	1.0	2.0	2.4	Riprap (D50 - 6 in)
C 262.004	0.2	0.7	0.08	Type I	1.0	1.3	2.4	Riprap (D50 - 6 in)
C 262.005	0.0	0.1	0.01	Type I	1.0	0.0	0.4	Grass Lined

Tables 4.059-061 to 8.059-061

Permanent Access Roads, Spread 6

Tables 4.059-061 Culvert List

Tables 5.059-061 Water Quantity

Tables 6.059-061 Energy Balance

Tables 7.059-061 Culvert Sizing

Tables 8.059-061 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 12-012-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.059

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
12-012-AR 1	C AR-703.001	6	AR-703	Nottoway	Little Creek-Flat Creek	212	82, 83
12-012-AR 1	C AR-703.002	6	AR-703	Nottoway	Little Creek-Flat Creek	212	82
12-012-AR 1	C AR-703.003	6	AR-703	Nottoway	Little Creek-Flat Creek	212	82
12-012-AR 1	C AR-703.004	6	AR-703	Nottoway	Little Creek-Flat Creek	212	82

Water Quantity for Culverts and Ditches
Access Road: 12-012-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.059

Table 5.059 - Water Quantity - 12-012-AR 1																	
12-012-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-703.001	137.33	3.0	3.5	5.5	28	57	12.3	29.5	149.7	28	57	12.3	29.5	149.7	0.0	0.0	0.0
C AR-703.002	1.84	3.0	3.5	5.5	15	38	0.0	0.0	0.1	15	39	0.0	0.0	0.2	0.0	0.0	0.1
C AR-703.003	0.49	3.0	3.5	5.5	14	34	0.0	0.0	0.0	14	37	0.0	0.0	0.0	0.0	0.0	0.0
C AR-703.004	0.29	3.0	3.5	5.5	16	44	0.0	0.0	0.1	16	49	0.0	0.0	0.2	0.0	0.0	0.1

Water Quantity for Culverts and Ditches

Access Road: 12-012-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.059

Column Legend

12-012-AR 1	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.059 - Energy Balance - 12-012-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-703.001	12.3	2.28	12.3	2.28	9.6	2.02	12.3	met	n/a	not exceeded	n/a	8.5	exceeded	3.8
C AR-703.002	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-703.003	0.0	0.00	0.0	0.00	0.0	0.00	See Note	met	n/a	not exceeded	n/a	See Note	not exceeded	n/a
C AR-703.004	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 12-012-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.059

Table 7.059 - Culvert Sizing - 12-012-AR 1					
12-012-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-703.001	137.33	149.7	multiple	< 8	EC-1 Class A1
C AR-703.002	1.84	0.2	12	< 6	EC-3 Type B
C AR-703.003	0.49	0.0	12	< 6	EC-3 Type B
C AR-703.004	0.29	0.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 12-012-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.059

Channel Types
12-012-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Note 1: Some ditches associated with this access road have a 2-year, 24-hour peak discharge of less than 0.005 cfs. Therefore, the calculated shear stress is negligible and will be less than the permissible shear stress for a grass lined channel.

Table 8.059 - Roadside Ditch Sizing - 12-012-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-703.001	29.5	149.7	0.03	Type III	4.0	2.4	4.8	Riprap (D50 - 12 in)
C AR-703.002	0.0	0.2	0.02	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-703.003	0.0	0.0	0.06	Type I	1.0	See Note 1	0.4	Grass Lined
C AR-703.004	0.0	0.2	0.08	Type I	1.0	0.4	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches

Access Road: 12-028-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.060

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
12-028-AR 1	C AR-704.001	6	AR-704	Nottoway	West Creek	215	84
12-028-AR 1	C AR-704.002	6	AR-704	Nottoway	West Creek	215	84
12-028-AR 1	C 277.003	6	277	Nottoway	West Creek	215	84
12-028-AR 1	C 277.004	6	277	Nottoway	West Creek	215	84
12-028-AR 1	C 277.005	6	277	Nottoway	West Creek	215	84

Water Quantity for Culverts and Ditches
Access Road: 12-028-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.060

Table 5.060 - Water Quantity - 12-028-AR 1																	
12-028-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-704.001	0.92	3.0	3.5	5.5	19	62	0.3	0.5	1.7	19	64	0.4	0.6	1.9	0.1	0.1	0.2
C AR-704.002	0.53	3.0	3.5	5.5	11	63	0.3	0.4	1.4	11	65	0.3	0.5	1.5	0.1	0.1	0.1
C 277.003	0.10	3.0	3.5	5.5	6	63	0.1	0.1	0.3	6	66	0.1	0.1	0.4	0.0	0.0	0.1
C 277.004	0.61	3.0	3.5	5.5	23	59	0.1	0.2	0.9	23	60	0.1	0.2	0.9	0.0	0.0	0.1
C 277.005	1.76	3.0	3.5	5.5	31	58	0.2	0.4	1.9	31	59	0.2	0.5	2.0	0.0	0.1	0.1

Water Quantity for Culverts and Ditches

Access Road: 12-028-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.060

Column Legend

12-028-AR 1	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.060 - Energy Balance - 12-028-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-704.001	0.3	0.03	0.4	0.03	0.2	0.02	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C AR-704.002	0.3	0.02	0.3	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.1	0.1	exceeded	0.2
C 277.003	0.1	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 277.004	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 277.005	0.2	0.03	0.2	0.04	0.2	0.03	0.2	not met	0.1	exceeded	0.0	0.1	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 12-028-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.060

Table 7.060 - Culvert Sizing - 12-028-AR 1					
12-028-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-704.001	0.92	1.9	12	< 6	EC-3 Type B
C AR-704.002	0.53	1.5	12	< 6	EC-3 Type B
C 277.003	0.10	0.4	12	< 6	EC-3 Type B
C 277.004	0.61	0.9	12	< 6	EC-3 Type B
C 277.005	1.76	2.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches

Access Road: 12-028-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.060

Channel Types
12-028-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.060 - Roadside Ditch Sizing - 12-028-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-704.001	0.6	1.9	0.01	Type I	1.5	0.3	0.4	Grass Lined
C AR-704.002	0.5	1.5	0.01	Type I	1.5	0.4	0.4	Grass Lined
C 277.003	0.1	0.4	0.01	Type I	1.0	0.1	0.4	Grass Lined
C 277.004	0.2	0.9	0.01	Type I	1.5	0.1	0.4	Grass Lined
C 277.005	0.5	2.0	0.01	Type I	1.5	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 12-047-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.061

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
12-047-AR 1	C AR-704.003	6	AR-704	Nottoway	Little Creek-Deep Creek	217	86
12-047-AR 1	C AR-704.004	6	AR-704	Nottoway	Little Creek-Deep Creek	217	86
12-047-AR 1	C AR-704.005	6	AR-704	Nottoway	Little Creek-Deep Creek	217	86
12-047-AR 1	C AR-704.006	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85, 86
12-047-AR 1	C AR-704.007	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85, 86
12-047-AR 1	C AR-704.008	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85, 86
12-047-AR 1	C AR-704.009	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85, 86
12-047-AR 1	C AR-704.010	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85, 86
12-047-AR 1	C AR-704.011	6	AR-704	Nottoway	Little Creek-Deep Creek	217	85
12-047-AR 1	C 280.001	6	280	Nottoway	Little Creek-Deep Creek	217	T-3
12-047-AR 1	C 280.002	6	280	Nottoway	Little Creek-Deep Creek	217	T-3
12-047-AR 1	C 280.003	6	280	Nottoway	Little Creek-Deep Creek	217	T-3
12-047-AR 1	C 280.004	6	280	Nottoway	Little Creek-Deep Creek	217	T-3
12-047-AR 1	C 280.005	6	280	Nottoway	Little Creek-Deep Creek	217	T-3

Water Quantity for Culverts and Ditches
Access Road: 12-047-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.061

Table 5.061 - Water Quantity - 12-047-AR 1																	
09-113-AR 1	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-704.003	0.61	3.0	3.5	5.5	9	63	0.3	0.6	1.8	9	64	0.4	0.6	1.8	0.0	0.1	0.1
C AR-704.004	14.00	3.0	3.5	5.5	11	64	7.5	12.5	38.3	11	64	7.5	12.5	38.3	0.0	0.0	0.0
C AR-704.005	0.50	3.0	3.5	5.5	16	56	0.1	0.1	0.7	16	57	0.1	0.2	0.8	0.0	0.0	0.1
C AR-704.006	0.28	3.0	3.5	5.5	15	56	0.0	0.1	0.4	15	58	0.1	0.1	0.5	0.0	0.0	0.1
C AR-704.007	0.91	3.0	3.5	5.5	16	55	0.1	0.2	1.2	16	56	0.1	0.2	1.3	0.0	0.0	0.1
C AR-704.008	6.83	3.0	3.5	5.5	24	55	0.4	1.2	7.2	24	55	0.4	1.2	7.2	0.0	0.0	0.0
C AR-704.009	0.36	3.0	3.5	5.5	25	52	0.0	0.0	0.3	25	56	0.0	0.1	0.4	0.0	0.0	0.1
C AR-704.010	0.23	3.0	3.5	5.5	15	56	0.0	0.1	0.3	15	57	0.0	0.1	0.4	0.0	0.0	0.0
C AR-704.011	0.21	3.0	3.5	5.5	15	59	0.0	0.1	0.4	15	61	0.1	0.1	0.4	0.0	0.0	0.1
C 280.001	3.89	3.0	3.5	5.5	16	53	0.1	0.5	4.4	16	53	0.1	0.5	4.4	0.0	0.0	0.0
C 280.002	3.02	3.0	3.5	5.5	17	56	0.3	0.8	4.2	17	56	0.3	0.8	4.2	0.0	0.0	0.0
C 280.003	0.79	3.0	3.5	5.5	15	68	0.6	0.9	2.3	15	68	0.6	0.9	2.3	0.0	0.0	0.0
C 280.004	0.51	3.0	3.5	5.5	15	70	0.4	0.6	1.6	15	71	0.5	0.7	1.7	0.0	0.1	0.1
C 280.005	2.02	3.0	3.5	5.5	17	70	1.5	2.3	5.8	17	70	1.5	2.3	5.8	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 12-047-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.061

Column Legend

09-113-AR 1	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.061 - Energy Balance - 12-047-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-704.003	0.3	0.02	0.4	0.02	0.3	0.02	0.3	not met	0.1	exceeded	0.0	0.2	exceeded	0.1
C AR-704.004	7.5	0.47	7.5	0.47	7.5	0.47	7.5	met	n/a	not exceeded	n/a	7.5	exceeded	0.0
C AR-704.005	0.1	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.006	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.007	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-704.008	0.4	0.09	0.4	0.09	0.4	0.09	0.4	met	n/a	not exceeded	n/a	0.4	exceeded	0.0
C AR-704.009	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.010	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.011	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 280.001	0.1	0.04	0.1	0.04	0.1	0.03	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C 280.002	0.3	0.05	0.3	0.05	0.2	0.04	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C 280.003	0.6	0.04	0.6	0.04	0.5	0.03	0.6	met	n/a	not exceeded	n/a	0.5	exceeded	0.1
C 280.004	0.4	0.03	0.5	0.03	0.4	0.03	0.4	not met	0.1	exceeded	0.0	0.4	exceeded	0.1
C 280.005	1.5	0.11	1.5	0.11	1.5	0.11	1.5	met	n/a	not exceeded	n/a	1.5	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 12-047-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.061

Table 7.061 - Culvert Sizing - 12-047-AR 1					
09-113-AR 1	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-704.003	0.61	1.8	12	< 6	EC-3 Type B
C AR-704.004	14.00	38.3	36	< 8	EC-1 Class A1
C AR-704.005	0.50	0.8	12	< 6	EC-3 Type B
C AR-704.006	0.28	0.5	12	< 6	EC-3 Type B
C AR-704.007	0.91	1.3	12	< 6	EC-3 Type B
C AR-704.008	6.83	7.2	18	< 8	EC-1 Class A1
C AR-704.009	0.36	0.4	12	< 6	EC-3 Type B
C AR-704.010	0.23	0.4	12	< 6	EC-3 Type B
C AR-704.011	0.21	0.4	12	< 6	EC-3 Type B
C 280.001	3.89	4.4	18	< 8	EC-1 Class A1
C 280.002	3.02	4.2	18	< 8	EC-1 Class A1
C 280.003	0.79	2.3	12	< 6	EC-3 Type B
C 280.004	0.51	1.7	12	< 6	EC-3 Type B
C 280.005	2.02	5.8	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 12-047-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.061

Channel Types
09-113-AR 1
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.061 - Roadside Ditch Sizing - 12-047-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-704.003	0.6	1.8	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-704.004	12.5	38.3	0.04	Type III	2.0	2.0	2.4	Riprap (D50 - 6 in)
C AR-704.005	0.2	0.8	0.04	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-704.006	0.1	0.5	0.04	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C AR-704.007	0.2	1.3	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-704.008	1.2	7.2	0.04	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)
C AR-704.009	0.1	0.4	0.05	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C AR-704.010	0.1	0.4	0.04	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C AR-704.011	0.1	0.4	0.08	Type I	1.0	1.1	2.4	Riprap (D50 - 6 in)
C 280.001	0.5	4.4	0.04	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 280.002	0.8	4.2	0.02	Type I	2.0	0.8	2.4	Riprap (D50 - 6 in)
C 280.003	0.9	2.3	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 280.004	0.7	1.7	0.04	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 280.005	2.3	5.8	0.04	Type I	2.0	1.7	2.4	Riprap (D50 - 6 in)

Tables 4.062-071 to 8.062-071

Permanent Access Roads, Spread 7

Tables 4.062-071 Culvert List

Tables 5. 062-071 Water Quantity

Tables 6.062-071 Energy Balance

Tables 7.062-071 Culvert Sizing

Tables 8.062-071 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 12-101-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.062

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
12-101-AR 1	C AR-704.012	7	AR-704	Nottoway	Cellar Creek	226	88
12-101-AR 1	C AR-704.013	7	AR-704	Nottoway	Cellar Creek	226	88
12-101-AR 1	C AR-704.014	7	AR-704	Nottoway	Cellar Creek	226	88
12-101-AR 1	C AR-704.015	7	AR-704	Nottoway	Cellar Creek	226	87
12-101-AR 1	C AR-704.016	7	AR-704	Nottoway	Cellar Creek	226	87
12-101-AR 1	C 288.001	7	288	Nottoway	Cellar Creek	226	87
12-101-AR 1	C 288.002	7	288	Nottoway	Cellar Creek	226	87
12-101-AR 1	C 288.003	7	288	Nottoway	Cellar Creek	226	87
12-101-AR 1	C 288.004	7	288	Nottoway	Cellar Creek	226	87
12-101-AR 1	C 288.005	7	288	Nottoway	Cellar Creek	226	87

Water Quantity for Culverts and Ditches
Access Road: 12-101-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.062

Table 5.062 - Water Quantity - 12-101-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-704.012	1.30	3.0	3.5	5.5	11	60	0.4	0.8	2.9	11	61	0.5	0.9	3.1	0.1	0.1	0.2
C AR-704.013	0.69	3.0	3.5	5.5	28	50	0.0	0.0	0.4	28	52	0.0	0.1	0.5	0.0	0.0	0.1
C AR-704.014	0.82	3.0	3.5	5.5	26	50	0.0	0.0	0.5	26	52	0.0	0.1	0.6	0.0	0.0	0.1
C AR-704.015	0.64	3.0	3.5	5.5	25	50	0.0	0.0	0.4	25	53	0.0	0.1	0.6	0.0	0.0	0.1
C AR-704.016	0.27	3.0	3.5	5.5	16	52	0.0	0.0	0.3	16	56	0.0	0.1	0.4	0.0	0.0	0.1
C 288.001	0.53	3.0	3.5	5.5	31	55	0.0	0.1	0.5	31	60	0.1	0.2	0.7	0.1	0.1	0.2
C 288.002	0.23	3.0	3.5	5.5	23	54	0.0	0.0	0.2	23	61	0.1	0.1	0.4	0.0	0.1	0.1
C 288.003	0.40	3.0	3.5	5.5	18	51	0.0	0.0	0.4	18	54	0.0	0.1	0.5	0.0	0.0	0.1
C 288.004	0.46	3.0	3.5	5.5	27	56	0.0	0.1	0.5	27	58	0.1	0.1	0.5	0.0	0.0	0.1
C 288.005	0.41	3.0	3.5	5.5	17	54	0.0	0.1	0.5	17	57	0.1	0.1	0.6	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 12-101-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.062

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.062 - Energy Balance - 12-101-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-704.012	0.4	0.03	0.5	0.03	0.3	0.03	0.4	not met	0.1	exceeded	0.1	0.2	exceeded	0.3
C AR-704.013	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	not exceeded	n/a	0.0	exceeded	0.0
C AR-704.014	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.015	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C AR-704.016	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 288.001	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 288.002	0.0	0.00	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 288.003	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 288.004	0.0	0.01	0.1	0.01	0.0	0.01	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 288.005	0.0	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 12-101-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.062

Table 7.062 - Culvert Sizing - 12-101-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-704.012	1.30	3.1	12	< 6	EC-3 Type B
C AR-704.013	0.69	0.5	12	< 6	EC-3 Type B
C AR-704.014	0.82	0.6	12	< 6	EC-3 Type B
C AR-704.015	0.64	0.6	12	< 6	EC-3 Type B
C AR-704.016	0.27	0.4	12	< 6	EC-3 Type B
C 288.001	0.53	0.7	12	< 6	EC-3 Type B
C 288.002	0.23	0.4	12	< 6	EC-3 Type B
C 288.003	0.40	0.5	12	< 6	EC-3 Type B
C 288.004	0.46	0.5	12	< 6	EC-3 Type B
C 288.005	0.41	0.6	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 12-101-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.062

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.062 - Roadside Ditch Sizing - 12-101-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-704.012	0.9	3.1	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C AR-704.013	0.1	0.5	0.04	Type I	1.0	0.4	2.4	Riprap (D50 - 6 in)
C AR-704.014	0.1	0.6	0.06	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-704.015	0.1	0.6	0.01	Type I	1.0	0.1	0.4	Grass Lined
C AR-704.016	0.1	0.4	0.03	Type I	1.0	0.4	2.4	Riprap (D50 - 6 in)
C 288.001	0.2	0.7	0.02	Type I	1.0	0.3	0.4	Grass Lined
C 288.002	0.1	0.4	0.01	Type I	1.0	0.2	0.4	Grass Lined
C 288.003	0.1	0.5	0.01	Type I	1.0	0.1	0.4	Grass Lined
C 288.004	0.1	0.5	0.01	Type I	1.0	0.1	0.4	Grass Lined
C 288.005	0.1	0.6	0.02	Type I	1.0	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 12-108-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.063

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
12-108-AR 1	C 290.001	7	290	Nottoway	Cellar Creek	224	89

Water Quantity for Culverts and Ditches
Access Road: 12-108-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.063

Table 5.063 - Water Quantity - 12-108-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 290.001	0.70	3.0	3.5	5.5	7	68	0.7	1.0	2.7	7	71	0.9	1.3	3.0	0.2	0.2	0.3

Water Quantity for Culverts and Ditches

Access Road: 12-108-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.063

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.063 - Energy Balance - 12-108-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 290.001	0.7	0.03	0.9	0.04	0.5	0.03	0.6	not met	0.3	exceeded	0.2	0.3	exceeded	0.5

Water Quantity for Culverts and Ditches

Access Road: 12-108-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.063

Table 7.063 - Culvert Sizing - 12-108-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 290.001	0.70	3.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 12-108-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.063

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.063 - Roadside Ditch Sizing - 12-108-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 290.001	1.3	3.0	0.04	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 13-006.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.064

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
13-006.AR1	C E-293.001	7	293	Dinwiddie	Butterwood Creek	228	90
13-006.AR1	C E-293.002	7	293	Dinwiddie	Butterwood Creek	228	90

Water Quantity for Culverts and Ditches
Access Road: 13-006.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.064

Table 5.064 - Water Quantity - 13-006.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E-293.001	0.61	3.0	3.5	5.6	9	58	0.1	0.3	1.4	9	59	0.2	0.4	1.4	0.0	0.1	0.1
C E-293.002	0.33	3.0	3.5	5.6	14	56	0.0	0.1	0.6	14	52	0.0	0.0	0.4	0.0	-0.1	-0.2

Water Quantity for Culverts and Ditches

Access Road: 13-006.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.064

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.064 - Energy Balance - 13-006.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E-293.001	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C E-293.002	0.0	0.01	0.0	0.00	0.0	0.00	0.1	met	n/a	not exceeded	n/a	0.0	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 13-006.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.064

Table 7.064 - Culvert Sizing - 13-006.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E-293.001	0.61	1.4	12	< 6	EC-3 Type B
C E-293.002	0.33	0.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 13-006.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.064

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.064 - Roadside Ditch Sizing - 13-006.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E-293.001	0.4	1.4	0.03	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C E-293.002	0.0	0.4	0.01	Type I	1.0	0.1	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 13-007.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.065

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
13-007.AR1	C E-293.003	7	293	Dinwiddie	Butterwood Creek	228	90

Water Quantity for Culverts and Ditches
Access Road: 13-007.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.065

Table 5.065 - Water Quantity - 13-007.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E-293.003	0.86	3.0	3.5	5.6	5	59	0.3	0.6	2.4	5	59	0.3	0.6	2.4	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 13-007.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.065

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.065 - Energy Balance - 13-007.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E-293.003	0.3	0.02	0.3	0.02	0.2	0.01	0.3	met	n/a	not exceeded	n/a	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 13-007.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.065

Table 7.065 - Culvert Sizing - 13-007.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E-293.003	0.86	2.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 13-007.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.065

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.065 - Roadside Ditch Sizing - 13-007.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E-293.003	0.6	2.4	0.02	Type I	1.5	0.5	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 13-041-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.066

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
13-041-AR 1	C E-303.001	7	303	Dinwiddie	Beaver Pond Creek-Nottoway River	202	91

Water Quantity for Culverts and Ditches
Access Road: 13-041-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.066

Table 5.066 - Water Quantity - 13-041-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E-303.001	2.21	3.0	3.5	5.6	13	89	5.7	7.0	12.6	13	89	5.7	7.1	12.7	0.0	0.0	0.1

Water Quantity for Culverts and Ditches

Access Road: 13-041-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.066

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.066 - Energy Balance - 13-041-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E-303.001	5.7	0.33	5.7	0.33	5.7	0.33	5.7	not met	0.0	exceeded	0.0	5.7	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 13-041-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.066

Table 7.066 - Culvert Sizing - 13-041-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E-303.001	2.21	12.7	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 13-041-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.066

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.066 - Roadside Ditch Sizing - 13-041-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E-303.001	7.1	12.7	0.02	Type II	2.0	1.0	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 14-001-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.067

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
14-001-AR 1	C E-303.002	7	303	Brunswick	Beaver Pond Creek-Nottoway River	202	91

Water Quantity for Culverts and Ditches
Access Road: 14-001-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.067

Table 5.067 - Water Quantity - 14-001-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C E-303.002	0.28	3.0	3.5	5.6	7	85	0.8	1.0	1.8	5	86	0.8	1.1	2.0	0.1	0.1	0.2

Water Quantity for Culverts and Ditches

Access Road: 14-001-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.067

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.067 - Energy Balance - 14-001-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C E-303.002	0.8	0.03	0.8	0.04	0.6	0.03	0.7	not met	0.1	exceeded	0.1	0.5	exceeded	0.4

Water Quantity for Culverts and Ditches

Access Road: 14-001-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.067

Table 7.067 - Culvert Sizing - 14-001-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C E-303.002	0.28	2.0	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 14-001-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.067

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.067 - Roadside Ditch Sizing - 14-001-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C E-303.002	1.1	2.0	0.02	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 14-020-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.068

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
14-020-AR 1	C AR-705.001	7	AR-705	Brunswick	Waqua Creek	238	94
14-020-AR 1	C AR-705.002	7	AR-705	Brunswick	Waqua Creek	238	94
14-020-AR 1	C AR-705.003	7	AR-705	Brunswick	Waqua Creek	238	94
14-020-AR 1	C AR-705.004	7	AR-705	Brunswick	Waqua Creek	238	93, 94
14-020-AR 1	C AR-705.005	7	AR-705	Brunswick	Waqua Creek	238	93, 94
14-020-AR 1	C AR-705.006	7	AR-705	Brunswick	Waqua Creek	238	93, 94
14-020-AR 1	C AR-705.007	7	AR-705	Brunswick	Waqua Creek	238	93
14-020-AR 1	C 307.001	7	307	Brunswick	Waqua Creek	238	92, 93
14-020-AR 1	C 307.002	7	307	Brunswick	Waqua Creek	238	92, 93
14-020-AR 1	C 307.003	7	307	Brunswick	Waqua Creek	238	92
14-020-AR 1	C 307.004	7	307	Brunswick	Waqua Creek	238	92
14-020-AR 1	C 307.005	7	307	Brunswick	Waqua Creek	238	92
14-020-AR 1	C 307.006	7	307	Brunswick	Waqua Creek	238	92

Water Quantity for Culverts and Ditches
Access Road: 14-020-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.068

Table 5.068 - Water Quantity - 14-020-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-705.001	13.85	3.0	3.5	5.6	21	60	2.7	5.5	23.0	21	60	2.7	5.5	23.0	0.0	0.0	0.0
C AR-705.002	6.29	3.0	3.5	5.6	19	55	0.4	1.2	8.1	19	55	0.4	1.2	8.1	0.0	0.0	0.0
C AR-705.003	0.68	3.0	3.5	5.6	15	61	0.2	0.4	1.4	15	62	0.2	0.4	1.5	0.0	0.1	0.1
C AR-705.004	0.16	3.0	3.5	5.6	9	62	0.1	0.1	0.4	9	64	0.1	0.2	0.5	0.0	0.0	0.0
C AR-705.005	0.13	3.0	3.5	5.6	9	60	0.0	0.1	0.3	9	63	0.1	0.1	0.4	0.0	0.0	0.1
C AR-705.006	11.86	3.0	3.5	5.6	20	55	0.7	2.2	14.6	20	55	0.7	2.2	14.6	0.0	0.0	0.0
C AR-705.007	0.41	3.0	3.5	5.6	17	58	0.1	0.1	0.7	17	59	0.1	0.2	0.7	0.0	0.0	0.0
C 307.001	0.20	3.0	3.5	5.6	9	60	0.1	0.1	0.5	9	64	0.1	0.2	0.6	0.1	0.1	0.1
C 307.002	0.20	3.0	3.5	5.6	21	61	0.1	0.1	0.4	21	64	0.1	0.1	0.4	0.0	0.0	0.1
C 307.003	0.25	3.0	3.5	5.6	16	59	0.1	0.1	0.5	16	62	0.1	0.2	0.5	0.0	0.0	0.1
C 307.004	0.29	3.0	3.5	5.6	14	59	0.1	0.1	0.6	14	61	0.1	0.2	0.6	0.0	0.0	0.1
C 307.005	74.48	3.0	3.5	5.6	28	61	14.4	27.6	109.3	28	61	14.4	27.6	109.3	0.0	0.0	0.0
C 307.006	1.47	3.0	3.5	5.6	12	61	0.5	0.9	3.5	12	62	0.6	1.1	3.7	0.1	0.1	0.2

Water Quantity for Culverts and Ditches
Access Road: 14-020-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.068

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.068 - Energy Balance - 14-020-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-705.001	2.7	0.32	2.7	0.32	2.7	0.32	2.7	met	n/a	not exceeded	n/a	2.7	exceeded	0.0
C AR-705.002	0.4	0.08	0.4	0.08	0.4	0.08	0.4	met	n/a	not exceeded	n/a	0.4	exceeded	0.0
C AR-705.003	0.2	0.02	0.2	0.02	0.1	0.01	0.2	not met	0.1	exceeded	0.0	0.1	exceeded	0.2
C AR-705.004	0.1	0.00	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-705.005	0.0	0.00	0.1	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C AR-705.006	0.7	0.15	0.7	0.15	0.7	0.15	0.7	met	n/a	not exceeded	n/a	0.7	exceeded	0.0
C AR-705.007	0.1	0.01	0.1	0.01	0.0	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 307.001	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.1	exceeded	0.1	0.0	exceeded	0.1
C 307.002	0.1	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 307.003	0.1	0.01	0.1	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 307.004	0.1	0.01	0.1	0.01	0.0	0.00	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.1
C 307.005	14.4	1.90	14.4	1.90	14.4	1.90	14.4	met	n/a	not exceeded	n/a	14.4	exceeded	0.0
C 307.006	0.5	0.04	0.6	0.04	0.4	0.03	0.4	not met	0.1	exceeded	0.1	0.3	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 14-020-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.068

Table 7.068 - Culvert Sizing - 14-020-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-705.001	13.85	23.0	30	< 8	EC-1 Class A1
C AR-705.002	6.29	8.1	18	< 8	EC-1 Class A1
C AR-705.003	0.68	1.5	12	< 6	EC-3 Type B
C AR-705.004	0.16	0.5	12	< 6	EC-3 Type B
C AR-705.005	0.13	0.4	12	< 6	EC-3 Type B
C AR-705.006	11.86	14.6	24	< 8	EC-1 Class A1
C AR-705.007	0.41	0.7	12	< 6	EC-3 Type B
C 307.001	0.20	0.6	12	< 6	EC-3 Type B
C 307.002	0.20	0.4	12	< 6	EC-3 Type B
C 307.003	0.25	0.5	12	< 6	EC-3 Type B
C 307.004	0.29	0.6	12	< 6	EC-3 Type B
C 307.005	74.48	109.3	multiple	< 8	EC-1 Class A1
C 307.006	1.47	3.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 14-020-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.068

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.068 - Roadside Ditch Sizing - 14-020-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-705.001	5.5	23.0	0.03	Type II	2.0	1.2	2.4	Riprap (D50 - 6 in)
C AR-705.002	1.2	8.1	0.03	Type I	2.0	1.0	2.4	Riprap (D50 - 6 in)
C AR-705.003	0.4	1.5	0.05	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C AR-705.004	0.2	0.5	0.03	Type I	1.0	0.4	0.4	Grass Lined
C AR-705.005	0.1	0.4	0.05	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-705.006	2.2	14.6	0.01	Type II	2.0	0.2	0.4	Grass Lined
C AR-705.007	0.2	0.7	0.02	Type I	1.0	0.3	0.4	Grass Lined
C 307.001	0.2	0.6	0.03	Type I	1.0	0.6	2.4	Riprap (D50 - 6 in)
C 307.002	0.1	0.4	0.02	Type I	1.0	0.2	0.4	Grass Lined
C 307.003	0.2	0.5	0.03	Type I	1.0	0.4	0.4	Grass Lined
C 307.004	0.2	0.6	0.05	Type I	1.0	0.8	2.4	Riprap (D50 - 6 in)
C 307.005	27.6	109.3	0.02	Type III	3.5	1.9	2.4	Riprap (D50 - 6 in)
C 307.006	1.1	3.7	0.03	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 14-096-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.069

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
14-096-AR 1	C 323.010	7	323	Brunswick	Reedy Creek	83	96, 97
14-096-AR 1	C 324.001	7	324	Brunswick	Reedy Creek	83	97
14-096-AR 1	C 324.002	7	324	Brunswick	Reedy Creek	83	97
14-096-AR 1	C 324.003	7	324	Brunswick	Reedy Creek	83	97

Water Quantity for Culverts and Ditches
Access Road: 14-096-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.069

Table 5.069 - Water Quantity - 14-096-AR 1

Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)					
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 323.010	42.23	3.0	3.5	5.6	27	68	19.9	31.1	89.3	27	68	19.9	31.1	89.3	0.0	0.0	0.0
C 324.001	0.99	3.0	3.5	5.6	13	62	0.4	0.7	2.4	13	62	0.4	0.7	2.4	0.0	0.0	0.0
C 324.002	0.71	3.0	3.5	5.6	13	61	0.2	0.4	1.6	13	61	0.2	0.4	1.6	0.0	0.0	0.0
C 324.003	9.91	3.0	3.5	5.6	20	64	3.7	6.3	20.9	20	64	3.7	6.3	20.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 14-096-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.069

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.069 - Energy Balance - 14-096-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 323.010	19.9	1.92	19.9	1.92	19.9	1.92	19.9	met	n/a	not exceeded	n/a	19.9	exceeded	0.0
C 324.001	0.4	0.03	0.4	0.03	0.3	0.02	0.4	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C 324.002	0.2	0.02	0.2	0.02	0.2	0.02	0.2	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C 324.003	3.7	0.33	3.7	0.33	3.2	0.31	3.7	met	n/a	not exceeded	n/a	2.9	exceeded	0.7

Water Quantity for Culverts and Ditches

Access Road: 14-096-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.069

Table 7.069 - Culvert Sizing - 14-096-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 323.010	42.23	89.3	48	< 8	EC-1 Class A1
C 324.001	0.99	2.4	12	< 6	EC-3 Type B
C 324.002	0.71	1.6	12	< 6	EC-3 Type B
C 324.003	9.91	20.9	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 14-096-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.069

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.069 - Roadside Ditch Sizing - 14-096-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 323.010	31.1	89.3	0.01	Type III	3.0	0.6	2.4	Riprap (D50 - 6 in)
C 324.001	0.7	2.4	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 324.002	0.4	1.6	0.01	Type I	1.5	0.1	0.4	Grass Lined
C 324.003	6.3	20.9	0.01	Type III	2.0	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 14-103-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.070

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
14-103-AR 1	C AR-706.001	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.002	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.003	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.004	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.005	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.006	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.007	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.008	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.009	7	AR-706	Brunswick	Reedy Creek	83	98
14-103-AR 1	C AR-706.010	7	AR-706	Brunswick	Reedy Creek	83	97, 98
14-103-AR 1	C AR-706.011	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.012	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.013	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.014	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.015	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.016	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.017	7	AR-706	Brunswick	Reedy Creek	83	97
14-103-AR 1	C AR-706.018	7	AR-706	Brunswick	Reedy Creek	83	96, 97
14-103-AR 1	C 323.003	7	323	Brunswick	Slagles Lake-Three Creek	82	95, 96
14-103-AR 1	C 323.004	7	323	Brunswick	Slagles Lake-Three Creek	82	95, 96
14-103-AR 1	C 323.005	7	323	Brunswick	Reedy Creek	83	95, 96, 97
14-103-AR 1	C 323.006	7	323	Brunswick	Reedy Creek	83	95, 96, 97
14-103-AR 1	C 323.007	7	323	Brunswick	Reedy Creek	83	95, 96
14-103-AR 1	C 323.008	7	323	Brunswick	Reedy Creek	83	95, 96
14-103-AR 1	C 323.009	7	323	Brunswick	Reedy Creek	83	95, 96

Water Quantity for Culverts and Ditches
Access Road: 14-103-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.070

Table 5.070 - Water Quantity - 14-103-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-706.001	6.38	3.0	3.5	5.6	18	71	5.2	7.5	19.3	18	71	5.2	7.5	19.3	0.0	0.0	0.0
C AR-706.002	0.37	3.0	3.5	5.6	15	73	0.4	0.6	1.3	15	74	0.4	0.6	1.4	0.0	0.0	0.1
C AR-706.003	0.40	3.0	3.5	5.6	14	72	0.4	0.6	1.4	14	73	0.4	0.6	1.5	0.0	0.0	0.1
C AR-706.004	0.18	3.0	3.5	5.6	13	72	0.2	0.3	0.7	13	73	0.2	0.3	0.7	0.0	0.0	0.0
C AR-706.005	0.34	3.0	3.5	5.6	8	73	0.5	0.7	1.5	8	74	0.5	0.7	1.6	0.0	0.0	0.1
C AR-706.006	1.20	3.0	3.5	5.6	11	74	1.6	2.2	5.0	11	75	1.7	2.3	5.2	0.1	0.1	0.2
C AR-706.007	2.96	3.0	3.5	5.6	15	74	3.3	4.6	10.8	15	75	3.5	4.8	11.2	0.2	0.3	0.4
C AR-706.008	2.95	3.0	3.5	5.6	13	74	3.5	4.9	11.6	13	75	3.8	5.2	12.0	0.2	0.3	0.4
C AR-706.009	0.52	3.0	3.5	5.6	11	74	0.7	0.9	2.2	11	75	0.7	1.0	2.2	0.0	0.0	0.1
C AR-706.010	0.30	3.0	3.5	5.6	21	71	0.2	0.3	0.8	21	72	0.2	0.3	0.9	0.0	0.0	0.0
C AR-706.011	1.92	3.0	3.5	5.6	16	75	2.2	3.0	7.0	16	75	2.2	3.0	7.0	0.0	0.0	0.0
C AR-706.012	2.92	3.0	3.5	5.6	17	75	3.3	4.5	10.5	17	75	3.3	4.5	10.5	0.0	0.0	0.0
C AR-706.013	0.39	3.0	3.5	5.6	17	78	0.5	0.7	1.5	17	78	0.5	0.7	1.5	0.0	0.0	0.0
C AR-706.014	30.55	3.0	3.5	5.6	25	72	21.6	31.4	79.1	25	72	21.6	31.4	79.1	0.0	0.0	0.0
C AR-706.015	0.14	3.0	3.5	5.6	12	79	0.2	0.3	0.7	12	80	0.2	0.3	0.7	0.0	0.0	0.0
C AR-706.016	0.70	3.0	3.5	5.6	28	78	0.7	0.9	2.1	28	78	0.7	0.9	2.1	0.0	0.0	0.0
C AR-706.017	1.04	3.0	3.5	5.6	28	64	0.3	0.5	1.8	28	65	0.4	0.6	1.9	0.0	0.0	0.1
C AR-706.018	1.19	3.0	3.5	5.6	28	61	0.2	0.4	1.7	28	61	0.2	0.4	1.7	0.0	0.0	0.0
C 323.003	0.88	3.0	3.5	5.6	14	62	0.3	0.6	2.0	14	63	0.4	0.6	2.1	0.1	0.1	0.1
C 323.004	0.56	3.0	3.5	5.6	28	63	0.2	0.3	0.9	28	61	0.1	0.2	0.8	0.0	-0.1	-0.1
C 323.005	1.07	3.0	3.5	5.6	9	62	0.5	0.9	3.1	9	62	0.5	0.9	3.1	0.0	0.0	0.0
C 323.006	0.87	3.0	3.5	5.6	9	68	0.8	1.2	3.2	9	68	0.8	1.2	3.2	0.0	0.0	0.0
C 323.007	0.34	3.0	3.5	5.6	2	71	0.5	0.7	1.7	2	73	0.6	0.8	1.8	0.1	0.1	0.1
C 323.008	0.42	3.0	3.5	5.6	4	68	0.5	0.7	1.8	4	69	0.5	0.7	1.9	0.0	0.0	0.1
C 323.009	0.93	3.0	3.5	5.6	15	63	0.4	0.7	2.2	15	64	0.4	0.7	2.3	0.1	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 14-103-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.070

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.070 - Energy Balance - 14-103-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-706.001	5.2	0.36	5.2	0.36	5.2	0.36	5.2	met	n/a	not exceeded	n/a	5.2	exceeded	0.0
C AR-706.002	0.4	0.02	0.4	0.03	0.3	0.02	0.4	not met	0.0	exceeded	0.0	0.3	exceeded	0.1
C AR-706.003	0.4	0.02	0.4	0.03	0.4	0.02	0.4	not met	0.1	exceeded	0.0	0.3	exceeded	0.2
C AR-706.004	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.0
C AR-706.005	0.5	0.02	0.5	0.02	0.4	0.02	0.4	not met	0.0	exceeded	0.0	0.3	exceeded	0.2
C AR-706.006	1.6	0.08	1.7	0.09	1.6	0.08	1.5	not met	0.2	exceeded	0.1	1.5	exceeded	0.2
C AR-706.007	3.3	0.20	3.5	0.21	3.3	0.20	3.1	not met	0.4	exceeded	0.2	3.1	exceeded	0.4
C AR-706.008	3.5	0.20	3.8	0.21	3.5	0.20	3.3	not met	0.4	exceeded	0.2	3.3	exceeded	0.4
C AR-706.009	0.7	0.04	0.7	0.04	0.6	0.03	0.6	not met	0.1	exceeded	0.0	0.6	exceeded	0.1
C AR-706.010	0.2	0.02	0.2	0.02	0.2	0.02	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-706.011	2.2	0.14	2.2	0.14	2.0	0.13	2.2	met	n/a	not exceeded	n/a	1.9	exceeded	0.3
C AR-706.012	3.3	0.21	3.3	0.21	3.1	0.20	3.3	met	n/a	not exceeded	n/a	2.9	exceeded	0.4
C AR-706.013	0.5	0.03	0.5	0.03	0.5	0.03	0.5	met	n/a	not exceeded	n/a	0.5	exceeded	0.1
C AR-706.014	21.6	1.82	21.6	1.82	21.6	1.82	21.6	met	n/a	not exceeded	n/a	21.6	exceeded	0.0
C AR-706.015	0.2	0.01	0.2	0.01	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C AR-706.016	0.7	0.06	0.7	0.06	0.7	0.06	0.7	met	n/a	not exceeded	n/a	0.6	exceeded	0.1
C AR-706.017	0.3	0.04	0.4	0.04	0.3	0.03	0.3	not met	0.1	exceeded	0.0	0.2	exceeded	0.1
C AR-706.018	0.2	0.03	0.2	0.03	0.2	0.03	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 323.003	0.3	0.03	0.4	0.03	0.2	0.02	0.3	not met	0.1	exceeded	0.1	0.2	exceeded	0.2
C 323.004	0.2	0.02	0.1	0.01	0.1	0.01	0.2	met	n/a	not exceeded	n/a	0.0	exceeded	0.1
C 323.005	0.5	0.03	0.5	0.03	0.4	0.03	0.5	met	n/a	not exceeded	n/a	0.3	exceeded	0.2
C 323.006	0.8	0.04	0.8	0.04	0.5	0.03	0.8	met	n/a	not exceeded	n/a	0.4	exceeded	0.4
C 323.007	0.5	0.02	0.6	0.02	0.3	0.01	0.4	not met	0.1	exceeded	0.1	0.2	exceeded	0.4
C 323.008	0.5	0.02	0.5	0.02	0.2	0.01	0.4	not met	0.1	exceeded	0.0	0.1	exceeded	0.4
C 323.009	0.4	0.03	0.4	0.03	0.3	0.02	0.3	not met	0.1	exceeded	0.1	0.2	exceeded	0.2

Water Quantity for Culverts and Ditches
Access Road: 14-103-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.070

Table 7.070 - Culvert Sizing - 14-103-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-706.001	6.38	19.3	24	< 8	EC-1 Class A1
C AR-706.002	0.37	1.4	12	< 6	EC-3 Type B
C AR-706.003	0.40	1.5	12	< 6	EC-3 Type B
C AR-706.004	0.18	0.7	12	< 6	EC-3 Type B
C AR-706.005	0.34	1.6	12	< 6	EC-3 Type B
C AR-706.006	1.20	5.2	18	< 8	EC-1 Class A1
C AR-706.007	2.96	11.2	18	< 8	EC-1 Class A1
C AR-706.008	2.95	12.0	18	< 8	EC-1 Class A1
C AR-706.009	0.52	2.2	12	< 6	EC-3 Type B
C AR-706.010	0.30	0.9	12	< 6	EC-3 Type B
C AR-706.011	1.92	7.0	18	< 8	EC-1 Class A1
C AR-706.012	2.92	10.5	18	< 8	EC-1 Class A1
C AR-706.013	0.39	1.5	12	< 6	EC-3 Type B
C AR-706.014	30.55	79.1	48	< 8	EC-1 Class A1
C AR-706.015	0.14	0.7	12	< 6	EC-3 Type B
C AR-706.016	0.70	2.1	12	< 6	EC-3 Type B
C AR-706.017	1.04	1.9	12	< 6	EC-3 Type B
C AR-706.018	1.19	1.7	12	< 6	EC-3 Type B
C 323.003	0.88	2.1	12	< 6	EC-3 Type B
C 323.004	0.56	0.8	12	< 6	EC-3 Type B
C 323.005	1.07	3.1	12	< 6	EC-3 Type B
C 323.006	0.87	3.2	12	< 6	EC-3 Type B
C 323.007	0.34	1.8	12	< 6	EC-3 Type B
C 323.008	0.42	1.9	12	< 6	EC-3 Type B
C 323.009	0.93	2.3	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 14-103-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.070

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.070 - Roadside Ditch Sizing - 14-103-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-706.001	7.5	19.3	0.02	Type III	2.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-706.002	0.6	1.4	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C AR-706.003	0.6	1.5	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-706.004	0.3	0.7	0.03	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C AR-706.005	0.7	1.6	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C AR-706.006	2.3	5.2	0.01	Type I	2.0	0.4	0.4	Grass Lined
C AR-706.007	4.8	11.2	0.02	Type II	2.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-706.008	5.2	12.0	0.01	Type II	2.0	0.7	2.4	Riprap (D50 - 6 in)
C AR-706.009	1.0	2.2	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-706.010	0.3	0.9	0.02	Type I	1.0	0.4	0.4	Grass Lined
C AR-706.011	3.0	7.0	0.03	Type I	2.0	1.5	2.4	Riprap (D50 - 6 in)
C AR-706.012	4.5	10.5	0.03	Type I	2.0	1.8	2.4	Riprap (D50 - 6 in)
C AR-706.013	0.7	1.5	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-706.014	31.4	79.1	0.01	Type III	3.0	0.6	2.4	Riprap (D50 - 6 in)
C AR-706.015	0.3	0.7	0.05	Type I	1.0	1.1	2.4	Riprap (D50 - 6 in)
C AR-706.016	0.9	2.1	0.01	Type I	1.5	0.5	0.4	Grass Lined
C AR-706.017	0.6	1.9	0.04	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C AR-706.018	0.4	1.7	0.06	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C 323.003	0.6	2.1	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 323.004	0.2	0.8	0.04	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 323.005	0.9	3.1	0.03	Type I	1.5	1.0	2.4	Riprap (D50 - 6 in)
C 323.006	1.2	3.2	0.04	Type I	1.5	1.3	2.4	Riprap (D50 - 6 in)
C 323.007	0.8	1.8	0.05	Type I	1.5	1.4	2.4	Riprap (D50 - 6 in)
C 323.008	0.7	1.9	0.01	Type I	1.5	0.4	0.4	Grass Lined
C 323.009	0.7	2.3	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 14-106-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.071

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
14-106-AR 1	C 323.001	7	323	Brunswick	Slagles Lake-Three Creek	82	95
14-106-AR 1	C 323.002	7	323	Brunswick	Slagles Lake-Three Creek	82	95

Water Quantity for Culverts and Ditches
Access Road: 14-106-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.071

Table 5.071 - Water Quantity - 14-106-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 323.001	0.87	3.0	3.5	5.6	10	77	1.4	1.9	4.1	10	78	1.5	2.0	4.2	0.1	0.1	0.1
C 323.002	0.48	3.0	3.5	5.6	11	76	0.7	0.9	2.1	11	76	0.7	0.9	2.1	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 14-106-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.071

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.071 - Energy Balance - 14-106-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 323.001	1.4	0.07	1.5	0.07	1.2	0.06	1.3	not met	0.2	exceeded	0.1	1.0	exceeded	0.4
C 323.002	0.7	0.04	0.7	0.04	0.5	0.03	0.7	met	n/a	not exceeded	n/a	0.4	exceeded	0.3

Water Quantity for Culverts and Ditches

Access Road: 14-106-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.071

Table 7.071 - Culvert Sizing - 14-106-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 323.001	0.87	4.2	18	< 8	EC-1 Class A1
C 323.002	0.48	2.1	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 14-106-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.071

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.071 - Roadside Ditch Sizing - 14-106-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 323.001	2.0	4.2	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C 323.002	0.9	2.1	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)

Tables 4.072 to 8.072

Temporary Access Road, Spread 7

Table 4.072 Culvert List

Table 5.072 Water Quantity

Table 7.072 Culvert Sizing

Table 8.072 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 15-011-AR 4
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.072

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-011-AR 4	C AP5.001	7	AP5	Greensville	Douglas Run-Meherrin River	84	T-5

Water Quantity for Culverts and Ditches
Access Road: 15-011-AR 4
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.072

Table 5.072 - Water Quantity - 15-011-AR 4									
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Construction Conditions				
					Tc (min)	Weighted CN	Q (cfs)		
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr
C AP5.001	11.19	3.0	3.6	5.7	22	76	11.4	16.5	36.7

Water Quantity for Culverts and Ditches

Access Road: 15-011-AR 4
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.072

Table 7.072 - Culvert Sizing - 15-011-AR 4					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AP5.001	11.19	36.7	36	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 15-011-AR 4
Road Designation: Temporary Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.072

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.072 - Roadside Ditch Sizing - 15-011-AR 4

Relief Culvert ID	$Q_{2\text{-yr Dev.}}$ (cfs)	$Q_{10\text{-yr Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AP5.001	16.5	36.7	0.01	Type III	2.5	0.3	0.4	Grass Lined

Tables 4.073-077 to 8.073-077

Permanent Access Roads, Spread 7

Tables 4.073-077 Culvert List

Tables 5. 073-077 Water Quantity

Tables 6.073-077 Energy Balance

Tables 7.073-077 Culvert Sizing

Tables 8.073-077 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 15-014.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.073

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-014.AR1	C AR-707.001	7	AR-707	Greensville	Douglas Run-Meherrin River	84	100
15-014.AR1	C AR-707.002	7	AR-707	Greensville	Douglas Run-Meherrin River	84	100
15-014.AR1	C AR-707.003	7	AR-707	Greensville	Douglas Run-Meherrin River	84	100
15-014.AR1	C AR-707.004	7	AR-707	Greensville	Douglas Run-Meherrin River	84	99, 100

Water Quantity for Culverts and Ditches
Access Road: 15-014.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.073

Table 5.073 - Water Quantity - 15-014.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-707.001	0.35	3.0	3.6	5.7	15	77	0.5	0.7	1.5	15	78	0.5	0.7	1.5	0.0	0.0	0.1
C AR-707.002	0.47	3.0	3.6	5.7	14	78	0.7	1.0	2.0	14	79	0.7	1.0	2.1	0.0	0.0	0.1
C AR-707.003	0.32	3.0	3.6	5.7	15	72	0.3	0.5	1.1	15	72	0.3	0.5	1.1	0.0	0.0	0.0
C AR-707.004	0.50	3.0	3.6	5.7	15	71	0.5	0.7	1.7	15	72	0.5	0.7	1.8	0.0	0.0	0.1

Water Quantity for Culverts and Ditches
Access Road: 15-014.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.073

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}}) / RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} < (Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}}) / RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.073 - Energy Balance - 15-014.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-707.001	0.5	0.03	0.5	0.03	0.4	0.03	0.4	not met	0.1	exceeded	0.0	0.4	exceeded	0.2
C AR-707.002	0.7	0.04	0.7	0.04	0.6	0.04	0.6	not met	0.1	exceeded	0.0	0.5	exceeded	0.2
C AR-707.003	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.2	exceeded	0.1
C AR-707.004	0.5	0.03	0.5	0.03	0.4	0.03	0.4	not met	0.1	exceeded	0.0	0.4	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 15-014.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.073

Table 7.073 - Culvert Sizing - 15-014.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-707.001	0.35	1.5	12	< 6	EC-3 Type B
C AR-707.002	0.47	2.1	12	< 6	EC-3 Type B
C AR-707.003	0.32	1.1	12	< 6	EC-3 Type B
C AR-707.004	0.50	1.8	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 15-014.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.073

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.073 - Roadside Ditch Sizing - 15-014.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-707.001	0.7	1.5	0.03	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C AR-707.002	1.0	2.1	0.01	Type I	1.5	0.2	0.4	Grass Lined
C AR-707.003	0.5	1.1	0.01	Type I	1.5	0.3	0.4	Grass Lined
C AR-707.004	0.7	1.8	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 15-029-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.074

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-029-AR 2	C AR-709.001	7	AR-709	Greensville	Cattail Creek-Fontaine Creek	87	101
15-029-AR 2	C AR-709.002	7	AR-709	Greensville	Cattail Creek-Fontaine Creek	87	101
15-029-AR 2	C AR-709.003	7	AR-709	Greensville	Cattail Creek-Fontaine Creek	87	101
15-029-AR 2	C 331.001	7	331	Greensville	Cattail Creek-Fontaine Creek	87	101

Water Quantity for Culverts and Ditches
Access Road: 15-029-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.074

Table 5.074 - Water Quantity - 15-029-AR 2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-709.001	0.48	3.0	3.6	5.7	16	68	0.3	0.5	1.4	16	68	0.3	0.5	1.4	0.0	0.0	0.0
C AR-709.002	0.63	3.0	3.6	5.7	17	68	0.4	0.7	1.8	17	68	0.4	0.7	1.8	0.0	0.0	0.0
C AR-709.003	6.05	3.0	3.6	5.7	17	64	2.5	4.7	14.7	17	64	2.5	4.7	14.7	0.0	0.0	0.0
C 331.001	0.30	3.0	3.6	5.7	18	64	0.1	0.2	0.7	18	64	0.1	0.2	0.7	0.0	0.0	0.0

Water Quantity for Culverts and Ditches

Access Road: 15-029-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.074

Column Legend

A	I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.$(Q_{1\text{-yr Pre-Dev.}})(RV_{1\text{-yr Pre-Dev.}})$ / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	$(Q_{1\text{-yr Forest}})(RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ $(Q_{1\text{-yr Forest}} * RV_{1\text{-yr Forest}})$ / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.074 - Energy Balance - 15-029-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-709.001	0.3	0.02	0.3	0.02	0.3	0.02	0.3	met	n/a	not exceeded	n/a	0.3	exceeded	0.1
C AR-709.002	0.4	0.03	0.4	0.03	0.4	0.03	0.4	met	n/a	not exceeded	n/a	0.4	exceeded	0.1
C AR-709.003	2.5	0.20	2.5	0.20	2.5	0.20	2.5	met	n/a	not exceeded	n/a	2.5	exceeded	0.0
C 331.001	0.1	0.01	0.1	0.01	0.1	0.01	0.1	met	n/a	not exceeded	n/a	0.0	exceeded	0.1

Water Quantity for Culverts and Ditches

Access Road: 15-029-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.074

Table 7.074 - Culvert Sizing - 15-029-AR 2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-709.001	0.48	1.4	12	< 6	EC-3 Type B
C AR-709.002	0.63	1.8	12	< 6	EC-3 Type B
C AR-709.003	6.05	14.7	24	< 8	EC-1 Class A1
C 331.001	0.30	0.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 15-029-AR 2
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.074

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.074 - Roadside Ditch Sizing - 15-029-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-709.001	0.5	1.4	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C AR-709.002	0.7	1.8	0.04	Type I	1.5	1.2	2.4	Riprap (D50 - 6 in)
C AR-709.003	4.7	14.7	0.03	Type II	2.0	1.3	2.4	Riprap (D50 - 6 in)
C 331.001	0.2	0.7	0.04	Type I	1.0	0.7	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 15-055-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.075

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-055-AR 1	C AR-710.001	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C AR-710.002	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C AR-710.003	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C AR-710.004	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C 337.001	7	337	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C 337.002	7	337	Greensville	Mill Swamp-Fontaine Creek	92	102
15-055-AR 1	C 337.003	7	337	Greensville	Mill Swamp-Fontaine Creek	92	102

Water Quantity for Culverts and Ditches
Access Road: 15-055-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.075

Table 5.075 - Water Quantity - 15-055-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-710.001	1.41	3.0	3.6	5.7	15	72	1.4	2.1	5.0	15	72	1.4	2.1	5.0	0.0	0.0	0.0
C AR-710.002	1.19	3.0	3.6	5.7	14	69	0.9	1.5	3.9	14	70	1.0	1.6	4.0	0.1	0.1	0.2
C AR-710.003	9.55	3.0	3.6	5.7	18	64	3.8	7.1	22.2	18	64	3.8	7.1	22.2	0.0	0.0	0.0
C AR-710.004	2.89	3.0	3.6	5.7	38	66	0.9	1.5	4.6	38	66	0.9	1.5	4.6	0.0	0.0	0.0
C 337.001	0.16	3.0	3.6	5.7	21	68	0.1	0.2	0.4	21	71	0.1	0.2	0.5	0.0	0.0	0.1
C 337.002	0.14	3.0	3.6	5.7	23	68	0.1	0.1	0.3	23	71	0.1	0.1	0.4	0.0	0.0	0.0
C 337.003	0.81	3.0	3.6	5.7	36	66	0.3	0.4	1.3	36	67	0.3	0.5	1.4	0.0	0.0	0.1

Water Quantity for Culverts and Ditches
Access Road: 15-055-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.075

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.075 - Energy Balance - 15-055-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-710.001	1.4	0.08	1.4	0.08	1.4	0.08	1.4	met	n/a	not exceeded	n/a	1.4	exceeded	0.0
C AR-710.002	0.9	0.06	1.0	0.06	0.9	0.06	0.9	not met	0.1	exceeded	0.1	0.9	exceeded	0.1
C AR-710.003	3.8	0.32	3.8	0.32	3.8	0.32	3.8	met	n/a	not exceeded	n/a	3.8	exceeded	0.0
C AR-710.004	0.9	0.11	0.9	0.11	0.8	0.10	0.9	met	n/a	not exceeded	n/a	0.7	exceeded	0.1
C 337.001	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.1	exceeded	0.0
C 337.002	0.1	0.01	0.1	0.01	0.1	0.01	0.1	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 337.003	0.3	0.03	0.3	0.03	0.3	0.03	0.2	not met	0.1	exceeded	0.0	0.2	exceeded	0.1

Water Quantity for Culverts and Ditches
Access Road: 15-055-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.075

Table 7.075 - Culvert Sizing - 15-055-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-710.001	1.41	5.0	18	< 8	EC-1 Class A1
C AR-710.002	1.19	4.0	12	< 6	EC-3 Type B
C AR-710.003	9.55	22.2	24	< 8	EC-1 Class A1
C AR-710.004	2.89	4.6	18	< 8	EC-1 Class A1
C 337.001	0.16	0.5	12	< 6	EC-3 Type B
C 337.002	0.14	0.4	12	< 6	EC-3 Type B
C 337.003	0.81	1.4	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 15-055-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.075

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.075 - Roadside Ditch Sizing - 15-055-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-710.001	2.1	5.0	0.02	Type I	2.0	1.0	2.4	Riprap (D50 - 6 in)
C AR-710.002	1.6	4.0	0.02	Type I	2.0	0.9	2.4	Riprap (D50 - 6 in)
C AR-710.003	7.1	22.2	0.02	Type III	2.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-710.004	1.5	4.6	0.02	Type I	2.0	0.8	2.4	Riprap (D50 - 6 in)
C 337.001	0.2	0.5	0.01	Type I	1.0	0.2	0.4	Grass Lined
C 337.002	0.1	0.4	0.03	Type I	1.0	0.4	0.4	Grass Lined
C 337.003	0.5	1.4	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 15-067-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.076

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-067-AR 1	C AR-710.005	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	96	T-2
15-067-AR 1	C AR-710.006	7	AR-710	Greensville	Mill Swamp-Fontaine Creek	96	T-2
15-067-AR 1	C 339.001	7	339	Greensville	Mill Swamp-Fontaine Creek	96	103
15-067-AR 1	C 339.002	7	339	Greensville	Mill Swamp-Fontaine Creek	96	103
15-067-AR 1	C 339.003	7	339	Greensville	Mill Swamp-Fontaine Creek	96	103
15-067-AR 1	C 339.004	7	339	Greensville	Mill Swamp-Fontaine Creek	96	103
15-067-AR 1	C 339.005	7	339	Greensville	Mill Swamp-Fontaine Creek	96	103

Water Quantity for Culverts and Ditches
Access Road: 15-067-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.076

Table 5.076 - Water Quantity - 15-067-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR-710.005	1.87	3.0	3.6	5.7	17	76	2.2	3.2	7.0	17	76	2.2	3.2	7.0	0.0	0.0	0.0
C AR-710.006	1.95	3.0	3.6	5.7	19	75	2.0	3.0	6.7	19	75	2.0	3.0	6.7	0.0	0.0	0.0
C 339.001	1.09	3.0	3.6	5.7	18	77	1.3	1.9	4.1	18	77	1.3	1.9	4.1	0.0	0.0	0.0
C 339.002	0.47	3.0	3.6	5.7	23	77	0.5	0.7	1.6	23	78	0.5	0.8	1.6	0.0	0.0	0.1
C 339.003	0.23	3.0	3.6	5.7	15	74	0.3	0.4	0.9	15	75	0.3	0.4	0.9	0.0	0.0	0.0
C 339.004	0.48	3.0	3.6	5.7	16	77	0.6	0.9	1.9	16	77	0.6	0.9	1.9	0.0	0.0	0.0
C 339.005	0.56	3.0	3.6	5.7	15	77	0.8	1.1	2.3	15	77	0.8	1.1	2.3	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 15-067-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.076

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.076 - Energy Balance - 15-067-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR-710.005	2.2	0.14	2.2	0.14	2.1	0.14	2.2	met	n/a	not exceeded	n/a	1.9	exceeded	0.3
C AR-710.006	2.0	0.14	2.0	0.14	1.9	0.13	2.0	met	n/a	not exceeded	n/a	1.8	exceeded	0.2
C 339.001	1.3	0.09	1.3	0.09	1.2	0.08	1.3	met	n/a	not exceeded	n/a	1.0	exceeded	0.3
C 339.002	0.5	0.04	0.5	0.04	0.4	0.03	0.5	not met	0.1	exceeded	0.0	0.4	exceeded	0.2
C 339.003	0.3	0.02	0.3	0.02	0.2	0.01	0.2	not met	0.0	exceeded	0.0	0.2	exceeded	0.1
C 339.004	0.6	0.04	0.6	0.04	0.5	0.03	0.6	met	n/a	not exceeded	n/a	0.5	exceeded	0.1
C 339.005	0.8	0.05	0.8	0.05	0.7	0.04	0.8	met	n/a	not exceeded	n/a	0.6	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 15-067-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.076

Table 7.076 - Culvert Sizing - 15-067-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR-710.005	1.87	7.0	18	< 8	EC-1 Class A1
C AR-710.006	1.95	6.7	18	< 8	EC-1 Class A1
C 339.001	1.09	4.1	18	< 8	EC-1 Class A1
C 339.002	0.47	1.6	12	< 6	EC-3 Type B
C 339.003	0.23	0.9	12	< 6	EC-3 Type B
C 339.004	0.48	1.9	12	< 6	EC-3 Type B
C 339.005	0.56	2.3	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 15-067-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.076

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.076 - Roadside Ditch Sizing - 15-067-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR-710.005	3.2	7.0	0.01	Type I	2.0	0.8	2.4	Riprap (D50 - 6 in)
C AR-710.006	3.0	6.7	0.02	Type I	2.0	1.3	2.4	Riprap (D50 - 6 in)
C 339.001	1.9	4.1	0.03	Type I	2.0	1.2	2.4	Riprap (D50 - 6 in)
C 339.002	0.8	1.6	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 339.003	0.4	0.9	0.03	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)
C 339.004	0.9	1.9	0.01	Type I	1.5	0.4	0.4	Grass Lined
C 339.005	1.1	2.3	0.02	Type I	1.5	0.9	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 15-072-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.077

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
15-072-AR 1	C 340.001	7	340	Greensville	Mill Swamp-Fontaine Creek	96	105
15-072-AR 1	C 340.002	7	340	Greensville	Mill Swamp-Fontaine Creek	96	105
15-072-AR 1	C 340.003	7	340	Greensville	Mill Swamp-Fontaine Creek	96	105
15-072-AR 1	C 340.004	7	340	Greensville	Mill Swamp-Fontaine Creek	96	105
15-072-AR 1	C 340.005	7	340	Greensville	Mill Swamp-Fontaine Creek	96	105

Water Quantity for Culverts and Ditches
Access Road: 15-072-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.077

Table 5.077 - Water Quantity - 15-072-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 340.001	2.77	3.0	3.6	5.7	18	50	0.0	0.2	2.5	18	50	0.0	0.2	2.5	0.0	0.0	0.0
C 340.002	2.34	3.0	3.6	5.7	17	55	0.2	0.6	3.4	17	55	0.2	0.6	3.4	0.0	0.0	0.0
C 340.003	2.74	3.0	3.6	5.7	17	67	1.6	2.7	7.6	17	67	1.6	2.7	7.6	0.0	0.0	0.0
C 340.004	2.30	3.0	3.6	5.7	16	68	1.5	2.5	6.8	16	68	1.5	2.5	6.8	0.0	0.0	0.0
C 340.005	2.09	3.0	3.6	5.7	16	67	1.2	2.1	5.9	16	67	1.2	2.1	5.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 15-072-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.077

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.077 - Energy Balance - 15-072-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 340.001	0.0	0.02	0.0	0.02	0.0	0.01	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C 340.002	0.2	0.03	0.2	0.03	0.1	0.03	0.2	met	n/a	not exceeded	n/a	0.1	exceeded	0.1
C 340.003	1.6	0.12	1.6	0.12	1.5	0.11	1.6	met	n/a	not exceeded	n/a	1.4	exceeded	0.3
C 340.004	1.5	0.11	1.5	0.11	1.4	0.10	1.5	met	n/a	not exceeded	n/a	1.3	exceeded	0.2
C 340.005	1.2	0.09	1.2	0.09	1.0	0.08	1.2	met	n/a	not exceeded	n/a	0.9	exceeded	0.4

Water Quantity for Culverts and Ditches
Access Road: 15-072-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.077

Table 7.077 - Culvert Sizing - 15-072-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 340.001	2.77	2.5	12	< 6	EC-3 Type B
C 340.002	2.34	3.4	12	< 6	EC-3 Type B
C 340.003	2.74	7.6	18	< 8	EC-1 Class A1
C 340.004	2.30	6.8	18	< 8	EC-1 Class A1
C 340.005	2.09	5.9	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 15-072-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.077

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.077 - Roadside Ditch Sizing - 15-072-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 340.001	0.2	2.5	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 340.002	0.6	3.4	0.01	Type I	2.0	0.4	2.4	Riprap (D50 - 6 in)
C 340.003	2.7	7.6	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C 340.004	2.5	6.8	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)
C 340.005	2.1	5.9	0.01	Type I	2.0	0.7	2.4	Riprap (D50 - 6 in)

Tables 4.078-089 to 8.078-089

Permanent Access Roads, Spread 11

Tables 4.078-089 Culvert List

Tables 5.078-089 Water Quantity

Tables 6.078-089 Energy Balance

Tables 7.078-089 Culvert Sizing

Tables 8.078-089 Roadside Ditch Sizing Table

Water Quantity for Culverts and Ditches
Access Road: 25-048-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.078

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
25-048-AR 1	C 26.002	11	26	Southampton	Lower Tarrara Creek	91	106
25-048-AR 1	C 26.003	11	26	Southampton	Lower Tarrara Creek	91	106
25-048-AR 1	C 26.004	11	26	Southampton	Lower Tarrara Creek	91	106

Water Quantity for Culverts and Ditches
Access Road: 25-048-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.078

Table 5.078 - Water Quantity - 25-048-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 26.002	0.82	3.0	3.6	5.8	64	76	0.4	0.6	1.3	64	77	0.4	0.6	1.4	0.0	0.0	0.0
C 26.003	0.87	3.0	3.6	5.8	27	78	0.9	1.2	2.7	27	78	0.9	1.2	2.7	0.0	0.0	0.0
C 26.004	1.33	3.0	3.6	5.8	13	76	1.8	2.6	5.8	13	76	1.8	2.6	5.8	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 25-048-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.078

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.078 - Energy Balance - 25-048-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 26.002	0.4	0.06	0.4	0.06	0.4	0.06	0.4	not met	0.0	exceeded	0.0	0.4	exceeded	0.0
C 26.003	0.9	0.07	0.9	0.07	0.9	0.07	0.9	met	n/a	not exceeded	n/a	0.9	exceeded	0.0
C 26.004	1.8	0.10	1.8	0.10	1.9	0.11	1.8	met	n/a	not exceeded	n/a	2.0	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 25-048-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.078

Table 7.078 - Culvert Sizing - 25-048-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 26.002	0.82	1.4	12	< 6	EC-3 Type B
C 26.003	0.87	2.7	12	< 6	EC-3 Type B
C 26.004	1.33	5.8	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 25-048-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.078

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.078 - Roadside Ditch Sizing - 25-048-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 26.002	0.6	1.4	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 26.003	1.2	2.7	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 26.004	2.6	5.8	0.01	Type I	2.0	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 25-055-A003.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.079

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
25-055-A003.AR1	C 28.001	11	28	Southampton	Darden Pond-Mill Swamp	56	107
25-055-A003.AR1	C 28.002	11	28	Southampton	Darden Pond-Mill Swamp	56	107
25-055-A003.AR1	C 28.003	11	28	Southampton	Darden Pond-Mill Swamp	56	107
25-055-A003.AR1	C 28.004	11	28	Southampton	Darden Pond-Mill Swamp	56	107

Water Quantity for Culverts and Ditches
Access Road: 25-055-A003.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.079

Table 5.079 - Water Quantity - 25-055-A003.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 28.001	2.28	3.0	3.6	5.8	25	74	1.9	2.8	6.6	26	74	1.8	2.7	6.5	-0.1	-0.1	-0.2
C 28.002	3.01	3.0	3.6	5.8	28	74	2.3	3.5	8.3	28	74	2.3	3.4	8.1	0.0	-0.1	-0.2
C 28.003	2.33	3.0	3.6	5.8	29	74	1.7	2.6	6.2	30	74	1.7	2.5	6.1	0.0	0.0	-0.1
C 28.004	2.88	3.0	3.6	5.8	28	74	2.2	3.3	7.8	29	74	2.1	3.2	7.7	0.0	0.0	-0.1

Water Quantity for Culverts and Ditches
Access Road: 25-055-A003.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.079

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.079 - Energy Balance - 25-055-A003.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 28.001	1.9	0.15	1.8	0.15	1.9	0.15	1.9	met	n/a	not exceeded	n/a	1.9	not exceeded	n/a
C 28.002	2.3	0.20	2.3	0.20	2.3	0.20	2.3	met	n/a	not exceeded	n/a	2.3	not exceeded	n/a
C 28.003	1.7	0.16	1.7	0.16	1.7	0.16	1.7	met	n/a	not exceeded	n/a	1.7	not exceeded	n/a
C 28.004	2.2	0.19	2.1	0.19	1.9	0.17	2.2	met	n/a	not exceeded	n/a	1.7	exceeded	0.5

Water Quantity for Culverts and Ditches

Access Road: 25-055-A003.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.079

Table 7.079 - Culvert Sizing - 25-055-A003.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 28.001	2.28	6.5	18	< 8	EC-1 Class A1
C 28.002	3.01	8.1	18	< 8	EC-1 Class A1
C 28.003	2.33	6.1	18	< 8	EC-1 Class A1
C 28.004	2.88	7.7	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 25-055-A003.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.079

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.079 - Roadside Ditch Sizing - 25-055-A003.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 28.001	2.7	6.5	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 28.002	3.4	8.1	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 28.003	2.5	6.1	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 28.004	3.2	7.7	0.00	Type I	2.0	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 25-066-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.080

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
25-066-AR 1	C 31.001	11	31	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 31.002	11	31	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 31.003	11	31	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.001	11	32	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.002	11	32	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.003	11	32	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.004	11	32	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.005	11	32	Southampton	Round Gut-Nottoway River	68	108
25-066-AR 1	C 32.006	11	32	Southampton	Round Gut-Nottoway River	68	108

Water Quantity for Culverts and Ditches
Access Road: 25-066-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.080

Table 5.080 - Water Quantity - 25-066-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 31.001	0.56	3.0	3.6	5.8	18	51	0.0	0.1	0.6	18	53	0.0	0.1	0.7	0.0	0.0	0.1
C 31.002	0.59	3.0	3.6	5.8	21	51	0.0	0.1	0.6	21	53	0.0	0.1	0.7	0.0	0.0	0.1
C 31.003	0.09	3.0	3.6	5.8	17	57	0.0	0.0	0.1	17	59	0.0	0.0	0.2	0.0	0.0	0.0
C 32.001	2.72	3.0	3.6	5.8	49	68	0.8	1.4	4.1	49	68	0.8	1.4	4.1	0.0	0.0	0.0
C 32.002	3.31	3.0	3.6	5.8	49	75	1.8	2.7	6.4	49	75	1.8	2.7	6.4	0.0	0.0	0.0
C 32.003	2.32	3.0	3.6	5.8	25	80	2.8	3.8	8.1	25	80	2.8	3.8	8.1	0.0	0.0	0.0
C 32.004	0.27	3.0	3.6	5.8	14	63	0.1	0.2	0.7	14	65	0.2	0.3	0.8	0.0	0.0	0.1
C 32.005	2.12	3.0	3.6	5.8	14	54	0.1	0.5	3.4	14	54	0.1	0.5	3.4	0.0	0.0	0.0
C 32.006	0.33	3.0	3.6	5.8	24	53	0.0	0.0	0.3	24	57	0.0	0.1	0.5	0.0	0.1	0.1

Water Quantity for Culverts and Ditches
Access Road: 25-066-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.080

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.080 - Energy Balance - 25-066-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 31.001	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 31.002	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 31.003	0.0	0.00	0.0	0.00	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 32.001	0.8	0.12	0.8	0.12	0.8	0.11	0.8	met	n/a	not exceeded	n/a	0.7	exceeded	0.1
C 32.002	1.8	0.23	1.8	0.23	1.8	0.23	1.8	met	n/a	not exceeded	n/a	1.8	exceeded	0.0
C 32.003	2.8	0.22	2.8	0.22	2.8	0.22	2.8	met	n/a	not exceeded	n/a	2.8	exceeded	0.0
C 32.004	0.1	0.01	0.2	0.01	0.1	0.01	0.1	not met	0.1	exceeded	0.0	0.0	exceeded	0.1
C 32.005	0.1	0.02	0.1	0.02	0.1	0.02	0.1	met	n/a	not exceeded	n/a	0.1	exceeded	0.0
C 32.006	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches
Access Road: 25-066-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.080

Table 7.080 - Culvert Sizing - 25-066-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 31.001	0.56	0.7	12	< 6	EC-3 Type B
C 31.002	0.59	0.7	12	< 6	EC-3 Type B
C 31.003	0.09	0.2	12	< 6	EC-3 Type B
C 32.001	2.72	4.1	12	< 6	EC-3 Type B
C 32.002	3.31	6.4	18	< 8	EC-1 Class A1
C 32.003	2.32	8.1	18	< 8	EC-1 Class A1
C 32.004	0.27	0.8	12	< 6	EC-3 Type B
C 32.005	2.12	3.4	12	< 6	EC-3 Type B
C 32.006	0.33	0.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 25-066-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.080

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.080 - Roadside Ditch Sizing - 25-066-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 31.001	0.1	0.7	0.03	Type I	1.5	0.4	2.4	Riprap (D50 - 6 in)
C 31.002	0.1	0.7	0.04	Type I	1.0	0.5	2.4	Riprap (D50 - 6 in)
C 31.003	0.0	0.2	0.02	Type I	1.0	0.1	0.4	Grass Lined
C 32.001	1.4	4.1	0.00	Type I	2.0	0.2	0.4	Grass Lined
C 32.002	2.7	6.4	0.01	Type II	1.5	0.2	0.4	Grass Lined
C 32.003	3.8	8.1	0.01	Type II	1.5	0.2	0.4	Grass Lined
C 32.004	0.3	0.8	0.04	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 32.005	0.5	3.4	0.03	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 32.006	0.1	0.5	0.02	Type I	1.0	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 25-074-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.081

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
25-074-AR 3	C 33.001	11	33	Southampton	Round Gut-Nottoway River	68	109

Water Quantity for Culverts and Ditches
Access Road: 25-074-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.081

Table 5.081 - Water Quantity - 25-074-AR 3																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 33.001	2.21	3.0	3.6	5.8	39	72	1.1	1.8	4.5	39	72	1.1	1.8	4.5	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 25-074-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.081

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.081 - Energy Balance - 25-074-AR 3

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 33.001	1.1	0.13	1.1	0.13	1.2	0.14	1.1	met	n/a	not exceeded	n/a	1.3	not exceeded	n/a

Water Quantity for Culverts and Ditches

Access Road: 25-074-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.081

Table 7.081 - Culvert Sizing - 25-074-AR 3					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 33.001	2.21	4.5	18	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 25-074-AR 3
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.081

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.081 - Roadside Ditch Sizing - 25-074-AR 3

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 33.001	1.8	4.5	0.01	Type I	2.0	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches

Access Road: 25-078-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.082

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
25-078-AR 1	C 34.001	11	34	Southampton	Round Gut-Nottoway River	68	110
25-078-AR 1	C 34.002	11	34	Southampton	Round Gut-Nottoway River	68	110
25-078-AR 1	C 34.003	11	34	Southampton	Round Gut-Nottoway River	68	110

Water Quantity for Culverts and Ditches

Access Road: 25-078-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.082

Table 5.082 - Water Quantity - 25-078-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 34.001	0.48	3.0	3.6	5.8	10	76	0.7	1.0	2.3	10	78	0.8	1.1	2.4	0.1	0.1	0.1
C 34.002	41.14	3.0	3.6	5.8	59	70	13.1	21.2	57.4	59	70	13.1	21.2	57.4	0.0	0.0	0.0
C 34.003	0.72	3.0	3.6	5.8	16	61	0.2	0.4	1.6	16	62	0.2	0.5	1.7	0.0	0.1	0.1

Water Quantity for Culverts and Ditches

Access Road: 25-078-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.082

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.082 - Energy Balance - 25-078-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 34.001	0.7	0.04	0.8	0.04	0.7	0.03	0.6	not met	0.2	exceeded	0.1	0.6	exceeded	0.2
C 34.002	13.1	2.11	13.1	2.11	12.0	1.97	13.1	met	n/a	not exceeded	n/a	11.2	exceeded	1.9
C 34.003	0.2	0.02	0.2	0.02	0.1	0.01	0.2	not met	0.0	exceeded	0.0	0.1	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 25-078-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.082

Table 7.082 - Culvert Sizing - 25-078-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 34.001	0.48	2.4	12	< 6	EC-3 Type B
C 34.002	41.14	57.4	42	< 8	EC-1 Class A1
C 34.003	0.72	1.7	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches

Access Road: 25-078-AR 1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.082

Channel Types

Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies

Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.082 - Roadside Ditch Sizing - 25-078-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 34.001	1.1	2.4	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 34.002	21.2	57.4	0.01	Type III	3.0	0.4	0.4	Grass Lined
C 34.003	0.5	1.7	0.01	Type I	1.5	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 26-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.083

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
26-001.AR1	C 41.001	11	41	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 41.002	11	41	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 41.003	11	41	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 42.001	11	42	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 42.002	11	42	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 42.003	11	42	Suffolk	Union Camp Holding Pond-Blackwater River	67	111
26-001.AR1	C 42.004	11	42	Suffolk	Union Camp Holding Pond-Blackwater River	67	111

Water Quantity for Culverts and Ditches
Access Road: 26-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.083

Table 5.083 - Water Quantity - 26-001.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 41.001	8.93	3.0	3.7	5.9	41	61	1.3	3.0	11.2	41	61	1.3	3.0	11.2	0.0	0.0	0.0
C 41.002	0.55	3.0	3.7	5.9	16	51	0.0	0.1	0.7	16	54	0.0	0.1	0.9	0.0	0.1	0.2
C 41.003	8.88	3.0	3.7	5.9	33	69	3.9	7.0	18.6	33	69	3.9	7.0	18.6	0.0	0.0	0.0
C 42.001	0.48	3.0	3.7	5.9	16	87	1.0	1.4	2.5	16	87	1.0	1.4	2.5	0.0	0.0	0.0
C 42.002	0.34	3.0	3.7	5.9	6	90	1.2	1.5	2.6	6	89	1.1	1.5	2.6	0.0	0.0	0.0
C 42.003	0.55	3.0	3.7	5.9	24	91	1.1	1.5	2.5	24	90	1.1	1.4	2.5	0.0	-0.1	0.0
C 42.004	0.76	3.0	3.7	5.9	36	83	0.8	1.2	2.3	36	83	0.8	1.2	2.3	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 26-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.083

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.083 - Energy Balance - 26-001.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 41.001	1.3	0.23	1.3	0.23	1.5	0.25	1.3	met	n/a	not exceeded	n/a	1.7	not exceeded	n/a
C 41.002	0.0	0.00	0.0	0.01	0.0	0.00	0.0	not met	0.0	exceeded	0.0	0.0	exceeded	0.0
C 41.003	3.9	0.43	3.9	0.43	3.9	0.43	3.9	met	n/a	not exceeded	n/a	3.9	exceeded	0.0
C 42.001	1.0	0.06	1.0	0.06	0.8	0.05	1.0	met	n/a	not exceeded	n/a	0.6	exceeded	0.4
C 42.002	1.2	0.05	1.1	0.05	0.9	0.04	1.2	met	n/a	not exceeded	n/a	0.6	exceeded	0.5
C 42.003	1.1	0.09	1.1	0.08	0.9	0.07	1.2	met	n/a	not exceeded	n/a	0.7	exceeded	0.4
C 42.004	0.8	0.08	0.8	0.08	0.7	0.07	0.8	met	n/a	not exceeded	n/a	0.5	exceeded	0.3

Water Quantity for Culverts and Ditches

Access Road: 26-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.083

Table 7.083 - Culvert Sizing - 26-001.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 41.001	8.93	11.2	18	< 8	EC-1 Class A1
C 41.002	0.55	0.9	12	< 6	EC-3 Type B
C 41.003	8.88	18.6	24	< 8	EC-1 Class A1
C 42.001	0.48	2.5	12	< 6	EC-3 Type B
C 42.002	0.34	2.6	12	< 6	EC-3 Type B
C 42.003	0.55	2.5	12	< 6	EC-3 Type B
C 42.004	0.76	2.3	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 26-001.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.083

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.083 - Roadside Ditch Sizing - 26-001.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 41.001	3.0	11.2	0.01	Type II	2.0	0.2	0.4	Grass Lined
C 41.002	0.1	0.9	0.04	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)
C 41.003	7.0	18.6	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 42.001	1.4	2.5	0.01	Type I	1.5	0.6	2.4	Riprap (D50 - 6 in)
C 42.002	1.5	2.6	0.02	Type I	1.5	0.8	2.4	Riprap (D50 - 6 in)
C 42.003	1.4	2.5	0.01	Type I	1.5	0.3	0.4	Grass Lined
C 42.004	1.2	2.3	0.02	Type I	1.5	0.7	2.4	Riprap (D50 - 6 in)

Water Quantity for Culverts and Ditches
Access Road: 26-060-A080.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.084

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
26-060-A080.AR1	C 66.001	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C 66.002	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C 66.003	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C 66.004	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C AR102.047	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C AR102.048	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113
26-060-A080.AR1	C AR102.049	11	66	Suffolk	Cedar Lake-Nansemond Rive	46	113

Water Quantity for Culverts and Ditches
Access Road: 26-060-A080.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.084

Table 5.084 - Water Quantity - 26-060-A080.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 66.001	0.52	3.0	3.7	5.9	12	91	1.5	2.0	3.4	12	91	1.5	2.0	3.4	0.0	0.0	0.0
C 66.002	0.47	3.0	3.7	5.9	8	86	1.3	1.7	3.2	8	86	1.3	1.7	3.2	0.0	0.0	0.0
C 66.003	0.56	3.0	3.7	5.9	12	65	0.3	0.6	1.8	12	65	0.3	0.6	1.8	0.0	0.0	0.0
C 66.004	0.18	3.0	3.7	5.9	10	48	0.0	0.0	0.2	10	48	0.0	0.0	0.2	0.0	0.0	0.0
C AR102.047	3.07	3.0	3.7	5.9	11	44	0.0	0.0	2.1	11	44	0.0	0.0	2.1	0.0	0.0	0.0
C AR102.048	1.09	3.0	3.7	5.9	6	47	0.0	0.0	1.4	6	47	0.0	0.0	1.4	0.0	0.0	0.0
C AR102.049	1.60	3.0	3.7	5.9	6	49	0.0	0.2	2.5	6	49	0.0	0.2	2.5	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 26-060-A080.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.084

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Note: Some culverts associated with this access road have a runoff volume of less than 0.005 acre-feet. Therefore, the conditions in columns B and G are satistifed.

Table 6.084 - Energy Balance - 26-060-A080.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 66.001	1.5	0.08	1.5	0.08	1.0	0.06	1.5	met	n/a	not exceeded	n/a	0.7	exceeded	0.8
C 66.002	1.3	0.06	1.3	0.06	0.7	0.03	1.3	met	n/a	not exceeded	n/a	0.4	exceeded	0.9
C 66.003	0.3	0.02	0.3	0.02	0.2	0.01	0.3	met	n/a	not exceeded	n/a	0.1	exceeded	0.2
C 66.004	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR102.047	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR102.048	0.0	0.00	0.0	0.00	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0
C AR102.049	0.0	0.01	0.0	0.01	0.0	0.00	0.0	met	n/a	not exceeded	n/a	0.0	exceeded	0.0

Water Quantity for Culverts and Ditches

Access Road: 26-060-A080.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.084

Table 7.084 - Culvert Sizing - 26-060-A080.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 66.001	0.52	3.4	12	< 6	EC-3 Type B
C 66.002	0.47	3.2	12	< 6	EC-3 Type B
C 66.003	0.56	1.8	12	< 6	EC-3 Type B
C 66.004	0.18	0.2	12	< 6	EC-3 Type B
C AR102.047	3.07	2.1	12	< 6	EC-3 Type B
C AR102.048	1.09	1.4	12	< 6	EC-3 Type B
C AR102.049	1.60	2.5	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 26-060-A080.AR1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.084

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.084 - Roadside Ditch Sizing - 26-060-A080.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 66.001	2.0	3.4	0.02	Type I	1.5	1.1	2.4	Riprap (D50 - 6 in)
C 66.002	1.7	3.2	0.01	Type I	1.5	0.4	0.4	Grass Lined
C 66.003	0.6	1.8	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 66.004	0.0	0.2	0.02	Type I	1.0	0.1	0.4	Grass Lined
C AR102.047	0.0	2.1	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR102.048	0.0	1.4	0.01	Type I	1.5	0.1	0.4	Grass Lined
C AR102.049	0.2	2.5	0.01	Type I	1.5	0.2	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 26-060-A098.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.085

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
26-060-A098.AR1	C 68.001	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114
26-060-A098.AR1	C 68.002	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114
26-060-A098.AR1	C 68.003	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114
26-060-A098.AR1	C 68.004	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114
26-060-A098.AR1	C 68.005	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114
26-060-A098.AR1	C 68.006	11	68	Suffolk	Cedar Lake-Nansemond Rive	46	114

Water Quantity for Culverts and Ditches
Access Road: 26-060-A098.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.085

Table 5.085 - Water Quantity - 26-060-A098.AR1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 68.001	0.92	3.0	3.7	5.9	10	85	2.2	3.0	5.7	10	85	2.2	3.0	5.7	0.0	0.0	0.0
C 68.002	6.73	3.0	3.7	5.9	24	97	16.6	20.8	33.6	24	97	16.6	20.8	33.6	0.0	0.0	0.0
C 68.003	7.21	3.0	3.7	5.9	28	100	16.9	20.8	33.2	28	100	16.9	20.8	33.2	0.0	0.0	0.0
C 68.004	3.76	3.0	3.7	5.9	28	100	8.8	10.9	17.4	28	100	8.8	10.9	17.4	0.0	0.0	0.0
C 68.005	4.34	3.0	3.7	5.9	28	100	10.2	12.6	20.0	28	100	10.2	12.6	20.0	0.0	0.0	0.0
C 68.006	4.70	3.0	3.7	5.9	29	100	10.6	13.1	20.9	29	100	10.6	13.1	20.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 26-060-A098.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.085

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.085 - Energy Balance - 26-060-A098.AR1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 68.001	2.2	0.11	2.2	0.11	2.2	0.11	2.2	met	n/a	not exceeded	n/a	2.2	exceeded	0.0
C 68.002	16.6	1.39	16.6	1.39	16.3	1.34	16.6	met	n/a	not exceeded	n/a	15.7	exceeded	1.0
C 68.003	16.9	1.61	16.9	1.61	16.8	1.58	16.9	met	n/a	not exceeded	n/a	16.6	exceeded	0.3
C 68.004	8.8	0.84	8.8	0.84	8.8	0.83	8.8	met	n/a	not exceeded	n/a	8.7	exceeded	0.2
C 68.005	10.2	0.97	10.2	0.97	10.1	0.95	10.2	met	n/a	not exceeded	n/a	10.0	exceeded	0.2
C 68.006	10.6	1.05	10.6	1.05	10.6	1.03	10.6	met	n/a	not exceeded	n/a	10.4	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 26-060-A098.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.085

Table 7.085 - Culvert Sizing - 26-060-A098.AR1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 68.001	0.92	5.7	18	< 8	EC-1 Class A1
C 68.002	6.73	33.6	30	< 8	EC-1 Class A1
C 68.003	7.21	33.2	30	< 8	EC-1 Class A1
C 68.004	3.76	17.4	24	< 8	EC-1 Class A1
C 68.005	4.34	20.0	24	< 8	EC-1 Class A1
C 68.006	4.70	20.9	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 26-060-A098.AR1
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.085

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.085 - Roadside Ditch Sizing - 26-060-A098.AR1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 68.001	3.0	5.7	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 68.002	20.8	33.6	0.01	Type III	2.5	0.4	0.4	Grass Lined
C 68.003	20.8	33.2	0.01	Type III	2.5	0.4	0.4	Grass Lined
C 68.004	10.9	17.4	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 68.005	12.6	20.0	0.01	Type II	2.0	0.4	0.4	Grass Lined
C 68.006	13.1	20.9	0.01	Type III	2.0	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 27-002-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.086

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
27-002-AR 1	C AR102.029	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-002-AR 1	C AR102.030	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-002-AR 1	C AR102.031	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-002-AR 1	C AR102.032	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-002-AR 1	C AR102.033	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116, 117
27-002-AR 1	C AR102.034	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115, 116, 117
27-002-AR 1	C AR102.035	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115, 116, 117
27-002-AR 1	C AR102.036	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115, 116, 117
27-002-AR 1	C AR102.037	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.038	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.039	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.040	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.041	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.042	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.043	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.044	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.045	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C AR102.046	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C 75.001	11	75	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C 75.002	11	75	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C 75.003	11	75	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115
27-002-AR 1	C 75.004	11	75	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	115

Water Quantity for Culverts and Ditches
Access Road: 27-002-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.086

Table 5.086 - Water Quantity - 27-002-AR 1																		
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions						Post-Construction Conditions						Δ Q (cfs)		
					Tc	Weighted	Q (cfs)			Tc	Weighted	Q (cfs)						
		1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	(min)	CN	1-yr	2-yr	10-yr	1-yr	2-yr	10-yr	
C AR102.029	1.73	3.0	3.8	5.9	22	84	2.7	4.0	7.4	22	84	2.7	4.0	7.4	0.0	0.0	0.0	
C AR102.030	2.06	3.0	3.8	5.9	22	81	2.8	4.2	8.2	22	81	2.8	4.2	8.2	0.0	0.0	0.0	
C AR102.031	2.21	3.0	3.8	5.9	22	80	2.9	4.4	8.6	22	80	2.9	4.4	8.6	0.0	0.0	0.0	
C AR102.032	2.07	3.0	3.8	5.9	22	87	3.8	5.3	9.4	22	87	3.8	5.3	9.4	0.0	0.0	0.0	
C AR102.033	2.16	3.0	3.8	5.9	22	92	4.9	6.5	10.7	22	92	4.9	6.5	10.7	0.0	0.0	0.0	
C AR102.034	2.12	3.0	3.8	5.9	22	94	5.0	6.6	10.7	22	93	4.9	6.5	10.6	-0.2	-0.2	-0.1	
C AR102.035	2.29	3.0	3.8	5.9	24	91	4.7	6.4	10.7	24	91	4.7	6.4	10.7	0.0	0.0	0.0	
C AR102.036	2.25	3.0	3.8	5.9	22	91	4.8	6.5	10.9	22	91	4.8	6.5	10.9	0.0	0.0	0.0	
C AR102.037	2.79	3.0	3.8	5.9	21	100	7.7	9.7	15.0	21	99	7.6	9.7	15.0	0.0	0.0	0.0	
C AR102.038	2.54	3.0	3.8	5.9	21	100	6.9	8.8	13.6	21	100	6.9	8.8	13.6	0.0	0.0	0.0	
C AR102.039	2.73	3.0	3.8	5.9	22	100	7.4	9.3	14.5	22	100	7.4	9.3	14.5	0.0	0.0	0.0	
C AR102.040	2.88	3.0	3.8	5.9	24	86	4.8	6.9	12.3	24	86	4.8	6.9	12.3	0.0	0.0	0.0	
C AR102.041	2.84	3.0	3.8	5.9	23	86	4.8	6.8	12.2	23	86	4.8	6.8	12.2	0.0	0.0	0.0	
C AR102.042	2.59	3.0	3.8	5.9	24	86	4.3	6.2	11.1	24	86	4.3	6.2	11.1	0.0	0.0	0.0	
C AR102.043	2.94	3.0	3.8	5.9	23	84	4.5	6.5	12.1	23	84	4.5	6.5	12.1	0.0	0.0	0.0	
C AR102.044	2.81	3.0	3.8	5.9	24	85	4.5	6.4	11.7	24	85	4.5	6.4	11.7	0.0	0.0	0.0	
C AR102.045	3.11	3.0	3.8	5.9	22	99	8.2	10.4	16.2	22	99	8.2	10.4	16.2	0.0	0.0	0.0	
C AR102.046	2.88	3.0	3.8	5.9	23	100	7.6	9.6	14.9	23	100	7.6	9.6	14.9	0.0	0.0	0.0	
C 75.001	3.21	3.0	3.8	5.9	23	100	8.3	10.6	16.4	23	100	8.3	10.6	16.4	0.0	0.0	0.0	
C 75.002	2.99	3.0	3.8	5.9	23	100	7.7	9.8	15.2	23	100	7.7	9.8	15.2	0.0	0.0	0.0	
C 75.003	2.93	3.0	3.8	5.9	24	100	7.5	9.6	14.8	24	100	7.5	9.6	14.8	0.0	0.0	0.0	
C 75.004	4.04	3.0	3.8	5.9	24	100	10.2	13.0	20.1	24	100	10.2	13.0	20.1	0.0	0.0	0.0	

Water Quantity for Culverts and Ditches
Access Road: 27-002-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.086

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.086 - Energy Balance - 27-002-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR102.029	2.7	0.20	2.7	0.20	2.5	0.18	2.7	met	n/a	not exceeded	n/a	2.2	exceeded	0.5
C AR102.030	2.8	0.21	2.8	0.21	2.7	0.19	2.8	met	n/a	not exceeded	n/a	2.5	exceeded	0.3
C AR102.031	2.9	0.21	2.9	0.21	2.9	0.21	2.9	met	n/a	not exceeded	n/a	2.9	exceeded	0.0
C AR102.032	3.8	0.28	3.8	0.28	3.6	0.26	3.8	met	n/a	not exceeded	n/a	3.5	exceeded	0.3
C AR102.033	4.9	0.36	4.9	0.36	4.7	0.35	4.9	met	n/a	not exceeded	n/a	4.5	exceeded	0.4
C AR102.034	5.0	0.39	4.9	0.37	4.7	0.36	5.3	met	n/a	not exceeded	n/a	4.5	exceeded	0.4
C AR102.035	4.7	0.37	4.7	0.37	4.6	0.35	4.7	met	n/a	not exceeded	n/a	4.3	exceeded	0.4
C AR102.036	4.8	0.36	4.8	0.36	4.6	0.35	4.8	met	n/a	not exceeded	n/a	4.4	exceeded	0.4
C AR102.037	7.7	0.62	7.6	0.61	7.5	0.60	7.7	met	n/a	not exceeded	n/a	7.3	exceeded	0.3
C AR102.038	6.9	0.57	6.9	0.57	6.9	0.56	6.9	met	n/a	not exceeded	n/a	6.8	exceeded	0.1
C AR102.039	7.4	0.61	7.4	0.61	7.3	0.60	7.4	met	n/a	not exceeded	n/a	7.2	exceeded	0.1
C AR102.040	4.8	0.37	4.8	0.37	4.6	0.35	4.8	met	n/a	not exceeded	n/a	4.4	exceeded	0.4
C AR102.041	4.8	0.36	4.8	0.36	4.6	0.35	4.8	met	n/a	not exceeded	n/a	4.3	exceeded	0.4
C AR102.042	4.3	0.33	4.3	0.33	4.1	0.31	4.3	met	n/a	not exceeded	n/a	3.9	exceeded	0.4
C AR102.043	4.5	0.34	4.5	0.34	4.3	0.32	4.5	met	n/a	not exceeded	n/a	4.1	exceeded	0.4
C AR102.044	4.5	0.34	4.5	0.34	4.3	0.32	4.5	met	n/a	not exceeded	n/a	4.0	exceeded	0.4
C AR102.045	8.2	0.68	8.2	0.68	8.1	0.66	8.2	met	n/a	not exceeded	n/a	7.9	exceeded	0.3
C AR102.046	7.6	0.64	7.6	0.64	7.5	0.63	7.6	met	n/a	not exceeded	n/a	7.4	exceeded	0.1
C 75.001	8.3	0.71	8.3	0.71	8.3	0.70	8.3	met	n/a	not exceeded	n/a	8.2	exceeded	0.2
C 75.002	7.7	0.67	7.7	0.67	7.7	0.66	7.7	met	n/a	not exceeded	n/a	7.6	exceeded	0.1
C 75.003	7.5	0.65	7.5	0.65	7.5	0.64	7.5	met	n/a	not exceeded	n/a	7.4	exceeded	0.1
C 75.004	10.2	0.90	10.2	0.90	10.2	0.89	10.2	met	n/a	not exceeded	n/a	10.0	exceeded	0.2

Water Quantity for Culverts and Ditches
Access Road: 27-002-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.086

Table 7.086 - Culvert Sizing - 27-002-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR102.029	1.73	7.4	18	< 8	EC-1 Class A1
C AR102.030	2.06	8.2	18	< 8	EC-1 Class A1
C AR102.031	2.21	8.6	18	< 8	EC-1 Class A1
C AR102.032	2.07	9.4	18	< 8	EC-1 Class A1
C AR102.033	2.16	10.7	18	< 8	EC-1 Class A1
C AR102.034	2.12	10.6	18	< 8	EC-1 Class A1
C AR102.035	2.29	10.7	18	< 8	EC-1 Class A1
C AR102.036	2.25	10.9	18	< 8	EC-1 Class A1
C AR102.037	2.79	15.0	24	< 8	EC-1 Class A1
C AR102.038	2.54	13.6	24	< 8	EC-1 Class A1
C AR102.039	2.73	14.5	24	< 8	EC-1 Class A1
C AR102.040	2.88	12.3	18	< 8	EC-1 Class A1
C AR102.041	2.84	12.2	18	< 8	EC-1 Class A1
C AR102.042	2.59	11.1	18	< 8	EC-1 Class A1
C AR102.043	2.94	12.1	18	< 8	EC-1 Class A1
C AR102.044	2.81	11.7	18	< 8	EC-1 Class A1
C AR102.045	3.11	16.2	24	< 8	EC-1 Class A1
C AR102.046	2.88	14.9	24	< 8	EC-1 Class A1
C 75.001	3.21	16.4	24	< 8	EC-1 Class A1
C 75.002	2.99	15.2	24	< 8	EC-1 Class A1
C 75.003	2.93	14.8	24	< 8	EC-1 Class A1
C 75.004	4.04	20.1	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 27-002-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.086

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.086 - Roadside Ditch Sizing - 27-002-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR102.029	4.0	7.4	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR102.030	4.2	8.2	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR102.031	4.4	8.6	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR102.032	5.3	9.4	0.01	Type I	2.0	0.4	0.4	Grass Lined
C AR102.033	6.5	10.7	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.034	6.5	10.6	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.035	6.4	10.7	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.036	6.5	10.9	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.037	9.7	15.0	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.038	8.8	13.6	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.039	9.3	14.5	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.040	6.9	12.3	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.041	6.8	12.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.042	6.2	11.1	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.043	6.5	12.1	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.044	6.4	11.7	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.045	10.4	16.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.046	9.6	14.9	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 75.001	10.6	16.4	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 75.002	9.8	15.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 75.003	9.6	14.8	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 75.004	13.0	20.1	0.01	Type II	2.0	0.4	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.087

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
27-006-AR 1	C AR102.015	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.016	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.017	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.018	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.019	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.020	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.021	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 1	C AR102.022	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116, 117
27-006-AR 1	C AR102.023	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116, 117
27-006-AR 1	C AR102.024	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C AR102.025	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C AR102.026	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C AR102.027	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C AR102.028	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C 76.003	11	76	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 1	C 76.004	11	76	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.087

Table 5.087 - Water Quantity - 27-006-AR 1																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR102.015	5.29	3.0	3.8	5.9	27	81	6.3	9.5	18.4	27	81	6.3	9.5	18.4	0.0	0.0	0.0
C AR102.016	3.18	3.0	3.8	5.9	26	80	3.7	5.7	11.2	26	80	3.7	5.7	11.2	0.0	0.0	0.0
C AR102.017	3.07	3.0	3.8	5.9	26	80	3.6	5.5	10.8	26	80	3.6	5.5	10.8	0.0	0.0	0.0
C AR102.018	3.31	3.0	3.8	5.9	26	80	3.8	5.8	11.5	26	80	3.8	5.8	11.5	0.0	0.0	0.0
C AR102.019	0.99	3.0	3.8	5.9	21	80	1.3	2.0	4.0	21	81	1.4	2.1	4.1	0.1	0.1	0.1
C AR102.020	0.68	3.0	3.8	5.9	18	91	1.6	2.2	3.7	18	91	1.6	2.2	3.7	0.0	0.0	0.0
C AR102.021	8.55	3.0	3.8	5.9	25	87	14.4	20.3	35.9	25	87	14.4	20.3	35.9	0.0	0.0	0.0
C AR102.022	3.58	3.0	3.8	5.9	25	100	8.9	11.2	17.4	25	100	8.9	11.2	17.4	0.0	0.0	0.0
C AR102.023	3.52	3.0	3.8	5.9	26	100	8.6	10.9	17.0	26	100	8.6	10.9	17.0	0.0	0.0	0.0
C AR102.024	3.45	3.0	3.8	5.9	26	100	8.5	10.7	16.7	26	100	8.5	10.7	16.7	0.0	0.0	0.0
C AR102.025	3.77	3.0	3.8	5.9	26	100	9.2	11.7	18.2	26	100	9.2	11.7	18.2	0.0	0.0	0.0
C AR102.026	3.55	3.0	3.8	5.9	26	100	8.6	10.9	16.9	26	100	8.6	10.9	16.9	0.0	0.0	0.0
C AR102.027	3.93	3.0	3.8	5.9	29	100	9.0	11.4	17.7	29	100	9.0	11.4	17.7	0.0	0.0	0.0
C AR102.028	3.94	3.0	3.8	5.9	27	99	9.4	11.9	18.6	27	99	9.4	11.9	18.6	0.0	0.0	0.0
C 76.003	3.68	3.0	3.8	5.9	27	93	7.5	10.0	16.4	27	93	7.5	10.0	16.4	0.0	0.0	0.0
C 76.004	5.87	3.0	3.8	5.9	28	100	13.7	17.3	26.9	28	100	13.7	17.3	26.9	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.087

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.087 - Energy Balance - 27-006-AR 1

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR102.015	6.3	0.53	6.3	0.53	6.3	0.53	6.3	met	n/a	not exceeded	n/a	6.3	exceeded	0.0
C AR102.016	3.7	0.30	3.7	0.30	3.7	0.30	3.7	met	n/a	not exceeded	n/a	3.7	exceeded	0.0
C AR102.017	3.6	0.29	3.6	0.29	3.6	0.29	3.6	met	n/a	not exceeded	n/a	3.6	exceeded	0.0
C AR102.018	3.8	0.31	3.8	0.31	3.8	0.31	3.8	met	n/a	not exceeded	n/a	3.8	exceeded	0.0
C AR102.019	1.3	0.09	1.4	0.10	1.3	0.09	1.3	not met	0.1	exceeded	0.1	1.3	exceeded	0.1
C AR102.020	1.6	0.11	1.6	0.11	1.5	0.10	1.6	met	n/a	not exceeded	n/a	1.3	exceeded	0.4
C AR102.021	14.4	1.14	14.4	1.14	13.8	1.09	14.4	met	n/a	not exceeded	n/a	13.1	exceeded	1.3
C AR102.022	8.9	0.80	8.9	0.80	8.8	0.79	8.9	met	n/a	not exceeded	n/a	8.7	exceeded	0.2
C AR102.023	8.6	0.78	8.6	0.78	8.6	0.77	8.6	met	n/a	not exceeded	n/a	8.5	exceeded	0.2
C AR102.024	8.5	0.77	8.5	0.77	8.4	0.76	8.5	met	n/a	not exceeded	n/a	8.3	exceeded	0.2
C AR102.025	9.2	0.84	9.2	0.84	9.2	0.83	9.2	met	n/a	not exceeded	n/a	9.1	exceeded	0.2
C AR102.026	8.6	0.79	8.6	0.79	8.6	0.78	8.6	met	n/a	not exceeded	n/a	8.4	exceeded	0.2
C AR102.027	9.0	0.87	9.0	0.87	9.0	0.86	9.0	met	n/a	not exceeded	n/a	8.8	exceeded	0.2
C AR102.028	9.4	0.87	9.4	0.87	9.4	0.87	9.4	met	n/a	not exceeded	n/a	9.4	exceeded	0.0
C 76.003	7.5	0.64	7.5	0.64	7.3	0.62	7.5	met	n/a	not exceeded	n/a	7.0	exceeded	0.6
C 76.004	13.7	1.31	13.7	1.31	13.6	1.29	13.7	met	n/a	not exceeded	n/a	13.4	exceeded	0.3

Water Quantity for Culverts and Ditches

Access Road: 27-006-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.087

Table 7.087 - Culvert Sizing - 27-006-AR 1					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR102.015	5.29	18.4	24	< 8	EC-1 Class A1
C AR102.016	3.18	11.2	18	< 8	EC-1 Class A1
C AR102.017	3.07	10.8	18	< 8	EC-1 Class A1
C AR102.018	3.31	11.5	18	< 8	EC-1 Class A1
C AR102.019	0.99	4.1	18	< 8	EC-1 Class A1
C AR102.020	0.68	3.7	12	< 6	EC-3 Type B
C AR102.021	8.55	35.9	30	< 8	EC-1 Class A1
C AR102.022	3.58	17.4	24	< 8	EC-1 Class A1
C AR102.023	3.52	17.0	24	< 8	EC-1 Class A1
C AR102.024	3.45	16.7	24	< 8	EC-1 Class A1
C AR102.025	3.77	18.2	24	< 8	EC-1 Class A1
C AR102.026	3.55	16.9	24	< 8	EC-1 Class A1
C AR102.027	3.93	17.7	24	< 8	EC-1 Class A1
C AR102.028	3.94	18.6	24	< 8	EC-1 Class A1
C 76.003	3.68	16.4	24	< 8	EC-1 Class A1
C 76.004	5.87	26.9	30	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 1
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.087

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.087 - Roadside Ditch Sizing - 27-006-AR 1

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR102.015	9.5	18.4	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.016	5.7	11.2	0.01	Type II	2.0	0.2	0.4	Grass Lined
C AR102.017	5.5	10.8	0.01	Type II	2.0	0.2	0.4	Grass Lined
C AR102.018	5.8	11.5	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.019	2.1	4.1	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR102.020	2.2	3.7	0.01	Type I	2.0	0.3	0.4	Grass Lined
C AR102.021	20.3	35.9	0.01	Type III	2.5	0.4	0.4	Grass Lined
C AR102.022	11.2	17.4	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.023	10.9	17.0	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.024	10.7	16.7	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.025	11.7	18.2	0.01	Type II	2.0	0.4	0.4	Grass Lined
C AR102.026	10.9	16.9	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.027	11.4	17.7	0.01	Type II	2.0	0.4	0.4	Grass Lined
C AR102.028	11.9	18.6	0.01	Type II	2.0	0.4	0.4	Grass Lined
C 76.003	10.0	16.4	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 76.004	17.3	26.9	0.01	Type III	2.0	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.088

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
27-006-AR 2	C AR102.001	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.002	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.003	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.004	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.005	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.006	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.007	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116
27-006-AR 2	C AR102.008	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116, 117
27-006-AR 2	C AR102.009	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	116, 117
27-006-AR 2	C AR102.010	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C AR102.011	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C AR102.012	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C AR102.013	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C AR102.014	11	AR-102	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C 76.001	11	76	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117
27-006-AR 2	C 76.002	11	76	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	117

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.088

Table 5.088 - Water Quantity - 27-006-AR 2																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C AR102.001	4.12	3.0	3.8	5.9	24	82	5.6	8.3	15.9	24	82	5.6	8.3	15.9	0.0	0.0	0.0
C AR102.002	2.89	3.0	3.8	5.9	22	91	6.2	8.4	14.1	22	91	6.2	8.4	14.1	0.0	0.0	0.0
C AR102.003	2.71	3.0	3.8	5.9	22	84	4.3	6.2	11.5	22	85	4.5	6.5	11.8	0.2	0.2	0.3
C AR102.004	2.76	3.0	3.8	5.9	22	98	7.3	9.3	14.5	22	98	7.3	9.3	14.5	0.0	0.0	0.0
C AR102.005	2.71	3.0	3.8	5.9	22	99	7.2	9.1	14.2	22	99	7.2	9.1	14.2	0.0	0.0	0.0
C AR102.006	2.89	3.0	3.8	5.9	22	100	7.7	9.7	15.1	22	100	7.7	9.7	15.1	0.0	0.0	0.0
C AR102.007	2.68	3.0	3.8	5.9	22	100	7.2	9.2	14.2	22	100	7.2	9.2	14.2	0.0	0.0	0.0
C AR102.008	2.63	3.0	3.8	5.9	22	100	7.1	9.0	14.0	22	100	7.1	9.0	14.0	0.0	0.0	0.0
C AR102.009	2.96	3.0	3.8	5.9	22	100	8.0	10.1	15.7	22	100	8.0	10.1	15.7	0.0	0.0	0.0
C AR102.010	2.22	3.0	3.8	5.9	22	100	6.0	7.6	11.8	22	100	6.0	7.6	11.8	0.0	0.0	0.0
C AR102.011	2.89	3.0	3.8	5.9	22	100	7.8	9.9	15.3	22	100	7.8	9.9	15.3	0.0	0.0	0.0
C AR102.012	2.82	3.0	3.8	5.9	22	100	7.6	9.7	15.0	22	100	7.6	9.7	15.0	0.0	0.0	0.0
C AR102.013	2.65	3.0	3.8	5.9	22	100	7.2	9.1	14.1	22	100	7.2	9.1	14.1	0.0	0.0	0.0
C AR102.014	2.79	3.0	3.8	5.9	22	99	7.5	9.5	14.8	22	99	7.5	9.5	14.8	0.0	0.0	0.0
C 76.001	2.67	3.0	3.8	5.9	23	92	5.8	7.8	12.9	23	92	5.8	7.8	12.9	0.0	0.0	0.0
C 76.002	4.09	3.0	3.8	5.9	24	100	10.5	13.2	20.6	24	100	10.5	13.2	20.6	0.0	0.0	0.0

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.088

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.088 - Energy Balance - 27-006-AR 2

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C AR102.001	5.6	0.43	5.6	0.43	5.3	0.41	5.6	met	n/a	not exceeded	n/a	5.0	exceeded	0.6
C AR102.002	6.2	0.46	6.2	0.46	6.2	0.46	6.2	met	n/a	not exceeded	n/a	6.2	exceeded	0.0
C AR102.003	4.3	0.31	4.5	0.33	4.3	0.31	4.1	not met	0.4	exceeded	0.2	4.1	exceeded	0.4
C AR102.004	7.3	0.59	7.3	0.59	7.2	0.57	7.3	met	n/a	not exceeded	n/a	6.9	exceeded	0.4
C AR102.005	7.2	0.59	7.2	0.59	7.1	0.58	7.2	met	n/a	not exceeded	n/a	6.9	exceeded	0.3
C AR102.006	7.7	0.64	7.7	0.64	7.7	0.63	7.7	met	n/a	not exceeded	n/a	7.5	exceeded	0.1
C AR102.007	7.2	0.60	7.2	0.60	7.2	0.59	7.2	met	n/a	not exceeded	n/a	7.1	exceeded	0.1
C AR102.008	7.1	0.59	7.1	0.59	7.1	0.58	7.1	met	n/a	not exceeded	n/a	7.0	exceeded	0.1
C AR102.009	8.0	0.66	8.0	0.66	8.0	0.65	8.0	met	n/a	not exceeded	n/a	7.8	exceeded	0.1
C AR102.010	6.0	0.49	6.0	0.49	6.0	0.49	6.0	met	n/a	not exceeded	n/a	5.9	exceeded	0.1
C AR102.011	7.8	0.64	7.8	0.64	7.8	0.64	7.8	met	n/a	not exceeded	n/a	7.7	exceeded	0.1
C AR102.012	7.6	0.63	7.6	0.63	7.6	0.62	7.6	met	n/a	not exceeded	n/a	7.5	exceeded	0.1
C AR102.013	7.2	0.59	7.2	0.59	7.1	0.58	7.2	met	n/a	not exceeded	n/a	7.0	exceeded	0.1
C AR102.014	7.5	0.61	7.5	0.61	7.4	0.60	7.5	met	n/a	not exceeded	n/a	7.2	exceeded	0.3
C 76.001	5.8	0.45	5.8	0.45	5.6	0.43	5.8	met	n/a	not exceeded	n/a	5.4	exceeded	0.5
C 76.002	10.5	0.91	10.5	0.91	10.4	0.90	10.5	met	n/a	not exceeded	n/a	10.3	exceeded	0.2

Water Quantity for Culverts and Ditches

Access Road: 27-006-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.088

Table 7.088 - Culvert Sizing - 27-006-AR 2					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C AR102.001	4.12	15.9	24	< 8	EC-1 Class A1
C AR102.002	2.89	14.1	24	< 8	EC-1 Class A1
C AR102.003	2.71	11.8	18	< 8	EC-1 Class A1
C AR102.004	2.76	14.5	24	< 8	EC-1 Class A1
C AR102.005	2.71	14.2	24	< 8	EC-1 Class A1
C AR102.006	2.89	15.1	24	< 8	EC-1 Class A1
C AR102.007	2.68	14.2	24	< 8	EC-1 Class A1
C AR102.008	2.63	14.0	24	< 8	EC-1 Class A1
C AR102.009	2.96	15.7	24	< 8	EC-1 Class A1
C AR102.010	2.22	11.8	18	< 8	EC-1 Class A1
C AR102.011	2.89	15.3	24	< 8	EC-1 Class A1
C AR102.012	2.82	15.0	24	< 8	EC-1 Class A1
C AR102.013	2.65	14.1	24	< 8	EC-1 Class A1
C AR102.014	2.79	14.8	24	< 8	EC-1 Class A1
C 76.001	2.67	12.9	24	< 8	EC-1 Class A1
C 76.002	4.09	20.6	24	< 8	EC-1 Class A1

Water Quantity for Culverts and Ditches
Access Road: 27-006-AR 2
Road Designation: Permanent Road
Road Category: Major Upgrade Road
Associated Table Numbers: X.088

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.088 - Roadside Ditch Sizing - 27-006-AR 2

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C AR102.001	8.3	15.9	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.002	8.4	14.1	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.003	6.5	11.8	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.004	9.3	14.5	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.005	9.1	14.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.006	9.7	15.1	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.007	9.2	14.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.008	9.0	14.0	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.009	10.1	15.7	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.010	7.6	11.8	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.011	9.9	15.3	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.012	9.7	15.0	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.013	9.1	14.1	0.01	Type II	2.0	0.3	0.4	Grass Lined
C AR102.014	9.5	14.8	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 76.001	7.8	12.9	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 76.002	13.2	20.6	0.01	Type III	2.0	0.3	0.4	Grass Lined

Water Quantity for Culverts and Ditches
Access Road: 27-045.AR1-revised
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.089

Access Road	Culvert ID	Spread	Alignment/Access Road Sheet	County	HUC-12 Watershed Name	Drainage Basin ID	Culvert and Ditch Analysis Pre- and Post-Development Figure
27-045.AR1-revised	C 80.001	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.002	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.003	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.004	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.005	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.006	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.007	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 80.008	11	80	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 81.001	11	81	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 81.002	11	81	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118
27-045.AR1-revised	C 81.003	11	81	Chesapeake	Deep Creek-Southern Branch Elizabeth River	51	118

Water Quantity for Culverts and Ditches
Access Road: 27-045.AR1-revised
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.089

Table 5.089 - Water Quantity - 27-045.AR1-revised																	
Culvert ID	Drainage Area (ac)	Rainfall (inches)			Pre-Construction Conditions					Post-Construction Conditions					Δ Q (cfs)		
					Tc (min)	Weighted CN	Q (cfs)			Tc (min)	Weighted CN	Q (cfs)					
		1-yr	2-yr	10-yr			1-yr	2-yr	10-yr			1-yr	2-yr	10-yr	1-yr	2-yr	10-yr
C 80.001	2.99	3.0	3.8	5.9	21	84	4.9	7.2	13.2	21	84	4.9	7.2	13.2	0.0	0.0	0.0
C 80.002	1.14	3.0	3.8	5.9	18	80	1.7	2.6	5.0	18	81	1.8	2.7	5.1	0.1	0.1	0.1
C 80.003	4.95	3.0	3.8	5.9	25	85	7.7	11.0	20.2	25	85	7.7	11.0	20.2	0.0	0.0	0.0
C 80.004	0.84	3.0	3.8	5.9	17	100	2.5	3.2	5.0	17	99	2.5	3.2	5.0	0.0	0.0	0.0
C 80.005	0.95	3.0	3.8	5.9	18	100	2.9	3.6	5.6	18	99	2.8	3.6	5.6	0.0	0.0	0.0
C 80.006	1.32	3.0	3.8	5.9	19	100	3.8	4.9	7.5	19	99	3.8	4.8	7.5	0.0	0.0	0.0
C 80.007	1.24	3.0	3.8	5.9	18	100	3.7	4.7	7.2	18	100	3.7	4.7	7.2	0.0	0.0	0.0
C 80.008	1.56	3.0	3.8	5.9	19	100	4.5	5.7	8.8	19	100	4.5	5.7	8.8	0.0	0.0	0.0
C 81.001	0.16	3.0	3.8	5.9	10	85	0.4	0.5	1.0	10	87	0.4	0.6	1.0	0.0	0.0	0.0
C 81.002	0.28	3.0	3.8	5.9	17	84	0.5	0.8	1.4	17	86	0.6	0.8	1.4	0.0	0.1	0.1
C 81.003	0.73	3.0	3.8	5.9	36	81	0.7	1.1	2.1	36	82	0.8	1.1	2.2	0.0	0.0	0.1

Water Quantity for Culverts and Ditches

Access Road: 27-045.AR1-revised
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.089

Column Legend

A	I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ where I.F.= 1
B	Is Energy Balance met so that $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$?
C	Exceedance of $Q_{1\text{-yr Dev.}} \leq$ I.F.($Q_{1\text{-yr Pre-Dev.}}$)($RV_{1\text{-yr Pre-Dev.}}$) / $RV_{1\text{-yr Dev.}}$ Where I.F. = 1 (cfs)
D	Is condition exceeded? $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$
E	Exceedance of $Q_{1\text{-yr Dev.}} > Q_{1\text{-yr Pre-Dev.}}$ (cfs)
F	($Q_{1\text{-yr Forest}}$)($RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
G	Is condition exceeded? $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$*$RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$
H	Exceedance $Q_{1\text{-yr Dev.}} <$ ($Q_{1\text{-yr Forest}}$ * $RV_{1\text{-yr Forest}}$) / $RV_{1\text{-yr Dev.}}$ (cfs)

Table 6.089 - Energy Balance - 27-045.AR1-revised

Culvert ID	$Q_{1\text{-yr Pre-Dev.}}$ (cfs)	$RV_{1\text{-yr Pre-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Dev.}}$ (cfs)	$RV_{1\text{-yr-Dev.}}$ (ac-ft)	$Q_{1\text{-yr Forest}}$ (cfs)	$RV_{1\text{-yr Forest}}$ (ac-ft)	A	B	C	D	E	F	G	H
C 80.001	4.9	0.35	4.9	0.35	#N/A	#N/A	4.9	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.002	1.7	0.11	1.8	0.11	#N/A	#N/A	1.6	not met	0.2	exceeded	0.1	#N/A	#N/A	###
C 80.003	7.7	0.60	7.7	0.60	#N/A	#N/A	7.7	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.004	2.5	0.19	2.5	0.18	#N/A	#N/A	2.5	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.005	2.9	0.21	2.8	0.21	#N/A	#N/A	2.9	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.006	3.8	0.29	3.8	0.29	#N/A	#N/A	3.9	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.007	3.7	0.28	3.7	0.28	#N/A	#N/A	3.7	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 80.008	4.5	0.35	4.5	0.35	#N/A	#N/A	4.5	met	n/a	not exceeded	n/a	#N/A	#N/A	###
C 81.001	0.4	0.02	0.4	0.02	#N/A	#N/A	0.3	not met	0.1	exceeded	0.0	#N/A	#N/A	###
C 81.002	0.5	0.03	0.6	0.04	#N/A	#N/A	0.5	not met	0.1	exceeded	0.0	#N/A	#N/A	###
C 81.003	0.7	0.07	0.8	0.08	#N/A	#N/A	0.7	not met	0.1	exceeded	0.0	#N/A	#N/A	###

Water Quantity for Culverts and Ditches

Access Road: 27-045.AR1-revised
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.089

Table 7.089 - Culvert Sizing - 27-045.AR1-revised					
Culvert ID	Drainage Area (ac)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Diameter (in)	Outlet Velocity = Q/A (ft/sec)	Additional Outlet Protection
C 80.001	2.99	13.2	24	< 8	EC-1 Class A1
C 80.002	1.14	5.1	18	< 8	EC-1 Class A1
C 80.003	4.95	20.2	24	< 8	EC-1 Class A1
C 80.004	0.84	5.0	18	< 8	EC-1 Class A1
C 80.005	0.95	5.6	18	< 8	EC-1 Class A1
C 80.006	1.32	7.5	18	< 8	EC-1 Class A1
C 80.007	1.24	7.2	18	< 8	EC-1 Class A1
C 80.008	1.56	8.8	18	< 8	EC-1 Class A1
C 81.001	0.16	1.0	12	< 6	EC-3 Type B
C 81.002	0.28	1.4	12	< 6	EC-3 Type B
C 81.003	0.73	2.2	12	< 6	EC-3 Type B

Water Quantity for Culverts and Ditches
Access Road: 27-045.AR1-revised
Road Designation: Permanent Road
Road Category: Proposed New Road
Associated Table Numbers: X.089

Channel Types
Type I - V-ditch, 2H:1V side slopes, maximum depth of 2 ft
Type II - Trapezoidal, 2 ft deep, 2 ft bottom width, 2H:1V side slopes, maximum depth of 2 ft
Type III - Trapezoidal, 4 ft bottom width, 2H:1V side slopes, depth varies
Lining Types - Grass Lined, Riprap (D50 = 6 in), Riprap (D50 = 12 in)

Table 8.089 - Roadside Ditch Sizing - 27-045.AR1-revised

Relief Culvert ID	$Q_{2\text{-yr Post-Dev.}}$ (cfs)	$Q_{10\text{-yr Post-Dev.}}$ (cfs)	Design Slope (ft/ft)	Minimum Channel Type	Minimum Channel Depth (ft)	Calculated Shear Stress, τd (lb/sf)	Permissible Shear Stress, τp (lb/sf)	Lining Type
C 80.001	7.2	13.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 80.002	2.7	5.1	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 80.003	11.0	20.2	0.01	Type II	2.0	0.3	0.4	Grass Lined
C 80.004	3.2	5.0	0.01	Type I	2.0	0.3	0.4	Grass Lined
C 80.005	3.6	5.6	0.01	Type II	1.5	0.2	0.4	Grass Lined
C 80.006	4.8	7.5	0.01	Type II	1.5	0.2	0.4	Grass Lined
C 80.007	4.7	7.2	0.01	Type II	1.5	0.2	0.4	Grass Lined
C 80.008	5.7	8.8	0.01	Type II	2.0	0.2	0.4	Grass Lined
C 81.001	0.6	1.0	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 81.002	0.8	1.4	0.01	Type I	1.5	0.2	0.4	Grass Lined
C 81.003	1.1	2.2	0.01	Type I	1.5	0.2	0.4	Grass Lined

TABLE 9.1

Summary of DEQ Virginia Runoff Reduction Method Water Quality Calculations

Water Quality

Table 9.1 - Summary of VRRM Water Quality Calculations

Notes:
1. The total phosphorous (TP) loading was evaluated for the area within the construction limit of disturbance of the pipeline right-of-way (ROW) and the permanent access road ROW.
2. The net TP load reduction is tracked by HUC-12 watershed.

HUC-12 Watershed	Workspace	Access Road Category	NEW DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.2*	RE-DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.3*	NET TP Load Reduction Required (lb/yr)
Angola Creek-Appomattox River	ROW	-	-22.10	-	-22.10
Barterbrook Branch-Christians Creek	07-001-A155.AR-AR 1	Proposed New Road	0.36	-	0.74
	ROW	-	0.38	-	
Beaver Creek-Rockfish River	08-210.AR-AR 1	Proposed New Road	0.39	-	-14.83
	ROW	-	-15.22	-	
Beaver Pond Creek-Nottoway River	13-041-AR 1	Proposed New Road	0.18	-	-27.02
	14-001-AR 1	Proposed New Road	0.18	-	
	ROW	-	-27.39	-	
Bennett Creek-Nansemond River	26-060-A080.AR1	Major Upgrade	-	0.21	4.07
	26-060-A082.AR1	Proposed New Road	4.75	-	
	ROW	-	-0.90	-	
Bishop Creek-Willis River	09-080-AR 1	Proposed New Road	0.69	-	-16.14
	09-103.AR2	Major Upgrade	-	0.91	
	09-113-AR 1	Major Upgrade	-	1.25	
	09-113-AR 3	Proposed New Road	0.14	-	
	ROW	-	-19.14	-	
Bolar Run-Jackson River	06-001-C028.AR2	Major Upgrade	-	2.64	-8.20
	06-001-C032.AR1	Major Upgrade	-	2.21	
	06-001-C036.AR1	Major Upgrade	-	0.39	
	06-001-C037.AR1	Major Upgrade	-	2.46	
	06-001-C037.AR2	Major Upgrade	-	3.77	
	06-001-C037.AR3	Major Upgrade	-	1.17	
	36-014.AR2	Major Upgrade	-	3.18	
	ROW	-	-24.02	-	
Buck Creek-Rockfish River	08-014-AR 1	Major Upgrade	-	3.00	-30.97
	08-086-A036.AR1	Proposed New Road	0.25	-	
	08-086-A039-AR 1	Proposed New Road	0.20	-	
	08-086-A045-AR 1	Proposed New Road	0.03	-	
	08-086-A045-AR 2	Proposed New Road	0.22	-	
	08-113-AR 1	Proposed New Road	0.33	-	
	08-113-AR 2	Proposed New Road	0.59	-	
	ROW	-	-35.59	-	
Buckhorn Swamp-Meherrin River	ROW	-	-5.84	-	-5.84
Buffalo Branch-Middle River	ROW	-	-1.10	-	-1.10
Butterwood Creek	13-006.AR1	Major Upgrade	-	0.17	-30.19
	13-007.AR1	Major Upgrade	-	0.20	
	ROW	-	-30.56	-	
Cabin Creek-Mill Creek	36-091.AR1	Major Upgrade	-	0.58	-21.59
	ROW	-	-22.18	-	
Canada Run-South River	ROW	-	-5.19	-	-5.19
Cattail Creek-Fontaine Creek	15-029-AR 2	Proposed New Road	1.30	-	-5.96
	ROW	-	-7.26	-	
Cedar Lake-Nansemond River	26-060-A080.AR1	Major Upgrade	-	0.92	-13.70
	26-060-A082.AR1	Proposed New Road	0.24	-	
	26-060-A098.AR1	Proposed New Road	0.64	-	
	ROW	-	-15.50	-	
Cellar Creek	12-101-AR 1	Major Upgrade	-	1.70	-18.13
	12-108-AR 1	Proposed New Road	0.23	-	
	ROW	-	-20.07	-	
Chair Draft-Calfpasture River	07-001.AR1-AR 4	Proposed New Road	0.07	-	-9.80
	07-001-A009-AR 1	Major Upgrade	-	0.41	
	07-001-A055.AR2	Major Upgrade	-	1.92	
	07-001-AR 3	Major Upgrade	-	3.95	
	07-001-AR 6	Major Upgrade	-	0.62	
	ROW	-	-16.77	-	
Chapel Swamp-Somerton Creek	ROW	-	-1.64	-	-1.64
Cohoon Creek	ROW	-	-6.61	-	-6.61
Darden Pond-Mill Swamp	25-048-AR 1	Major Upgrade	-	0.11	1.07
	25-055-A003.AR1	Proposed New Road	0.62	-	
	ROW	-	0.34	-	

HUC-12 Watershed	Workspace	Access Road Category	NEW DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.2*	RE-DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.3*	NET TP Load Reduction Required (lb/yr)
Deep Creek-Southern Branch Elizabeth River	27-002-AR 1	Major Upgrade	-	2.16	20.00
	27-006-AR 1	Major Upgrade	-	1.58	
	27-006-AR 2	Major Upgrade	-	1.58	
	27-045.AR1-revised	Proposed New Road	1.71	-	
	ROW	-	12.97	-	
Douglas Run-Meherrin River	15-011-A001-AR 1	Major Upgrade	-	0.29	-15.69
	15-011-AR 1	Proposed New Road	0.05	-	
	15-011-AR 3	Major Upgrade	-	1.24	
	15-014.AR1	Major Upgrade	-	1.77	
	ROW	-	-19.04	-	
Dry Run	36-014.AR2	Major Upgrade	-	7.35	0.40
	36-014.AR3	Proposed New Road	3.74	-	
	36-018.AR1	Major Upgrade	-	1.24	
	36-027.AR1	Major Upgrade	-	3.09	
	ROW	-	-15.02	-	
Ducker Creek-Appomattox River	ROW	-	-10.11	-	-10.11
Dutch Creek-Rockfish River	08-086-A045-AR 3	Proposed New Road	0.58	-	-19.03
	08-086-A050-AR 1	Proposed New Road	1.91	-	
	08-086-A054.AR1	Proposed New Road	0.95	-	
	08-086-A112.AR1	Major Upgrade	-	0.30	
	ROW	-	-22.76	-	
Edison Creek-Middle River	ROW	-	-3.37	-	-3.37
Falling Run-Meherrin River	15-029-AR 2	Proposed New Road	0.19	-	-6.00
	ROW	-	-6.19	-	
Folly Mills Creek-Christians Creek	07-001-A138.AR 1	Proposed New Road	1.51	-	-6.15
	07-001-A148-AR 1	Proposed New Road	2.08	-	
	ROW	-	-9.73	-	
Grease Creek-Slate River	09-051.AR1	Major Upgrade	-	0.02	-3.47
	ROW	-	-3.49	-	
Hamilton Branch	07-001-F002.AR1	Major Upgrade	-	0.97	-10.68
	07-001-F002.AR2	Major Upgrade	-	0.79	
	07-001-F009.AR1	Major Upgrade	-	0.30	
	07-001-F012.AR1	Major Upgrade	-	0.49	
	07-001-F029.AR1	Major Upgrade	-	1.06	
	ROW	-	-14.28	-	
Holloway Draft-Calfpasture River	07-001-A017.AR1	Proposed New Road	0.66	-	-4.45
	ROW	-	-5.11	-	
Horsepen Creek-Slate River	09-048.AR1	Major Upgrade	-	2.67	-18.06
	09-051.AR1	Major Upgrade	-	0.79	
	ROW	-	-21.53	-	
Inch Branch-Back Creek	ROW	-	-23.97	-	-23.97
Jacks Swamp	ROW	-	-0.28	-	-0.28
Jennings Branch	07-001.AR1-AR 9	Major Upgrade	-	1.38	-14.82
	07-001-A011.AR-AR 1	Major Upgrade	-	0.80	
	07-001-A011-AR 1	Major Upgrade	-	0.37	
	07-001-A057.AR-AR 1	Proposed New Road	0.18	-	
	07-001-AR 3	Major Upgrade	-	2.35	
	07-001-AR 6	Major Upgrade	-	0.01	
	07-001-AR 7	Proposed New Road	1.38	-	
	ROW	-	-21.28	-	
Jim Dave Run-Back Creek	06-001-C004.AR3	Major Upgrade	-	1.73	-32.61
	06-001-C026.AR2	Major Upgrade	-	0.78	
	ROW	-	-35.12	-	
Jones Swamp	ROW	-	-9.31	-	-9.31
Kingsale Swamp	ROW	-	-3.18	-	-3.18
Lake Drummond-Dismal Swamp	ROW	-	3.42	-	3.42
Lake Prince	ROW	-	-1.29	-	-1.29
Lewis Creek	ROW	-	1.14	-	1.14
Lick Run-Stuart Run	36-001.AR1	Major Upgrade	-	4.29	-17.62
	36-001.AR2	Major Upgrade	-	0.26	
	36-016.AR2	Major Upgrade	-	1.43	
	36-039.AR1	Major Upgrade	-	0.88	
	36-059.AR1	Major Upgrade	-	0.21	
	ROW	-	-24.69	-	
Little Creek-Deep Creek	12-047-AR 1	Major Upgrade	-	1.35	-28.09
	ROW	-	-29.43	-	
Little Creek-Flat Creek	12-012-AR 1	Major Upgrade	-	1.21	-12.78
	ROW	-	-13.99	-	

HUC-12 Watershed	Workspace	Access Road Category	NEW DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.2*	RE-DEVELOPMENT TP Load Reduction Required (lb/yr) *See Table 9.3*	NET TP Load Reduction Required (lb/yr)
Little Willis River	09-129-AR 2	Major Upgrade	-	1.61	-13.15
	10-007-AR 1	Major Upgrade	-	0.60	
	ROW	-	-15.36	-	
Lower Tarrara Creek	25-001-B047.AR 1	Major Upgrade	-	0.66	-4.03
	25-048-AR 1	Major Upgrade	-	0.05	
	ROW	-	-4.74	-	
Maclins Creek	ROW	-	-0.04	-	-0.04
Meadow Creek-North River	09-040.AR-AR 1	Major Upgrade	-	0.12	-9.46
	09-040.AR-AR 4	Major Upgrade	-	0.20	
	09-040-A001-AR 1	Major Upgrade	-	0.87	
	09-045.AR3	Proposed New Road	1.46	-	
	09-048.AR1	Major Upgrade	-	0.02	
	ROW	-	-12.13	-	
Mill Creek	ROW	-	-0.78	-	-0.78
Mill Swamp-Fontaine Creek	15-055-AR 1	Major Upgrade	-	0.71	-11.22
	15-067-AR 1	Major Upgrade	-	1.05	
	15-072-AR 1	Major Upgrade	-	1.70	
	ROW	-	-14.68	-	
Moffett Creek	07-001-A023.AR-AR 1	Proposed New Road	0.37	-	-1.02
	07-001-A029.AR-AR 1	Proposed New Road	0.38	-	
	07-001-A030-AR 1	Proposed New Road	0.90	-	
	07-001-A030-AR 2	Proposed New Road	0.18	-	
	07-001-AR 7	Proposed New Road	0.02	-	
	ROW	-	-2.87	-	
Ramseys Draft	ROW	-	-7.18	-	-7.18
Red Oak Creek-Nottoway River	14-003-AR 1	Major Upgrade	-	0.06	1.42
	ROW	-	1.36	-	
Reedy Creek	14-096-AR 1	Major Upgrade	-	0.98	-21.96
	14-103-AR 1	Major Upgrade	-	2.47	
	ROW	-	-25.41	-	
Ripley Creek-Walton Fork	09-005-AR 3	Major Upgrade	-	0.51	-16.50
	ROW	-	-17.00	-	
Round Gut-Nottoway River	25-066-AR 1	Major Upgrade	-	0.75	-9.26
	25-074-AR 3	Major Upgrade	-	0.18	
	25-078-AR 1	Proposed New Road	0.57	-	
	ROW	-	-10.77	-	
Rucker Run	ROW	-	-2.62	-	-2.62
Saylers Creek	11-040.AR-AR 1	Major Upgrade	-	0.46	-15.48
	ROW	-	-15.94	-	
Scotchtown Draft-Cowpasture River	36-027.AR1	Major Upgrade	-	0.59	-17.07
	ROW	-	-17.66	-	
Slagles Lake-Three Creek	14-103-AR 1	Major Upgrade	-	0.34	-1.31
	14-106-AR 1	Major Upgrade	-	0.14	
	ROW	-	-1.79	-	
South Fork Rockfish River	08-001-B013-AR 1	Proposed New Road	0.57	-	-26.22
	08-001-B051-AR 1	Proposed New Road	0.49	-	
	ROW	-	-27.28	-	
Speights Run-Lake Kilby	ROW	-	-1.33	-	-1.33
Sturgeon Creek	ROW	-	-19.93	-	-19.93
Sycamore Creek-James River	08-214-B004-AR 1	Major Upgrade	-	2.38	-1.52
	08-214-B007.AR1	Proposed New Road	0.64	-	
	09-001-A001.AR2	Major Upgrade	-	3.02	
	09-001-A011-AR 1	Major Upgrade	-	1.01	
	09-005-AR 3	Major Upgrade	-	0.00	
	ROW	-	-8.57	-	
Tommeheton Creek	ROW	-	-3.34	-	-3.34
Union Camp Holding Pond-Blackwater River	26-001.AR1	Major Upgrade	-	2.81	-4.39
	ROW	-	-7.20	-	
Waqua Creek	14-020-AR 1	Major Upgrade	-	1.90	-21.37
	ROW	-	-23.27	-	
Warm Springs Run-Jackson River	36-014.AR2	Major Upgrade	-	2.12	2.12
West Creek	12-028-AR 1	Major Upgrade	-	0.54	-14.01
	ROW	-	-14.55	-	
Western Branch Reservoir	ROW	-	-3.36	-	-3.36
Whispering Creek-Willis River	09-113-AR 1	Major Upgrade	-	0.13	-1.97
	ROW	-	-2.11	-	
	Project Net TP Load Reduction Required (lb/yr)				**34.40**

TABLE 9.2

Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations

Table 9.2 - Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations - Part 1 of 3

HUC-12 Watershed	Workspace	Access Road Category	Post-Development Land Cover (acres)															Site Total (acres)
			Forest/Open Space (acres) *undisturbed, protected forest/open space or reforested land*					Managed Turf (acres) *disturbed, graded for yards or other turf to be mowed/managed*					Impervious Cover (acres)					
			A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	
Angola Creek-Appomattox River	ROW	-	0.02	30.12	16.76	29.99	76.89	1.19	9.68	11.57	3.33	25.77	0.00	0.14	0.12	0.00	0.26	**102.92**
Barterbrook Branch-Christians Creek	07-001-A155.AR-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.05	0.13	0.00	0.15	0.00	0.05	0.20	**0.33**
Barterbrook Branch-Christians Creek	ROW	-	0.00	6.32	0.85	0.00	7.17	0.00	13.37	1.23	9.46	24.06	0.00	0.19	0.00	0.13	0.33	**31.56**
Beaver Creek-Rockfish River	08-210.AR-AR 1	Proposed New Road	0.00	0.09	0.00	0.00	0.09	0.00	0.13	0.00	0.00	0.13	0.00	0.24	0.00	0.00	0.24	**0.46**
Beaver Creek-Rockfish River	ROW	-	0.00	45.12	0.31	2.12	47.55	0.00	8.22	0.47	0.37	9.06	0.00	0.17	0.00	0.08	0.25	**56.86**
Beaver Pond Creek-Nottoway River	13-041-AR 1	Proposed New Road	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.11	0.11	**0.21**
Beaver Pond Creek-Nottoway River	14-001-AR 1	Proposed New Road	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.00	0.10	0.10	**0.17**
Beaver Pond Creek-Nottoway River	ROW	-	0.00	73.51	0.00	14.08	87.59	0.00	17.39	0.00	1.25	18.64	0.00	0.43	0.00	0.08	0.51	**106.74**
Bennett Creek-Nansemond River	26-060-A082.AR1	Proposed New Road	0.17	0.14	0.00	0.00	0.31	0.35	0.25	0.27	0.79	1.67	0.60	0.43	0.33	1.33	2.69	**4.67**
Bennett Creek-Nansemond River	ROW	-	0.41	1.81	0.19	0.83	3.25	7.54	3.07	0.68	2.64	13.94	0.00	0.03	0.00	0.00	0.03	**17.22**
Bishop Creek-Willis River	09-080-AR 1	Proposed New Road	0.00	0.17	0.22	0.00	0.39	0.00	0.03	0.00	0.00	0.03	0.00	0.22	0.25	0.00	0.47	**0.88**
Bishop Creek-Willis River	09-113-AR 3	Proposed New Road	0.00	0.12	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10	**0.22**
Bishop Creek-Willis River	ROW	-	0.00	15.84	49.60	10.95	76.38	0.00	1.95	3.49	0.18	5.61	0.00	0.06	2.72	0.00	2.78	**84.78**
Bolar Run-Jackson River	ROW	-	47.33	10.56	10.49	9.60	77.97	2.37	0.70	3.45	9.22	15.75	0.49	0.18	0.05	0.06	0.77	**94.49**
Buck Creek-Rockfish River	08-086-A036.AR1	Proposed New Road	0.00	0.00	0.00	0.13	0.13	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.16	0.16	**0.31**
Buck Creek-Rockfish River	08-086-A039-AR 1	Proposed New Road	0.03	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.02	0.07	0.08	0.00	0.00	0.04	0.12	**0.23**
Buck Creek-Rockfish River	08-086-A045-AR 1	Proposed New Road	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	**0.06**
Buck Creek-Rockfish River	08-086-A045-AR 2	Proposed New Road	0.00	0.12	0.00	0.00	0.12	0.00	0.02	0.00	0.00	0.02	0.00	0.15	0.00	0.00	0.15	**0.29**
Buck Creek-Rockfish River	08-113-AR 1	Proposed New Road	0.00	0.16	0.00	0.05	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.05	0.23	**0.43**
Buck Creek-Rockfish River	08-113-AR 2	Proposed New Road	0.00	0.27	0.00	0.13	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.13	0.41	**0.81**
Buck Creek-Rockfish River	ROW	-	3.54	100.05	0.75	5.80	110.14	2.04	11.21	0.00	2.14	15.39	0.04	0.49	0.00	0.10	0.63	**126.16**
Buckhorn Swamp-Meherrin River	ROW	-	0.96	1.75	0.64	30.76	34.12	0.35	3.71	3.00	5.50	12.56	0.00	0.53	0.05	1.19	1.77	**48.45**
Buffalo Branch-Middle River	ROW	-	0.44	4.40	0.06	6.11	11.01	0.44	24.91	0.00	3.31	28.66	0.00	0.42	0.00	0.00	0.42	**40.09**
Butterwood Creek	ROW	-	0.74	84.45	3.21	8.46	96.86	0.00	17.73	0.00	0.00	17.73	0.00	0.72	0.00	0.00	0.72	**115.32**
Cabin Creek-Mill Creek	ROW	-	14.56	27.78	16.32	14.94	73.61	0.00	12.80	1.49	4.11	18.41	0.00	0.34	0.00	0.15	0.49	**92.50**
Canada Run-South River	ROW	-	3.55	22.83	2.59	3.46	32.43	0.58	45.57	3.99	7.27	57.40	0.02	1.11	0.06	0.03	1.23	**91.06**
Cattail Creek-Fontaine Creek	15-029-AR 2	Proposed New Road	0.00	0.21	0.22	0.00	0.43	0.00	0.21	0.00	0.00	0.21	0.00	0.57	0.25	0.00	0.81	**1.45**
Cattail Creek-Fontaine Creek	ROW	-	0.00	2.77	10.44	20.92	34.13	0.00	1.02	5.93	3.35	10.30	0.00	0.25	0.59	0.34	1.18	**45.61**
Cedar Lake-Nansemond River	26-060-A082.AR1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.02	0.01	0.08	0.07	0.04	0.02	0.00	0.13	**0.21**
Cedar Lake-Nansemond River	26-060-A098.AR1	Proposed New Road	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.42	0.42	**0.77**
Cedar Lake-Nansemond River	ROW	-	2.47	4.02	0.00	47.88	54.36	1.45	2.40	0.00	3.01	6.87	0.01	0.00	0.00	0.25	0.25	**61.49**
Cellar Creek	12-108-AR 1	Proposed New Road	0.00	0.03	0.00	0.00	0.03	0.00	0.06	0.00	0.00	0.06	0.00	0.14	0.00	0.00	0.14	**0.24**
Cellar Creek	ROW	-	1.25	49.53	5.98	6.97	63.73	0.00	8.54	1.04	0.63	10.21	0.00	0.27	0.09	0.02	0.39	**74.33**
Chair Draft-Calfpasture River	07-001.AR1-AR 4	Proposed New Road	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	**0.12**
Chair Draft-Calfpasture River	ROW	-	3.58	47.39	0.32	3.84	55.14	0.97	5.58	0.15	0.86	7.55	0.10	0.56	0.04	0.22	0.92	**63.61**
Chapel Swamp-Somerton Creek	ROW	-	0.00	0.00	0.00	6.15	6.15	0.00	0.00	0.00	0.88	0.88	0.00	0.00	0.00	0.02	0.02	**7.05**
Cohoon Creek	ROW	-	4.25	4.38	4.36	13.54	26.53	5.70	3.40	4.43	7.05	20.59	0.01	0.04	0.14	0.11	0.30	**47.42**
Darden Pond-Mill Swamp	25-055-A003.AR1	Proposed New Road	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.35	0.00	0.35	**0.65**
Darden Pond-Mill Swamp	ROW	-	0.00	0.24	3.19	5.83	9.26	0.00	2.63	17.99	4.85	25.47	0.00	0.05	0.30	0.01	0.35	**35.08**
Deep Creek-Southern Branch Elizabeth River	27-045.AR1-revised	Proposed New Road	0.00	0.00	0.00	0.34	0.34	0.00	0.00	0.00	0.37	0.37	0.00	0.00	0.00	1.00	1.00	**1.70**
Deep Creek-Southern Branch Elizabeth River	ROW	-	5.76	0.00	0.00	56.59	62.35	0.64	0.00	0.00	30.78	31.42	0.17	0.00	0.00	15.17	15.33	**109.10**
Douglas Run-Meherrin River	15-011-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.02	0.02	**0.06**
Douglas Run-Meherrin River	ROW	-	0.00	11.37	34.07	24.34	69.78	0.00	0.47	10.03	1.72	12.22	0.00	0.07	0.84	0.05	0.96	**82.96**
Dry Run	36-014.AR3	Proposed New Road	2.17	0.00	0.00	0.00	2.17	0.07	0.00	0.00	0.00	0.07	2.58	0.00	0.00	0.00	2.58	**4.82**
Dry Run	ROW	-	26.63	15.84	0.00	2.21	44.67	0.57	3.04	0.00	2.22	5.83	0.13	0.04	0.00	0.00	0.17	**50.67**

HUC-12 Watershed	Workspace	Access Road Category	Post-Development Land Cover (acres)															Site Total (acres)
			Forest/Open Space (acres) *undisturbed, protected forest/open space or reforested land*					Managed Turf (acres) *disturbed, graded for yards or other turf to be mowed/managed*					Impervious Cover (acres)					
			A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	
Ducker Creek-Appomattox River	ROW	-	0.00	14.22	17.35	0.70	32.27	0.00	0.28	2.42	0.00	2.70	0.00	0.02	0.12	0.00	0.14	**35.11**
Dutch Creek-Rockfish River	08-086-A045-AR 3	Proposed New Road	0.00	0.37	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.40	**0.77**
Dutch Creek-Rockfish River	08-086-A050-AR 1	Proposed New Road	0.00	1.09	0.00	0.00	1.09	0.00	0.04	0.00	0.00	0.04	0.00	1.30	0.00	0.00	1.30	**2.42**
Dutch Creek-Rockfish River	08-086-A054.AR1	Proposed New Road	0.00	0.49	0.00	0.00	0.49	0.00	0.06	0.00	0.00	0.06	0.00	0.64	0.00	0.00	0.64	**1.18**
Dutch Creek-Rockfish River	ROW	-	0.00	63.49	3.60	0.66	67.75	0.00	0.55	0.00	0.00	0.55	0.00	0.14	0.00	0.00	0.14	**68.44**
Edison Creek-Middle River	ROW	-	0.00	15.40	0.00	4.96	20.36	0.00	43.67	0.00	2.61	46.28	0.00	0.43	0.00	0.09	0.52	**67.16**
Falling Run-Meherrin River	15-029-AR 2	Proposed New Road	0.00	0.12	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.13	**0.25**
Falling Run-Meherrin River	ROW	-	0.00	2.31	10.86	10.95	24.12	0.00	0.99	1.05	0.43	2.48	0.00	0.25	0.26	0.11	0.62	**27.22**
Folly Mills Creek-Christians Creek	07-001-A138.AR 1	Proposed New Road	0.00	0.17	0.00	0.00	0.17	0.00	0.53	0.07	0.00	0.60	0.00	0.79	0.08	0.00	0.87	**1.64**
Folly Mills Creek-Christians Creek	07-001-A148-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.37	0.88	0.00	0.60	0.00	0.54	1.14	**2.02**
Folly Mills Creek-Christians Creek	ROW	-	0.00	24.37	11.18	6.96	42.51	0.00	25.08	5.30	6.84	37.23	0.00	0.57	0.02	0.25	0.84	**80.58**
Grease Creek-Slate River	ROW	-	0.00	8.26	0.45	2.06	10.77	0.00	0.94	0.00	0.29	1.23	0.00	0.00	0.00	0.00	0.00	**12.00**
Hamilton Branch	ROW	-	7.87	32.60	4.19	5.56	50.23	3.59	2.21	7.83	8.14	21.77	0.21	0.09	0.00	0.17	0.47	**72.46**
Holloway Draft-Calfpasture River	07-001-A017.AR1	Proposed New Road	0.00	0.01	0.00	0.00	0.01	0.17	0.02	0.12	0.00	0.31	0.19	0.04	0.15	0.00	0.38	**0.70**
Holloway Draft-Calfpasture River	ROW	-	8.41	11.16	0.85	2.15	22.57	22.99	7.89	5.43	14.55	50.86	0.20	0.08	0.14	0.18	0.60	**74.02**
Horsepen Creek-Slate River	ROW	-	0.00	21.37	39.16	8.34	68.87	0.00	3.78	1.24	1.02	6.05	0.00	0.06	0.09	0.00	0.15	**75.07**
Inch Branch-Back Creek	ROW	-	9.98	50.82	6.17	8.95	75.92	8.96	4.70	0.00	1.47	15.12	0.34	0.48	0.00	0.20	1.03	**92.07**
Jacks Swamp	ROW	-	0.00	0.00	0.22	1.20	1.42	0.00	0.00	0.01	0.70	0.71	0.00	0.00	0.00	0.02	0.02	**2.15**
Jennings Branch	07-001-A057.AR-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09	0.00	0.10	0.00	0.00	0.10	**0.20**
Jennings Branch	07-001-AR 7	Proposed New Road	0.00	0.19	0.00	0.00	0.19	0.05	0.31	0.00	0.00	0.36	0.07	0.74	0.00	0.00	0.81	**1.36**
Jennings Branch	ROW	-	6.03	60.04	0.91	3.27	70.25	0.48	25.67	0.00	0.19	26.34	0.12	0.73	0.00	0.01	0.85	**97.44**
Jim Dave Run-Back Creek	ROW	-	29.76	23.40	2.43	54.85	110.43	0.80	1.62	2.44	0.21	5.07	0.00	0.21	0.00	0.05	0.26	**115.76**
Jones Swamp	ROW	-	0.31	7.63	3.22	26.03	37.19	2.42	2.32	6.94	6.18	17.86	0.04	0.05	0.14	0.09	0.32	**55.38**
Kingsale Swamp	ROW	-	0.02	3.04	2.12	11.24	16.41	0.93	2.93	4.18	5.12	13.16	0.00	0.02	0.23	0.08	0.33	**29.90**
Lake Drummond-Dismal Swamp	ROW	-	0.00	0.00	0.00	0.40	0.40	0.00	0.00	0.00	1.06	1.06	0.00	0.00	0.00	1.92	1.92	**3.39**
Lake Prince	ROW	-	3.22	2.96	2.18	0.58	8.94	6.11	3.87	2.44	1.69	14.11	0.07	0.63	0.00	0.15	0.85	**23.90**
Lewis Creek	ROW	-	0.00	0.75	0.00	0.00	0.75	0.00	18.16	0.88	0.00	19.04	0.00	0.27	0.00	0.00	0.27	**20.06**
Lick Run-Stuart Run	ROW	-	13.79	11.03	22.13	32.19	79.14	0.64	3.79	0.53	0.77	5.73	0.06	0.04	0.12	0.00	0.22	**85.09**
Little Creek-Deep Creek	ROW	-	8.72	43.45	19.39	24.22	95.78	0.21	7.40	5.54	2.51	15.66	0.00	0.23	0.17	0.00	0.40	**111.84**
Little Creek-Flat Creek	ROW	-	1.35	18.18	12.15	17.88	49.55	0.00	11.40	6.00	1.48	18.88	0.00	0.22	0.10	0.00	0.32	**68.75**
Little Willis River	ROW	-	0.22	7.26	33.25	16.02	56.75	0.00	0.61	8.64	5.27	14.53	0.00	0.00	0.26	0.24	0.50	**71.77**
Lower Tarrara Creek	ROW	-	1.32	2.35	11.02	8.77	23.46	0.00	3.46	20.42	0.43	24.31	0.00	0.02	0.29	0.00	0.32	**48.10**
Maclins Creek	ROW	-	0.00	0.00	0.16	0.09	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	**0.27**
Meadow Creek-North River	09-045.AR3	Proposed New Road	0.00	0.00	0.30	0.36	0.66	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.35	0.58	0.93	**1.76**
Meadow Creek-North River	ROW	-	0.00	12.33	17.32	16.34	45.99	0.00	0.15	3.39	10.30	13.84	0.00	0.04	0.23	0.00	0.27	**60.10**
Mill Creek	ROW	-	0.00	0.00	0.22	2.38	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.60**
Mill Swamp-Fontaine Creek	ROW	-	1.50	1.88	22.56	38.99	64.93	0.79	3.93	22.98	8.68	36.38	0.08	0.04	0.58	0.22	0.92	**102.23**
Moffett Creek	07-001-A023.AR-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.15	0.18	0.00	0.03	0.00	0.17	0.19	**0.38**
Moffett Creek	07-001-A029.AR-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.03	0.19	0.00	0.18	0.00	0.03	0.21	**0.40**
Moffett Creek	07-001-A030-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.43	0.00	0.50	0.00	0.00	0.50	**0.93**
Moffett Creek	07-001-A030-AR 2	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10	0.00	0.10	0.00	0.00	0.10	**0.20**
Moffett Creek	07-001-AR 7	Proposed New Road	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	**0.03**
Moffett Creek	ROW	-	3.51	20.90	0.00	0.51	24.92	0.66	30.90	11.05	6.75	49.36	0.00	1.07	0.19	0.00	1.26	**75.54**
Ramseys Draft	ROW	-	1.17	18.82	0.51	0.52	21.01	3.38	0.36	0.22	0.00	3.96	0.04	0.00	0.06	0.00	0.10	**25.08**
Red Oak Creek-Nottoway River	ROW	-	0.00	0.55	0.00	0.00	0.55	0.00	3.20	0.00	0.00	3.20	0.00	0.80	0.00	0.00	0.80	**4.54**
Reedy Creek	ROW	-	0.00	51.91	2.66	35.67	90.23	0.00	5.37	2.59	1.11	9.07	0.00	0.36	0.48	0.91	1.74	**101.04**
Ripley Creek-Walton Fork	ROW	-	0.00	28.16	18.08	7.11	53.35	0.00	0.49	0.00	0.96	1.45	0.00	0.12	0.00	0.05	0.18	**54.97**
Round Gut-Nottoway River	25-078-AR 1	Proposed New Road	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.17	0.06	0.27	0.00	0.05	0.20	0.06	0.31	**0.58**
Round Gut-Nottoway River	ROW	-	2.21	11.14	11.60	22.90	47.85	6.47	6.02	13.75	7.43	33.67	0.08	0.27	0.61	0.19	1.15	**82.67**

HUC-12 Watershed	Workspace	Access Road Category	Post-Development Land Cover (acres)															Site Total (acres)
			Forest/Open Space (acres) *undisturbed, protected forest/open space or reforested land*					Managed Turf (acres) *disturbed, graded for yards or other turf to be mowed/managed*					Impervious Cover (acres)					
			A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	
Rucker Run	ROW	-	0.00	7.68	0.00	0.00	7.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**7.68**
Saylers Creek	ROW	-	7.41	33.28	0.70	9.08	50.46	1.71	10.62	0.55	0.47	13.34	0.04	0.15	0.00	0.12	0.30	**64.11**
Scotchtown Draft-Cowpasture River	ROW	-	8.34	21.27	2.67	24.59	56.86	0.17	0.38	0.55	2.46	3.57	0.04	0.00	0.14	0.00	0.18	**60.61**
Slagles Lake-Three Creek	ROW	-	0.00	5.11	1.56	0.91	7.59	0.00	2.11	0.62	0.36	3.09	0.00	0.24	0.06	0.00	0.29	**10.97**
South Fork Rockfish River	08-001-B013-AR 1	Proposed New Road	0.00	0.27	0.00	0.00	0.27	0.00	0.05	0.00	0.00	0.05	0.00	0.38	0.00	0.00	0.38	**0.69**
South Fork Rockfish River	08-001-B051-AR 1	Proposed New Road	0.00	0.11	0.00	0.12	0.23	0.00	0.04	0.00	0.02	0.06	0.00	0.17	0.00	0.15	0.32	**0.60**
South Fork Rockfish River	ROW	-	7.08	74.92	0.57	2.06	84.63	4.03	2.02	1.46	4.21	11.72	0.24	0.36	0.00	0.00	0.60	**96.95**
Speights Run-Lake Kilby	ROW	-	0.00	0.00	0.00	4.84	4.84	0.00	0.00	0.00	0.64	0.64	0.00	0.00	0.00	0.00	0.00	**5.49**
Sturgeon Creek	ROW	-	0.00	47.38	0.00	16.01	63.39	0.00	9.82	0.00	1.17	10.99	0.00	0.19	0.00	0.01	0.20	**74.58**
Sycamore Creek-James River	08-214-B007.AR1	Proposed New Road	0.00	0.30	0.09	0.00	0.39	0.00	0.00	0.03	0.00	0.03	0.00	0.29	0.15	0.00	0.44	**0.85**
Sycamore Creek-James River	ROW	-	0.51	23.52	27.02	36.55	87.60	0.09	3.08	7.04	1.40	11.60	0.01	4.09	5.98	0.21	10.29	**109.49**
Tommeheton Creek	ROW	-	0.00	8.62	3.06	0.82	12.49	0.00	3.26	0.00	0.23	3.50	0.00	0.36	0.00	0.00	0.36	**16.35**
Union Camp Holding Pond-Blackwater River	ROW	-	2.72	5.32	13.28	13.73	35.05	3.89	7.73	17.55	3.94	33.11	0.04	0.14	0.49	0.22	0.89	**69.05**
Waqua Creek	ROW	-	0.00	64.69	3.53	4.56	72.79	0.00	7.37	1.12	0.37	8.86	0.00	0.31	0.05	0.09	0.46	**82.10**
West Creek	ROW	-	9.12	25.38	8.51	1.12	44.13	0.00	2.47	0.77	0.00	3.24	0.00	0.10	0.07	0.00	0.17	**47.54**
Western Branch Reservoir	ROW	-	2.35	9.89	0.00	0.14	12.38	7.31	3.15	0.02	0.00	10.48	0.43	0.29	0.00	0.00	0.72	**23.58**
Whispering Creek-Willis River	ROW	-	0.00	0.44	6.80	0.96	8.21	0.00	0.00	0.76	2.64	3.40	0.00	0.00	0.00	0.00	0.00	**11.61**

Table 9.2 - Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations - Part 2 of 3

HUC-12 Watershed	Workspace	Access Road Category	Constants						Runoff Coefficients (Rv)											
									Forest/Open Space				Managed Turf				Impervious Cover			
			Annual Rainfall (inches)	Target Rainfall Event (inches)	Total Phosphorus (TP) EMC (mg/L)	Total Nitrogen (TN) EMC (mg/L)	Target TP Load (lb/ac/yr)	Pj (unitless correction factor)	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils
Angola Creek-Appomattox River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Barterbrook Branch-Christians Creek	07-001-A155.AR-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Barterbrook Branch-Christians Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Beaver Creek-Rockfish River	08-210.AR-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Beaver Creek-Rockfish River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Beaver Pond Creek-Nottoway River	13-041-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Beaver Pond Creek-Nottoway River	14-001-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Beaver Pond Creek-Nottoway River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bennett Creek-Nansemond River	26-060-A082.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bennett Creek-Nansemond River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bishop Creek-Willis River	09-080-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bishop Creek-Willis River	09-113-AR 3	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bishop Creek-Willis River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-086-A036.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-086-A039-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-086-A045-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-086-A045-AR 2	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-113-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-113-AR 2	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buckhorn Swamp-Meherrin River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buffalo Branch-Middle River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Butterwood Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cabin Creek-Mill Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Canada Run-South River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cattail Creek-Fontaine Creek	15-029-AR 2	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cattail Creek-Fontaine Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cedar Lake-Nansemond River	26-060-A082.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cedar Lake-Nansemond River	26-060-A098.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cedar Lake-Nansemond River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cellar Creek	12-108-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cellar Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	07-001.AR1-AR 4	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chapel Swamp-Somerton Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cohoon Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Darden Pond-Mill Swamp	25-055-A003.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Darden Pond-Mill Swamp	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Deep Creek-Southern Branch Elizabeth River	27-045.AR1-revised	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Deep Creek-Southern Branch Elizabeth River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Douglas Run-Meherrin River	15-011-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Douglas Run-Meherrin River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dry Run	36-014.AR3	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dry Run	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95

HUC-12 Watershed	Workspace	Access Road Category	Constants						Runoff Coefficients (Rv)											
									Forest/Open Space				Managed Turf				Impervious Cover			
			Annual Rainfall (inches)	Target Rainfall Event (inches)	Total Phosphorus (TP) EMC (mg/L)	Total Nitrogen (TN) EMC (mg/L)	Target TP Load (lb/ac/yr)	Pj (unitless correction factor)	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils
Ducker Creek-Appomattox River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dutch Creek-Rockfish River	08-086-A045-AR 3	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dutch Creek-Rockfish River	08-086-A050-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dutch Creek-Rockfish River	08-086-A054.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dutch Creek-Rockfish River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Edison Creek-Middle River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Falling Run-Meherrin River	15-029-AR 2	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Falling Run-Meherrin River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Folly Mills Creek-Christians Creek	07-001-A138.AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Folly Mills Creek-Christians Creek	07-001-A148-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Folly Mills Creek-Christians Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Grease Creek-Slate River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Holloway Draft-Calfpasture River	07-001-A017.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Holloway Draft-Calfpasture River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Horsepen Creek-Slate River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Inch Branch-Back Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jacks Swamp	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-A057.AR-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-AR 7	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jim Dave Run-Back Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jones Swamp	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Kingsale Swamp	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lake Drummond-Dismal Swamp	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lake Prince	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lewis Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Creek-Deep Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Creek-Flat Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Willis River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lower Tarrara Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Maclins Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Meadow Creek-North River	09-045.AR3	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Meadow Creek-North River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Mill Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Mill Swamp-Fontaine Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	07-001-A023.AR-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	07-001-A029.AR-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	07-001-A030-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	07-001-A030-AR 2	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	07-001-AR 7	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Moffett Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Ramseys Draft	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Red Oak Creek-Nottoway River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Reedy Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Ripley Creek-Walton Fork	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Round Gut-Nottoway River	25-078-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Round Gut-Nottoway River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95

HUC-12 Watershed	Workspace	Access Road Category	Constants						Runoff Coefficients (Rv)											
									Forest/Open Space				Managed Turf				Impervious Cover			
			Annual Rainfall (inches)	Target Rainfall Event (inches)	Total Phosphorus (TP) EMC (mg/L)	Total Nitrogen (TN) EMC (mg/L)	Target TP Load (lb/ac/yr)	Pj (unitless correction factor)	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils
Rucker Run	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Saylers Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Scotchtown Draft-Cowpasture River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Slagles Lake-Three Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
South Fork Rockfish River	08-001-B013-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
South Fork Rockfish River	08-001-B051-AR 1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
South Fork Rockfish River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Speights Run-Lake Kilby	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sturgeon Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	08-214-B007.AR1	Proposed New Road	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Tommeheton Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Union Camp Holding Pond-Blackwater River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Waqua Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
West Creek	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Western Branch Reservoir	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Whispering Creek-Willis River	ROW	-	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95

Table 9.2 - Summary of DEQ Virginia Runoff Reduction Method New Development Compliance Calculations - Part 3 of 3

HUC-12 Watershed	Workspace	Access Road Category	Land Cover Summary											Treatment Volume and Nutrient Loads				TP Load Reduction Required (lb/yr)
			Forest/Open Space Cover (acres)	Weighted Rv (forest)	% Forest	Managed Turf Cover (acres)	Weighted Rv (turf)	% Managed Turf	Impervious Cover (acres)	Rv (impervious)	% Impervious	Site Area (acres)	Site Rv	Treatment Volume (acre-ft)	Treatment Volume (cubic feet)	TP Load (lb/yr)	TN Load (lb/yr) (Informational Purposes Only)	
Angola Creek-Appomattox River	ROW	-	76.89	0.04	75%	25.77	0.21	25%	0.26	0.95	0%	102.92	0.09	0.7343	31,988	20.10	143.78	**-22.10**
Barterbrook Branch-Christians Creek	07-001-A155.AR-AR 1	Proposed New Road	0.00	0.00	0%	0.13	0.22	40%	0.20	0.95	60%	0.33	0.66	0.0179	779	0.49	3.50	**0.36**
Barterbrook Branch-Christians Creek	ROW	-	7.17	0.03	23%	24.06	0.22	76%	0.33	0.95	1%	31.56	0.19	0.4868	21,204	13.32	95.31	**0.38**
Beaver Creek-Rockfish River	08-210.AR-AR 1	Proposed New Road	0.09	0.03	20%	0.13	0.20	28%	0.24	0.95	52%	0.46	0.55	0.0210	916	0.58	4.12	**0.39**
Beaver Creek-Rockfish River	ROW	-	47.55	0.03	84%	9.06	0.20	16%	0.25	0.95	0%	56.86	0.06	0.2957	12,880	8.09	57.89	**-15.22**
Beaver Pond Creek-Nottoway River	13-041-AR 1	Proposed New Road	0.08	0.05	37%	0.02	0.25	10%	0.11	0.95	54%	0.21	0.55	0.0099	429	0.27	1.93	**0.18**
Beaver Pond Creek-Nottoway River	14-001-AR 1	Proposed New Road	0.01	0.05	8%	0.06	0.25	33%	0.10	0.95	59%	0.17	0.65	0.0092	400	0.25	1.80	**0.18**
Beaver Pond Creek-Nottoway River	ROW	-	87.59	0.03	82%	18.64	0.20	17%	0.51	0.95	0%	106.74	0.07	0.5984	26,066	16.38	117.16	**-27.39**
Bennett Creek-Nansemond River	26-060-A082.AR1	Proposed New Road	0.31	0.02	7%	1.67	0.22	36%	2.69	0.95	58%	4.67	0.63	0.2436	10,610	6.67	47.69	**4.75**
Bennett Creek-Nansemond River	ROW	-	3.25	0.03	19%	13.94	0.18	81%	0.03	0.95	0%	17.22	0.16	0.2251	9,804	6.16	44.07	**-0.90**
Bishop Creek-Willis River	09-080-AR 1	Proposed New Road	0.39	0.04	44%	0.03	0.20	3%	0.47	0.95	53%	0.88	0.52	0.0386	1,683	1.06	7.56	**0.69**
Bishop Creek-Willis River	09-113-AR 3	Proposed New Road	0.12	0.03	53%	0.00	0.00	0%	0.10	0.95	47%	0.22	0.46	0.0083	364	0.23	1.63	**0.14**
Bishop Creek-Willis River	ROW	-	76.38	0.04	90%	5.61	0.21	7%	2.78	0.95	3%	84.78	0.08	0.5709	24,866	15.62	111.77	**-19.14**
Bolar Run-Jackson River	ROW	-	77.97	0.03	83%	15.75	0.23	17%	0.77	0.95	1%	94.49	0.07	0.5377	23,421	14.72	105.27	**-24.02**
Buck Creek-Rockfish River	08-086-A036.AR1	Proposed New Road	0.13	0.05	41%	0.02	0.24	5%	0.16	0.95	53%	0.31	0.54	0.0137	598	0.38	2.69	**0.25**
Buck Creek-Rockfish River	08-086-A039-AR 1	Proposed New Road	0.04	0.03	18%	0.07	0.18	29%	0.12	0.95	53%	0.23	0.56	0.0108	470	0.30	2.11	**0.20**
Buck Creek-Rockfish River	08-086-A045-AR 1	Proposed New Road	0.03	0.03	55%	0.00	0.00	0%	0.03	0.95	45%	0.06	0.44	0.0021	90	0.06	0.40	**0.03**
Buck Creek-Rockfish River	08-086-A045-AR 2	Proposed New Road	0.12	0.03	41%	0.02	0.20	7%	0.15	0.95	52%	0.29	0.52	0.0126	547	0.34	2.46	**0.22**
Buck Creek-Rockfish River	08-113-AR 1	Proposed New Road	0.21	0.03	48%	0.00	0.00	0%	0.23	0.95	52%	0.43	0.51	0.0185	806	0.51	3.62	**0.33**
Buck Creek-Rockfish River	08-113-AR 2	Proposed New Road	0.40	0.04	49%	0.00	0.00	0%	0.41	0.95	51%	0.81	0.50	0.0337	1,466	0.92	6.59	**0.59**
Buck Creek-Rockfish River	ROW	-	110.14	0.03	87%	15.39	0.20	12%	0.63	0.95	0%	126.16	0.06	0.5895	25,679	16.13	115.42	**-35.59**
Buckhorn Swamp-Meherrin River	ROW	-	34.12	0.05	70%	12.56	0.23	26%	1.77	0.95	4%	48.45	0.13	0.5123	22,317	14.02	100.31	**-5.84**
Buffalo Branch-Middle River	ROW	-	11.01	0.04	27%	28.66	0.21	71%	0.42	0.95	1%	40.09	0.17	0.5603	24,405	15.33	109.69	**-1.10**
Butterwood Creek	ROW	-	96.86	0.03	84%	17.73	0.20	15%	0.72	0.95	1%	115.32	0.06	0.6111	26,618	16.72	119.64	**-30.56**
Cabin Creek-Mill Creek	ROW	-	73.61	0.03	80%	18.41	0.21	20%	0.49	0.95	1%	92.50	0.07	0.5755	25,068	15.75	112.67	**-22.18**
Canada Run-South River	ROW	-	32.43	0.03	36%	57.40	0.21	63%	1.23	0.95	1%	91.06	0.15	1.1744	51,156	32.14	229.93	**-5.19**
Cattail Creek-Fontaine Creek	15-029-AR 2	Proposed New Road	0.43	0.04	29%	0.21	0.20	15%	0.81	0.95	56%	1.45	0.57	0.0692	3,017	1.90	13.56	**1.30**
Cattail Creek-Fontaine Creek	ROW	-	34.13	0.05	75%	10.30	0.23	23%	1.18	0.95	3%	45.61	0.11	0.4180	18,207	11.44	81.84	**-7.26**
Cedar Lake-Nansemond River	26-060-A082.AR1	Proposed New Road	0.00	0.00	0%	0.08	0.20	36%	0.13	0.95	64%	0.21	0.68	0.0119	519	0.33	2.33	**0.24**
Cedar Lake-Nansemond River	26-060-A098.AR1	Proposed New Road	0.33	0.05	42%	0.03	0.25	4%	0.42	0.95	54%	0.77	0.54	0.0349	1,518	0.95	6.82	**0.64**
Cedar Lake-Nansemond River	ROW	-	54.36	0.05	88%	6.87	0.21	11%	0.25	0.95	0%	61.49	0.07	0.3547	15,451	9.71	69.45	**-15.50**
Cellar Creek	12-108-AR 1	Proposed New Road	0.03	0.03	15%	0.06	0.20	26%	0.14	0.95	59%	0.24	0.62	0.0121	527	0.33	2.37	**0.23**
Cellar Creek	ROW	-	63.73	0.03	86%	10.21	0.21	14%	0.39	0.95	1%	74.33	0.06	0.3801	16,557	10.40	74.42	**-20.07**
Chair Draft-Calfpasture River	07-001.AR1-AR 4	Proposed New Road	0.07	0.02	55%	0.00	0.00	0%	0.05	0.95	45%	0.12	0.44	0.0043	188	0.12	0.84	**0.07**
Chair Draft-Calfpasture River	ROW	-	55.14	0.03	87%	7.55	0.20	12%	0.92	0.95	1%	63.61	0.06	0.3401	14,814	9.31	66.58	**-16.77**
Chapel Swamp-Somerton Creek	ROW	-	6.15	0.05	87%	0.88	0.25	12%	0.02	0.95	0%	7.05	0.08	0.0457	1,992	1.25	8.95	**-1.64**
Cohoon Creek	ROW	-	26.53	0.04	56%	20.59	0.21	43%	0.30	0.95	1%	47.42	0.12	0.4690	20,428	12.83	91.82	**-6.61**
Darden Pond-Mill Swamp	25-055-A003.AR1	Proposed New Road	0.05	0.04	8%	0.25	0.22	39%	0.35	0.95	53%	0.65	0.60	0.0323	1,408	0.88	6.33	**0.62**
Darden Pond-Mill Swamp	ROW	-	9.26	0.05	26%	25.47	0.22	73%	0.35	0.95	1%	35.08	0.18	0.5381	23,442	14.73	105.36	**0.34**
Deep Creek-Southern Branch Elizabeth River	27-045.AR1-revised	Proposed New Road	0.34	0.05	20%	0.37	0.25	21%	1.00	0.95	58%	1.70	0.62	0.0879	3,829	2.41	17.21	**1.71**
Deep Creek-Southern Branch Elizabeth River	ROW	-	62.35	0.05	57%	31.42	0.25	29%	15.33	0.95	14%	109.10	0.23	2.1085	91,844	57.71	412.82	**12.97**
Douglas Run-Meherrin River	15-011-AR 1	Proposed New Road	0.00	0.00	0%	0.03	0.25	61%	0.02	0.95	39%	0.06	0.53	0.0025	110	0.07	0.49	**0.05**
Douglas Run-Meherrin River	ROW	-	69.78	0.04	84%	12.22	0.22	15%	0.96	0.95	1%	82.96	0.08	0.5472	23,835	14.98	107.13	**-19.04**
Dry Run	36-014.AR3	Proposed New Road	2.17	0.02	45%	0.07	0.15	1%	2.58	0.95	54%	4.82	0.52	0.2090	9,102	5.72	40.91	**3.74**
Dry Run	ROW	-	44.67	0.03	88%	5.83	0.21	12%	0.17	0.95	0%	50.67	0.05	0.2104	9,164	5.76	41.19	**-15.02**

HUC-12 Watershed	Workspace	Access Road Category	Land Cover Summary											Treatment Volume and Nutrient Loads				TP Load Reduction Required (lb/yr)
			Forest/Open Space Cover (acres)	Weighted Rv (forest)	% Forest	Managed Turf Cover (acres)	Weighted Rv (turf)	% Managed Turf	Impervious Cover (acres)	Rv (impervious)	% Impervious	Site Area (acres)	Site Rv	Treatment Volume (acre-ft)	Treatment Volume (cubic feet)	TP Load (lb/yr)	TN Load (lb/yr) (Informational Purposes Only)	
Ducker Creek-Appomattox River	ROW	-	32.27	0.04	92%	2.70	0.22	8%	0.14	0.95	0%	35.11	0.05	0.1567	6,826	4.29	30.68	**-10.11**
Dutch Creek-Rockfish River	08-086-A045-AR 3	Proposed New Road	0.37	0.03	48%	0.00	0.00	0%	0.40	0.95	52%	0.77	0.51	0.0326	1,419	0.89	6.38	**0.58**
Dutch Creek-Rockfish River	08-086-A050-AR 1	Proposed New Road	1.09	0.03	45%	0.04	0.20	2%	1.30	0.95	53%	2.42	0.52	0.1059	4,614	2.90	20.74	**1.91**
Dutch Creek-Rockfish River	08-086-A054.AR1	Proposed New Road	0.49	0.03	41%	0.06	0.20	5%	0.64	0.95	54%	1.18	0.53	0.0525	2,285	1.44	10.27	**0.95**
Dutch Creek-Rockfish River	ROW	-	67.75	0.03	99%	0.55	0.20	1%	0.14	0.95	0%	68.44	0.03	0.1935	8,429	5.30	37.88	**-22.76**
Edison Creek-Middle River	ROW	-	20.36	0.03	30%	46.28	0.20	69%	0.52	0.95	1%	67.16	0.16	0.8828	38,457	24.16	172.85	**-3.37**
Falling Run-Meherrin River	15-029-AR 2	Proposed New Road	0.12	0.03	47%	0.00	0.00	0%	0.13	0.95	53%	0.25	0.52	0.0108	470	0.30	2.11	**0.19**
Falling Run-Meherrin River	ROW	-	24.12	0.04	89%	2.48	0.22	9%	0.62	0.95	2%	27.22	0.08	0.1815	7,907	4.97	35.54	**-6.19**
Folly Mills Creek-Christians Creek	07-001-A138.AR 1	Proposed New Road	0.17	0.03	10%	0.60	0.20	37%	0.87	0.95	53%	1.64	0.58	0.0795	3,463	2.18	15.56	**1.51**
Folly Mills Creek-Christians Creek	07-001-A148-AR 1	Proposed New Road	0.00	0.03	0%	0.88	0.22	44%	1.14	0.95	56%	2.02	0.63	0.1061	4,622	2.90	20.77	**2.08**
Folly Mills Creek-Christians Creek	ROW	-	42.51	0.04	53%	37.23	0.21	46%	0.84	0.95	1%	80.58	0.13	0.8515	37,090	23.30	166.71	**-9.73**
Grease Creek-Slate River	ROW	-	10.77	0.03	90%	1.23	0.21	10%	0.00	0.95	0%	12.00	0.05	0.0524	2,283	1.43	10.26	**-3.49**
Hamilton Branch	ROW	-	50.23	0.03	69%	21.77	0.22	30%	0.47	0.95	1%	72.46	0.09	0.5636	24,549	15.42	110.34	**-14.28**
Holloway Draft-Calfpasture River	07-001-A017.AR1	Proposed New Road	0.01	0.03	2%	0.31	0.18	44%	0.38	0.95	54%	0.70	0.59	0.0346	1,507	0.95	6.77	**0.66**
Holloway Draft-Calfpasture River	ROW	-	22.57	0.03	30%	50.86	0.19	69%	0.60	0.95	1%	74.02	0.15	0.9224	40,179	25.24	180.59	**-5.11**
Horsepen Creek-Slate River	ROW	-	68.87	0.04	92%	6.05	0.21	8%	0.15	0.95	0%	75.07	0.05	0.3380	14,721	9.25	66.17	**-21.53**
Inch Branch-Back Creek	ROW	-	75.92	0.03	82%	15.12	0.18	16%	1.03	0.95	1%	92.07	0.07	0.5037	21,939	13.78	98.61	**-23.97**
Jacks Swamp	ROW	-	1.42	0.05	66%	0.71	0.25	33%	0.02	0.95	1%	2.15	0.12	0.0220	956	0.60	4.30	**-0.28**
Jennings Branch	07-001-A057.AR-AR 1	Proposed New Road	0.00	0.00	0%	0.09	0.20	48%	0.10	0.95	52%	0.20	0.59	0.0096	420	0.26	1.89	**0.18**
Jennings Branch	07-001-AR 7	Proposed New Road	0.19	0.03	14%	0.36	0.19	26%	0.81	0.95	60%	1.36	0.62	0.0706	3,077	1.93	13.83	**1.38**
Jennings Branch	ROW	-	70.25	0.03	72%	26.34	0.20	27%	0.85	0.95	1%	97.44	0.08	0.6821	29,713	18.67	133.55	**-21.28**
Jim Dave Run-Back Creek	ROW	-	110.43	0.04	95%	5.07	0.20	4%	0.26	0.95	0%	115.76	0.05	0.4511	19,650	12.35	88.32	**-35.12**
Jones Swamp	ROW	-	37.19	0.04	67%	17.86	0.22	32%	0.32	0.95	1%	55.38	0.11	0.4894	21,318	13.39	95.82	**-9.31**
Kingsale Swamp	ROW	-	16.41	0.04	55%	13.16	0.22	44%	0.33	0.95	1%	29.90	0.13	0.3317	14,450	9.08	64.95	**-3.18**
Lake Drummond-Dismal Swamp	ROW	-	0.40	0.05	12%	1.06	0.25	31%	1.92	0.95	57%	3.39	0.62	0.1758	7,659	4.81	34.43	**3.42**
Lake Prince	ROW	-	8.94	0.03	37%	14.11	0.19	59%	0.85	0.95	4%	23.90	0.16	0.3107	13,536	8.50	60.84	**-1.29**
Lewis Creek	ROW	-	0.75	0.03	4%	19.04	0.20	95%	0.27	0.95	1%	20.06	0.20	0.3423	14,909	9.37	67.01	**1.14**
Lick Run-Stuart Run	ROW	-	79.14	0.04	93%	5.73	0.20	7%	0.22	0.95	0%	85.09	0.05	0.3726	16,231	10.20	72.96	**-24.69**
Little Creek-Deep Creek	ROW	-	95.78	0.04	86%	15.66	0.21	14%	0.40	0.95	0%	111.84	0.06	0.6001	26,139	16.42	117.49	**-29.43**
Little Creek-Flat Creek	ROW	-	49.55	0.04	72%	18.88	0.21	27%	0.32	0.95	0%	68.75	0.09	0.5187	22,596	14.20	101.56	**-13.99**
Little Willis River	ROW	-	56.75	0.04	79%	14.53	0.23	20%	0.50	0.95	1%	71.77	0.09	0.5139	22,386	14.07	100.62	**-15.36**
Lower Tarrara Creek	ROW	-	23.46	0.04	49%	24.31	0.22	51%	0.32	0.95	1%	48.10	0.14	0.5474	23,847	14.98	107.19	**-4.74**
Maclins Creek	ROW	-	0.25	0.04	92%	0.00	0.00	0%	0.02	0.95	8%	0.27	0.11	0.0026	113	0.07	0.51	**-0.04**
Meadow Creek-North River	09-045.AR3	Proposed New Road	0.66	0.05	37%	0.17	0.25	10%	0.93	0.95	53%	1.76	0.54	0.0797	3,472	2.18	15.60	**1.46**
Meadow Creek-North River	ROW	-	45.99	0.04	77%	13.84	0.24	23%	0.27	0.95	0%	60.10	0.09	0.4572	19,916	12.51	89.52	**-12.13**
Mill Creek	ROW	-	2.60	0.05	100%	0.00	0.00	0%	0.00	0.95	0%	2.60	0.05	0.0107	464	0.29	2.09	**-0.78**
Mill Swamp-Fontaine Creek	ROW	-	64.93	0.05	64%	36.38	0.22	36%	0.92	0.95	1%	102.23	0.12	0.9950	43,344	27.23	194.82	**-14.68**
Moffett Creek	07-001-A023.AR-AR 1	Proposed New Road	0.00	0.00	0%	0.18	0.24	49%	0.19	0.95	51%	0.38	0.60	0.0190	828	0.52	3.72	**0.37**
Moffett Creek	07-001-A029.AR-AR 1	Proposed New Road	0.00	0.00	0%	0.19	0.21	48%	0.21	0.95	52%	0.40	0.59	0.0198	862	0.54	3.88	**0.38**
Moffett Creek	07-001-A030-AR 1	Proposed New Road	0.00	0.00	0%	0.43	0.20	46%	0.50	0.95	54%	0.93	0.60	0.0470	2,046	1.29	9.20	**0.90**
Moffett Creek	07-001-A030-AR 2	Proposed New Road	0.00	0.00	0%	0.10	0.20	48%	0.10	0.95	52%	0.20	0.59	0.0097	423	0.27	1.90	**0.18**
Moffett Creek	07-001-AR 7	Proposed New Road	0.02	0.03	55%	0.00	0.20	4%	0.01	0.95	40%	0.03	0.41	0.0010	46	0.03	0.20	**0.02**
Moffett Creek	ROW	-	24.92	0.03	33%	49.36	0.21	65%	1.26	0.95	2%	75.54	0.16	1.0267	44,721	28.10	201.01	**-2.87**
Ramseys Draft	ROW	-	21.01	0.03	84%	3.96	0.16	16%	0.10	0.95	0%	25.08	0.05	0.1135	4,943	3.11	22.22	**-7.18**
Red Oak Creek-Nottoway River	ROW	-	0.55	0.03	12%	3.20	0.20	70%	0.80	0.95	18%	4.54	0.31	0.1179	5,136	3.23	23.08	**1.36**
Reedy Creek	ROW	-	90.23	0.04	89%	9.07	0.21	9%	1.74	0.95	2%	101.04	0.07	0.5851	25,489	16.01	114.57	**-25.41**
Ripley Creek-Walton Fork	ROW	-	53.35	0.04	97%	1.45	0.23	3%	0.18	0.95	0%	54.97	0.04	0.2023	8,814	5.54	39.62	**-17.00**
Round Gut-Nottoway River	25-078-AR 1	Proposed New Road	0.00	0.00	0%	0.27	0.22	47%	0.31	0.95	53%	0.58	0.61	0.0297	1,294	0.81	5.82	**0.57**
Round Gut-Nottoway River	ROW	-	47.85	0.04	58%	33.67	0.21	41%	1.15	0.95	1%	82.67	0.12	0.8449	36,806	23.12	165.43	**-10.77**

HUC-12 Watershed	Workspace	Access Road Category	Land Cover Summary											Treatment Volume and Nutrient Loads				TP Load Reduction Required (lb/yr)
			Forest/Open Space Cover (acres)	Weighted Rv (forest)	% Forest	Managed Turf Cover (acres)	Weighted Rv (turf)	% Managed Turf	Impervious Cover (acres)	Rv (impervious)	% Impervious	Site Area (acres)	Site Rv	Treatment Volume (acre-ft)	Treatment Volume (cubic feet)	TP Load (lb/yr)	TN Load (lb/yr) (Informational Purposes Only)	
Rucker Run	ROW	-	7.68	0.03	100%	0.00	0.00	0%	0.00	0.95	0%	7.68	0.03	0.0192	837	0.53	3.76	**-2.62**
Saylers Creek	ROW	-	50.46	0.03	79%	13.34	0.20	21%	0.30	0.95	0%	64.11	0.07	0.3780	16,464	10.34	74.00	**-15.94**
Scotchtown Draft-Cowpasture River	ROW	-	56.86	0.04	94%	3.57	0.24	6%	0.18	0.95	0%	60.61	0.05	0.2627	11,443	7.19	51.44	**-17.66**
Slagles Lake-Three Creek	ROW	-	7.59	0.03	69%	3.09	0.21	28%	0.29	0.95	3%	10.97	0.11	0.0990	4,313	2.71	19.38	**-1.79**
South Fork Rockfish River	08-001-B013-AR 1	Proposed New Road	0.27	0.03	39%	0.05	0.20	7%	0.38	0.95	54%	0.69	0.54	0.0312	1,358	0.85	6.10	**0.57**
South Fork Rockfish River	08-001-B051-AR 1	Proposed New Road	0.23	0.04	38%	0.06	0.22	10%	0.32	0.95	53%	0.60	0.54	0.0269	1,171	0.74	5.26	**0.49**
South Fork Rockfish River	ROW	-	84.63	0.03	87%	11.72	0.20	12%	0.60	0.95	1%	96.95	0.06	0.4558	19,854	12.47	89.24	**-27.28**
Speights Run-Lake Kilby	ROW	-	4.84	0.05	88%	0.64	0.25	12%	0.00	0.95	0%	5.49	0.07	0.0336	1,462	0.92	6.57	**-1.33**
Sturgeon Creek	ROW	-	63.39	0.04	85%	10.99	0.21	15%	0.20	0.95	0%	74.58	0.06	0.3890	16,943	10.65	76.16	**-19.93**
Sycamore Creek-James River	08-214-B007.AR1	Proposed New Road	0.39	0.03	45%	0.03	0.21	4%	0.44	0.95	51%	0.85	0.51	0.0363	1,580	0.99	7.10	**0.64**
Sycamore Creek-James River	ROW	-	87.60	0.04	80%	11.60	0.22	11%	10.29	0.95	9%	109.49	0.15	1.3270	57,806	36.32	259.82	**-8.57**
Tommeheton Creek	ROW	-	12.49	0.03	76%	3.50	0.20	21%	0.36	0.95	2%	16.35	0.09	0.1231	5,362	3.37	24.10	**-3.34**
Union Camp Holding Pond-Blackwater River	ROW	-	35.05	0.04	51%	33.11	0.21	48%	0.89	0.95	1%	69.05	0.13	0.7711	33,590	21.10	150.98	**-7.20**
Waqua Creek	ROW	-	72.79	0.03	89%	8.86	0.20	11%	0.46	0.95	1%	82.10	0.06	0.3796	16,535	10.39	74.32	**-23.27**
West Creek	ROW	-	44.13	0.03	93%	3.24	0.20	7%	0.17	0.95	0%	47.54	0.05	0.1805	7,864	4.94	35.35	**-14.55**
Western Branch Reservoir	ROW	-	12.38	0.03	53%	10.48	0.17	44%	0.72	0.95	3%	23.58	0.12	0.2306	10,044	6.31	45.14	**-3.36**
Whispering Creek-Willis River	ROW	-	8.21	0.04	71%	3.40	0.24	29%	0.00	0.95	0%	11.61	0.10	0.0969	4,220	2.65	18.97	**-2.11**

TABLE 9.3

Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations

Table 9.3 - Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations - Part 1 of 3

			Pre-Development Land Cover (acres)															
			Forest/Open Space (acres) *undisturbed, protected forest/open space or reforested land*					**Managed Turf (acres)** *disturbed, graded for yards or other turf to be mowed/managed*					**Impervious Cover (acres)**					
HUC-12 Watershed	**Workspace**	**Access Road Category**	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	**Site Total**
Bennett Creek-Nansemond River	26-060-A080.AR1	Major Upgrade	0.02	0.00	0.00	0.00	0.02	0.10	0.09	0.04	0.00	0.23	0.04	0.03	0.01	0.00	0.09	**0.34**
Bishop Creek-Willis River	09-103.AR2	Major Upgrade	0.00	0.39	0.40	0.00	0.78	0.00	0.00	0.21	0.00	0.21	0.00	0.14	0.23	0.00	0.38	**1.37**
Bishop Creek-Willis River	09-113-AR 1	Major Upgrade	0.00	0.76	0.12	0.42	1.30	0.00	0.05	0.00	0.00	0.05	0.00	0.29	0.04	0.15	0.49	**1.84**
Bolar Run-Jackson River	06-001-C028.AR2	Major Upgrade	2.71	0.00	0.00	0.00	2.71	0.14	0.00	0.00	0.00	0.14	1.04	0.00	0.00	0.00	1.04	**3.90**
Bolar Run-Jackson River	06-001-C032.AR1	Major Upgrade	1.61	0.27	0.33	0.06	2.28	0.05	0.03	0.00	0.00	0.08	0.61	0.12	0.12	0.02	0.88	**3.24**
Bolar Run-Jackson River	06-001-C036.AR1	Major Upgrade	0.00	0.00	0.01	0.00	0.01	0.00	0.12	0.23	0.04	0.39	0.00	0.08	0.15	0.02	0.25	**0.65**
Bolar Run-Jackson River	06-001-C037.AR1	Major Upgrade	0.77	0.42	0.00	0.58	1.77	0.39	0.41	0.00	0.00	0.80	0.57	0.43	0.00	0.20	1.20	**3.77**
Bolar Run-Jackson River	06-001-C037.AR2	Major Upgrade	3.31	0.29	0.00	0.00	3.59	0.40	0.00	0.00	0.00	0.40	1.47	0.11	0.00	0.00	1.57	**5.57**
Bolar Run-Jackson River	06-001-C037.AR3	Major Upgrade	0.61	0.00	0.00	0.26	0.87	0.19	0.00	0.00	0.24	0.43	0.29	0.00	0.00	0.18	0.46	**1.75**
Bolar Run-Jackson River	36-014.AR2	Major Upgrade	1.23	0.85	0.00	0.00	2.08	1.06	0.13	0.00	0.00	1.18	1.25	0.39	0.00	0.00	1.64	**4.90**
Buck Creek-Rockfish River	08-014-AR 1	Major Upgrade	0.00	3.07	0.00	0.07	3.14	0.00	0.07	0.00	0.00	0.07	0.00	1.16	0.00	0.03	1.19	**4.40**
Butterwood Creek	13-006.AR1	Major Upgrade	0.00	0.19	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.07	**0.26**
Butterwood Creek	13-007.AR1	Major Upgrade	0.00	0.17	0.00	0.00	0.17	0.00	0.04	0.00	0.00	0.04	0.00	0.09	0.00	0.00	0.09	**0.30**
Cabin Creek-Mill Creek	36-091.AR1	Major Upgrade	0.35	0.13	0.00	0.00	0.48	0.00	0.13	0.00	0.00	0.13	0.13	0.14	0.00	0.00	0.27	**0.88**
Cedar Lake-Nansemond River	26-060-A080.AR1	Major Upgrade	0.16	0.79	0.00	0.00	0.96	0.00	0.00	0.03	0.00	0.03	0.06	0.29	0.01	0.00	0.36	**1.35**
Cellar Creek	12-101-AR 1	Major Upgrade	0.00	1.65	0.00	0.00	1.65	0.00	0.18	0.00	0.00	0.18	0.00	0.69	0.00	0.00	0.69	**2.52**
Chair Draft-Calfpasture River	07-001-A009-AR 1	Major Upgrade	0.32	0.00	0.00	0.00	0.32	0.11	0.00	0.00	0.00	0.11	0.19	0.00	0.00	0.00	0.19	**0.62**
Chair Draft-Calfpasture River	07-001-A055.AR2	Major Upgrade	0.00	1.76	0.03	0.00	1.79	0.00	0.14	0.11	0.00	0.25	0.00	0.78	0.09	0.00	0.86	**2.91**
Chair Draft-Calfpasture River	07-001-AR 3	Major Upgrade	0.51	2.99	0.30	0.00	3.80	0.09	0.25	0.06	0.00	0.41	0.22	1.29	0.15	0.00	1.65	**5.86**
Chair Draft-Calfpasture River	07-001-AR 6	Major Upgrade	0.00	0.67	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.24	**0.91**
Darden Pond-Mill Swamp	25-048-AR 1	Major Upgrade	0.00	0.00	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	**0.16**
Deep Creek-Southern Branch Elizabeth River	27-002-AR 1	Major Upgrade	0.00	0.00	0.00	2.14	2.14	0.00	0.00	0.00	0.22	0.22	0.00	0.00	0.00	0.86	0.86	**3.21**
Deep Creek-Southern Branch Elizabeth River	27-006-AR 1	Major Upgrade	0.00	0.00	0.00	1.14	1.14	0.00	0.00	0.00	0.61	0.61	0.00	0.00	0.00	0.66	0.66	**2.41**
Deep Creek-Southern Branch Elizabeth River	27-006-AR 2	Major Upgrade	0.00	0.00	0.00	1.35	1.35	0.00	0.00	0.00	0.40	0.40	0.00	0.00	0.00	0.65	0.65	**2.39**
Douglas Run-Meherrin River	15-011-A001-AR 1	Major Upgrade	0.00	0.00	0.28	0.00	0.28	0.00	0.00	0.04	0.00	0.04	0.00	0.00	0.12	0.00	0.12	**0.44**
Douglas Run-Meherrin River	15-011-AR 3	Major Upgrade	0.00	0.00	0.39	0.07	0.46	0.00	0.00	0.82	0.05	0.87	0.00	0.00	0.60	0.04	0.65	**1.98**
Douglas Run-Meherrin River	15-014.AR1	Major Upgrade	0.00	0.00	0.75	0.00	0.75	0.00	0.00	1.07	0.00	1.07	0.00	0.00	1.02	0.00	1.02	**2.85**
Dry Run	36-014.AR2	Major Upgrade	2.69	1.09	0.00	0.00	3.78	1.97	1.66	0.00	0.00	3.63	2.55	1.57	0.00	0.00	4.11	**11.52**
Dry Run	36-018.AR1	Major Upgrade	1.11	0.00	0.00	0.00	1.11	0.21	0.00	0.00	0.00	0.21	0.54	0.00	0.00	0.00	0.54	**1.85**
Dry Run	36-027.AR1	Major Upgrade	1.38	1.35	0.00	0.55	3.29	0.00	0.00	0.00	0.04	0.04	0.50	0.49	0.00	0.21	1.19	**4.52**
Dutch Creek-Rockfish River	08-086-A112.AR1	Major Upgrade	0.00	0.11	0.00	0.01	0.13	0.00	0.17	0.00	0.01	0.18	0.00	0.16	0.00	0.01	0.17	**0.48**
Grease Creek-Slate River	09-051.AR1	Major Upgrade	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	**0.03**
Hamilton Branch	07-001-F002.AR1	Major Upgrade	0.00	0.77	0.00	0.14	0.90	0.00	0.04	0.00	0.09	0.13	0.00	0.30	0.00	0.11	0.42	**1.45**
Hamilton Branch	07-001-F002.AR2	Major Upgrade	0.00	0.62	0.00	0.25	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.09	0.31	**1.17**
Hamilton Branch	07-001-F009.AR1	Major Upgrade	0.00	0.11	0.00	0.00	0.11	0.00	0.22	0.00	0.00	0.22	0.00	0.13	0.00	0.00	0.13	**0.47**
Hamilton Branch	07-001-F012.AR1	Major Upgrade	0.00	0.12	0.00	0.32	0.44	0.02	0.00	0.00	0.06	0.08	0.01	0.04	0.00	0.16	0.21	**0.74**
Hamilton Branch	07-001-F029.AR1	Major Upgrade	0.03	0.00	0.04	0.00	0.07	0.45	0.00	0.65	0.00	1.10	0.18	0.00	0.34	0.00	0.52	**1.69**
Horsepen Creek-Slate River	09-048.AR1	Major Upgrade	0.00	0.18	0.94	0.17	1.29	0.00	0.10	1.37	0.24	1.71	0.00	0.10	0.84	0.16	1.10	**4.10**
Horsepen Creek-Slate River	09-051.AR1	Major Upgrade	0.00	0.00	0.85	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.31	**1.16**
Jennings Branch	07-001.AR1-AR 9	Major Upgrade	0.26	0.11	0.81	0.00	1.18	0.14	0.00	0.14	0.00	0.28	0.19	0.03	0.41	0.00	0.62	**2.08**
Jennings Branch	07-001-A011.AR-AR 1	Major Upgrade	0.00	0.81	0.00	0.06	0.86	0.00	0.01	0.00	0.00	0.01	0.00	0.29	0.00	0.02	0.31	**1.19**
Jennings Branch	07-001-A011-AR 1	Major Upgrade	0.00	0.43	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.13	**0.56**
Jennings Branch	07-001-AR 3	Major Upgrade	0.00	2.24	0.00	0.27	2.50	0.00	0.02	0.00	0.00	0.02	0.00	0.82	0.00	0.10	0.92	**3.44**
Jennings Branch	07-001-AR 6	Major Upgrade	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
Jim Dave Run-Back Creek	06-001-C004.AR3	Major Upgrade	0.90	0.13	0.00	0.00	1.03	0.00	0.86	0.03	0.00	0.89	0.32	0.36	0.01	0.00	0.69	**2.61**
Jim Dave Run-Back Creek	06-001-C026.AR2	Major Upgrade	0.80	0.00	0.00	0.00	0.80	0.03	0.00	0.00	0.00	0.03	0.31	0.00	0.00	0.00	0.31	**1.15**
Lick Run-Stuart Run	36-001.AR1	Major Upgrade	0.00	0.20	4.22	0.21	4.63	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.54	0.06	1.67	**6.30**
Lick Run-Stuart Run	36-001.AR2	Major Upgrade	0.00	0.17	0.02	0.10	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.04	0.10	**0.39**
Lick Run-Stuart Run	36-016.AR2	Major Upgrade	0.00	0.03	0.82	0.62	1.46	0.00	0.01	0.00	0.07	0.08	0.00	0.01	0.29	0.27	0.58	**2.12**
Lick Run-Stuart Run	36-039.AR1	Major Upgrade	0.00	0.27	0.00	0.62	0.89	0.05	0.01	0.00	0.00	0.06	0.03	0.11	0.00	0.22	0.36	**1.31**
Lick Run-Stuart Run	36-059.AR1	Major Upgrade	0.14	0.00	0.00	0.00	0.14	0.08	0.00	0.00	0.00	0.08	0.10	0.00	0.00	0.00	0.10	**0.33**
Little Creek-Deep Creek	12-047-AR 1	Major Upgrade	0.10	0.93	0.34	0.07	1.44	0.00	0.01	0.00	0.00	0.01	0.04	0.34	0.12	0.02	0.53	**1.98**
Little Creek-Flat Creek	12-012-AR 1	Major Upgrade	0.79	0.52	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.29	0.18	0.00	0.00	0.47	**1.77**
Little Willis River	09-129-AR 2	Major Upgrade	0.00	0.00	1.63	0.08	1.71	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.61	0.03	0.64	**2.38**
Little Willis River	10-007-AR 1	Major Upgrade	0.00	0.00	0.52	0.00	0.52	0.00	0.00	0.14	0.00	0.14	0.00	0.00	0.24	0.00	0.24	**0.90**
Lower Tarrara Creek	25-001-B047.AR 1	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.76	0.00	0.00	0.31	0.00	0.31	**1.07**
Lower Tarrara Creek	25-048-AR 1	Major Upgrade	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	**0.07**

HUC-12 Watershed	Workspace	Access Road Category	Pre-Development Land Cover (acres)															Site Total
			Forest/Open Space (acres) *undisturbed, protected forest/open space or reforested land*					Managed Turf (acres) *disturbed, graded for yards or other turf to be mowed/managed*					Impervious Cover (acres)					
			A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	A Soils	B Soils	C Soils	D Soils	Total	
Meadow Creek-North River	09-040.AR-AR 1	Major Upgrade	0.00	0.00	0.15	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04	**0.19**
Meadow Creek-North River	09-040.AR-AR 4	Major Upgrade	0.00	0.22	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.07	**0.29**
Meadow Creek-North River	09-040-A001-AR 1	Major Upgrade	0.00	0.90	0.00	0.00	0.90	0.00	0.04	0.00	0.00	0.04	0.00	0.35	0.00	0.00	0.35	**1.29**
Meadow Creek-North River	09-048.AR1	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.01	0.01	**0.03**
Mill Swamp-Fontaine Creek	15-055-AR 1	Major Upgrade	0.00	0.00	0.75	0.00	0.75	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.28	0.00	0.28	**1.05**
Mill Swamp-Fontaine Creek	15-067-AR 1	Major Upgrade	0.00	0.00	0.26	0.10	0.36	0.00	0.00	0.71	0.01	0.72	0.00	0.00	0.56	0.04	0.61	**1.69**
Mill Swamp-Fontaine Creek	15-072-AR 1	Major Upgrade	0.04	0.02	0.00	0.36	0.42	0.10	0.32	0.28	0.74	1.43	0.05	0.15	0.14	0.52	0.86	**2.71**
Red Oak Creek-Nottoway River	14-003-AR 1	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.04	0.00	0.00	0.04	**0.11**
Reedy Creek	14-096-AR 1	Major Upgrade	0.00	0.42	0.00	0.41	0.83	0.00	0.10	0.00	0.15	0.25	0.00	0.19	0.00	0.20	0.39	**1.47**
Reedy Creek	14-103-AR 1	Major Upgrade	0.00	0.04	0.83	0.85	1.72	0.00	0.49	0.45	0.06	0.99	0.00	0.25	0.47	0.33	1.05	**3.76**
Ripley Creek-Walton Fork	09-005-AR 3	Major Upgrade	0.00	0.26	0.14	0.00	0.40	0.00	0.14	0.00	0.00	0.14	0.00	0.19	0.05	0.00	0.24	**0.78**
Round Gut-Nottoway River	25-066-AR 1	Major Upgrade	0.00	0.51	0.00	0.31	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.11	0.29	**1.11**
Round Gut-Nottoway River	25-074-AR 3	Major Upgrade	0.00	0.00	0.05	0.16	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.07	**0.27**
Saylers Creek	11-040.AR-AR 1	Major Upgrade	0.41	0.00	0.00	0.00	0.41	0.08	0.00	0.00	0.00	0.08	0.19	0.00	0.00	0.00	0.19	**0.68**
Scotchtown Draft-Cowpasture River	36-027.AR1	Major Upgrade	0.00	0.52	0.00	0.00	0.52	0.00	0.10	0.00	0.00	0.10	0.00	0.26	0.00	0.00	0.26	**0.88**
Slagles Lake-Three Creek	14-103-AR 1	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.34	0.00	0.21	0.00	0.00	0.21	**0.55**
Slagles Lake-Three Creek	14-106-AR 1	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.15	0.00	0.00	0.10	0.00	0.10	**0.24**
Sycamore Creek-James River	08-214-B004-AR 1	Major Upgrade	0.00	1.40	0.07	1.11	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.02	0.39	0.92	**3.51**
Sycamore Creek-James River	09-001-A001.AR2	Major Upgrade	0.00	0.00	0.58	0.33	0.91	0.00	0.72	0.97	0.80	2.50	0.00	0.26	0.63	0.42	1.32	**4.72**
Sycamore Creek-James River	09-001-A011-AR 1	Major Upgrade	0.00	0.17	0.14	0.00	0.31	0.00	0.22	0.08	0.00	0.30	0.00	0.67	0.63	0.00	1.30	**1.91**
Sycamore Creek-James River	09-005-AR 3	Major Upgrade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Union Camp Holding Pond-Blackwater River	26-001.AR1	Major Upgrade	0.28	0.17	0.81	1.00	2.26	0.45	0.30	0.08	0.00	0.83	0.26	0.18	0.32	0.36	1.12	**4.21**
Waqua Creek	14-020-AR 1	Major Upgrade	0.00	1.98	0.00	0.04	2.02	0.00	0.00	0.00	0.02	0.02	0.00	0.72	0.00	0.03	0.74	**2.79**
Warm Springs Run-Jackson River	36-014.AR2	Major Upgrade	0.00	1.18	0.00	0.00	1.18	0.00	1.00	0.00	0.00	1.00	0.00	1.14	0.00	0.00	1.14	**3.31**
West Creek	12-028-AR 1	Major Upgrade	0.00	0.29	0.10	0.00	0.39	0.00	0.21	0.00	0.00	0.21	0.00	0.18	0.04	0.00	0.21	**0.81**
Whispering Creek-Willis River	09-113-AR 1	Major Upgrade	0.00	0.15	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05	**0.20**

Table 9.3 - Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations - Part 2 of 3

			Constants						Runoff Coefficients (Rv)											
									Forest/Open Space				Managed Turf				Impervious Cover			
HUC-12 Watershed	**Workspace**	**Access Road Category**	Annual Rainfall (inches)	Target Rainfall Event (inches)	Total Phosphorus (TP) EMC (mg/L)	Total Nitrogen (TN) EMC (mg/L)	Target TP Load (lb/ac/yr)	Pj (unitless correction factor)	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils
Bennett Creek-Nansemond River	26-060-A080.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bishop Creek-Willis River	09-103.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bishop Creek-Willis River	09-113-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C028.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C032.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C036.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C037.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C037.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	06-001-C037.AR3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Bolar Run-Jackson River	36-014.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Buck Creek-Rockfish River	08-014-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Butterwood Creek	13-006.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Butterwood Creek	13-007.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cabin Creek-Mill Creek	36-091.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cedar Lake-Nansemond River	26-060-A080.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Cellar Creek	12-101-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	07-001-A009-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	07-001-A055.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	07-001-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Chair Draft-Calfpasture River	07-001-AR 6	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Darden Pond-Mill Swamp	25-048-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Deep Creek-Southern Branch Elizabeth River	27-002-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Deep Creek-Southern Branch Elizabeth River	27-006-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Deep Creek-Southern Branch Elizabeth River	27-006-AR 2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Douglas Run-Meherrin River	15-011-A001-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Douglas Run-Meherrin River	15-011-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Douglas Run-Meherrin River	15-014.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dry Run	36-014.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dry Run	36-018.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dry Run	36-027.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Dutch Creek-Rockfish River	08-086-A112.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Grease Creek-Slate River	09-051.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	07-001-F002.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	07-001-F002.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	07-001-F009.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	07-001-F012.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Hamilton Branch	07-001-F029.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Horsepen Creek-Slate River	09-048.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Horsepen Creek-Slate River	09-051.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001.AR1-AR 9	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-A011.AR-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-A011-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jennings Branch	07-001-AR 6	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jim Dave Run-Back Creek	06-001-C004.AR3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Jim Dave Run-Back Creek	06-001-C026.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	36-001.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	36-001.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	36-016.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	36-039.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lick Run-Stuart Run	36-059.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Creek-Deep Creek	12-047-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Creek-Flat Creek	12-012-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Willis River	09-129-AR 2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Little Willis River	10-007-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lower Tarrara Creek	25-001-B047.AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Lower Tarrara Creek	25-048-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95

HUC-12 Watershed	Workspace	Access Road Category	Constants						Runoff Coefficients (Rv)											
									Forest/Open Space				Managed Turf				Impervious Cover			
			Annual Rainfall (inches)	Target Rainfall Event (inches)	Total Phosphorus (TP) EMC (mg/L)	Total Nitrogen (TN) EMC (mg/L)	Target TP Load (lb/ac/yr)	Pj (unitless correction factor)	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils	A Soils	B Soils	C Soils	D Soils
Meadow Creek-North River	09-040.AR-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Meadow Creek-North River	09-040.AR-AR 4	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Meadow Creek-North River	09-040-A001-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Meadow Creek-North River	09-048.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Mill Swamp-Fontaine Creek	15-055-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Mill Swamp-Fontaine Creek	15-067-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Mill Swamp-Fontaine Creek	15-072-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Red Oak Creek-Nottoway River	14-003-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Reedy Creek	14-096-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Reedy Creek	14-103-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Ripley Creek-Walton Fork	09-005-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Round Gut-Nottoway River	25-066-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Round Gut-Nottoway River	25-074-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Saylers Creek	11-040.AR-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Scotchtown Draft-Cowpasture River	36-027.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Slagles Lake-Three Creek	14-103-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Slagles Lake-Three Creek	14-106-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	08-214-B004-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	09-001-A001.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	09-001-A011-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Sycamore Creek-James River	09-005-AR 3	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Union Camp Holding Pond-Blackwater River	26-001.AR1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Waqua Creek	14-020-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Warm Springs Run-Jackson River	36-014.AR2	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
West Creek	12-028-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95
Whispering Creek-Willis River	09-113-AR 1	Major Upgrade	43	1.00	0.26	1.86	0.41	0.90	0.02	0.03	0.04	0.05	0.15	0.20	0.22	0.25	0.95	0.95	0.95	0.95

Table 9.3 - Summary of DEQ Virginia Runoff Reduction Method Re-Development Compliance Calculations - Part 3 of 3

			Land Cover Summary											Treatment Volume and Nutrient Loads						
HUC-12 Watershed	**Workspace**	**Access Road Category**	Forest/Open Space Cover (acres)	Weighted Rv (forest)	% Forest	Managed Turf Cover (acres)	Weighted Rv (turf)	% Managed Turf	Impervious Cover (acres)	Rv (impervious)	% Impervious	Site Area (acres)	Site Rv	Treatment Volume (acre-ft)	Treatment Volume (cubic feet)	TP Load (lb/yr)	TN Load (lb/yr) (Informational Purposes Only)	**80% of Pre-Development TP Load Reduction Required (lb/yr)**	**Allowable TP Load (lb/yr)**	**Post-Development TP Load Reduction Required (lb/yr)** *See Table 9.2 Part 3 of 3*	**Re-Development TP Load Reduction Required (lb/yr)**
Bennett Creek-Nansemond River	26-060-A080.AR1	26-060-A080.AR1	0.02	0.02	6%	0.23	0.18	68%	0.09	0.95	26%	0.34	0.37	0.0103	450	0.28	2.02	0.23	0.14	0.44	0.21
Bishop Creek-Willis River	09-103.AR2	09-103.AR2	0.78	0.04	57%	0.21	0.22	15%	0.38	0.95	27%	1.37	0.31	0.0359	1,563	0.98	7.03	0.79	0.56	1.70	0.91
Bishop Creek-Willis River	09-113-AR 1	09-113-AR 1	1.30	0.04	71%	0.05	0.20	3%	0.49	0.95	27%	1.84	0.28	0.0435	1,894	1.19	8.51	0.95	0.75	2.20	1.25
Bolar Run-Jackson River	06-001-C028.AR2	06-001-C028.AR2	2.71	0.02	70%	0.14	0.15	4%	1.04	0.95	27%	3.90	0.27	0.0887	3,865	2.43	17.37	1.94	1.60	4.59	2.64
Bolar Run-Jackson River	06-001-C032.AR1	06-001-C032.AR1	2.28	0.02	70%	0.08	0.17	2%	0.88	0.95	27%	3.24	0.28	0.0754	3,287	2.06	14.77	1.65	1.33	3.86	2.21
Bolar Run-Jackson River	06-001-C036.AR1	06-001-C036.AR1	0.01	0.04	1%	0.39	0.22	60%	0.25	0.95	39%	0.65	0.50	0.0270	1,176	0.74	5.28	0.59	0.27	0.98	0.39
Bolar Run-Jackson River	06-001-C037.AR1	06-001-C037.AR1	1.77	0.03	47%	0.80	0.18	21%	1.20	0.95	32%	3.77	0.36	0.1114	4,854	3.05	21.82	2.44	1.54	4.90	2.46
Bolar Run-Jackson River	06-001-C037.AR2	06-001-C037.AR2	3.59	0.02	65%	0.40	0.15	7%	1.57	0.95	28%	5.57	0.29	0.1359	5,920	3.72	26.61	2.98	2.28	6.74	3.77
Bolar Run-Jackson River	06-001-C037.AR3	06-001-C037.AR3	0.87	0.03	49%	0.43	0.21	24%	0.46	0.95	26%	1.75	0.31	0.0459	1,998	1.26	8.98	1.00	0.72	2.17	1.17
Bolar Run-Jackson River	36-014.AR2	36-014.AR2	2.08	0.02	42%	1.18	0.16	24%	1.64	0.95	33%	4.90	0.37	0.1493	6,504	4.09	29.23	3.27	2.01	6.45	3.18
Buck Creek-Rockfish River	08-014-AR 1	08-014-AR 1	3.14	0.03	72%	0.07	0.20	2%	1.19	0.95	27%	4.40	0.28	0.1029	4,484	2.82	20.15	2.25	1.80	5.25	3.00
Butterwood Creek	13-006.AR1	13-006.AR1	0.19	0.03	74%	0.00	0.20	1%	0.07	0.95	25%	0.26	0.27	0.0057	248	0.16	1.11	0.12	0.11	0.30	0.17
Butterwood Creek	13-007.AR1	13-007.AR1	0.17	0.03	58%	0.04	0.20	14%	0.09	0.95	29%	0.30	0.32	0.0079	344	0.22	1.54	0.17	0.12	0.37	0.20
Cabin Creek-Mill Creek	36-091.AR1	36-091.AR1	0.48	0.02	55%	0.13	0.20	15%	0.27	0.95	30%	0.88	0.33	0.0242	1,052	0.66	4.73	0.53	0.36	1.11	0.58
Cedar Lake-Nansemond River	26-060-A080.AR1	26-060-A080.AR1	0.96	0.03	71%	0.03	0.22	2%	0.36	0.95	27%	1.35	0.28	0.0312	1,359	0.85	6.11	0.68	0.55	1.60	0.92
Cellar Creek	12-101-AR 1	12-101-AR 1	1.65	0.03	66%	0.18	0.20	7%	0.69	0.95	27%	2.52	0.29	0.0613	2,672	1.68	12.01	1.34	1.03	3.05	1.70
Chair Draft-Calfpasture River	07-001-A009-AR 1	07-001-A009-AR 1	0.32	0.02	52%	0.11	0.15	18%	0.19	0.95	30%	0.62	0.33	0.0169	737	0.46	3.31	0.37	0.26	0.78	0.41
Chair Draft-Calfpasture River	07-001-A055.AR2	07-001-A055.AR2	1.79	0.03	62%	0.25	0.21	9%	0.86	0.95	30%	2.91	0.32	0.0772	3,361	2.11	15.11	1.69	1.19	3.61	1.92
Chair Draft-Calfpasture River	07-001-AR 3	07-001-AR 3	3.80	0.03	65%	0.41	0.19	7%	1.65	0.95	28%	5.86	0.30	0.1468	6,392	4.02	28.73	3.21	2.40	7.16	3.95
Chair Draft-Calfpasture River	07-001-AR 6	07-001-AR 6	0.67	0.03	74%	0.00	0.00	0%	0.24	0.95	26%	0.91	0.27	0.0207	903	0.57	4.06	0.45	0.37	1.08	0.62
Darden Pond-Mill Swamp	25-048-AR 1	25-048-AR 1	0.12	0.05	76%	0.00	0.00	0%	0.04	0.95	24%	0.16	0.27	0.0036	158	0.10	0.71	0.08	0.07	0.19	0.11
Deep Creek-Southern Branch Elizabeth River	27-002-AR 1	27-002-AR 1	2.14	0.05	66%	0.22	0.25	7%	0.86	0.95	27%	3.21	0.30	0.0817	3,559	2.24	16.00	1.79	1.32	3.95	2.16
Deep Creek-Southern Branch Elizabeth River	27-006-AR 1	27-006-AR 1	1.14	0.05	47%	0.61	0.25	25%	0.66	0.95	27%	2.41	0.35	0.0695	3,027	1.90	13.60	1.52	0.99	3.10	1.58
Deep Creek-Southern Branch Elizabeth River	27-006-AR 2	27-006-AR 2	1.35	0.05	56%	0.40	0.25	17%	0.65	0.95	27%	2.39	0.33	0.0650	2,831	1.78	12.72	1.42	0.98	3.01	1.58
Douglas Run-Meherrin River	15-011-A001-AR 1	15-011-A001-AR 1	0.28	0.04	64%	0.04	0.22	8%	0.12	0.95	28%	0.44	0.31	0.0112	489	0.31	2.20	0.25	0.18	0.54	0.29
Douglas Run-Meherrin River	15-011-AR 3	15-011-AR 3	0.46	0.04	23%	0.87	0.22	44%	0.65	0.95	33%	1.98	0.42	0.0690	3,005	1.89	13.51	1.51	0.81	2.75	1.24
Douglas Run-Meherrin River	15-014.AR1	15-014.AR1	0.75	0.04	26%	1.07	0.22	38%	1.02	0.95	36%	2.85	0.43	0.1030	4,487	2.82	20.17	2.26	1.17	4.03	1.77
Dry Run	36-014.AR2	36-014.AR2	3.78	0.02	33%	3.63	0.17	32%	4.11	0.95	36%	11.52	0.40	0.3849	16,768	10.54	75.37	8.43	4.72	15.78	7.35
Dry Run	36-018.AR1	36-018.AR1	1.11	0.02	60%	0.21	0.15	11%	0.54	0.95	29%	1.85	0.30	0.0469	2,041	1.28	9.17	1.03	0.76	2.27	1.24
Dry Run	36-027.AR1	36-027.AR1	3.29	0.03	73%	0.04	0.25	1%	1.19	0.95	26%	4.52	0.27	0.1029	4,482	2.82	20.14	2.25	1.85	5.34	3.09
Dutch Creek-Rockfish River	08-086-A112.AR1	08-086-A112.AR1	0.13	0.03	27%	0.18	0.20	38%	0.17	0.95	35%	0.48	0.42	0.0169	736	0.46	3.31	0.37	0.20	0.67	0.30
Grease Creek-Slate River	09-051.AR1	09-051.AR1	0.01	0.04	45%	0.01	0.22	28%	0.01	0.95	28%	0.03	0.34	0.0009	38	0.02	0.17	0.02	0.01	0.04	0.02
Hamilton Branch	07-001-F002.AR1	07-001-F002.AR1	0.90	0.03	62%	0.13	0.24	9%	0.42	0.95	29%	1.45	0.32	0.0382	1,665	1.05	7.48	0.84	0.60	1.81	0.97
Hamilton Branch	07-001-F002.AR2	07-001-F002.AR2	0.86	0.04	74%	0.00	0.00	0%	0.31	0.95	26%	1.17	0.27	0.0268	1,166	0.73	5.24	0.59	0.48	1.38	0.79
Hamilton Branch	07-001-F009.AR1	07-001-F009.AR1	0.11	0.03	24%	0.22	0.20	48%	0.13	0.95	29%	0.47	0.38	0.0146	637	0.40	2.86	0.32	0.19	0.62	0.30
Hamilton Branch	07-001-F012.AR1	07-001-F012.AR1	0.44	0.04	60%	0.08	0.22	11%	0.21	0.95	29%	0.74	0.33	0.0200	872	0.55	3.92	0.44	0.30	0.92	0.49
Hamilton Branch	07-001-F029.AR1	07-001-F029.AR1	0.07	0.03	4%	1.10	0.19	65%	0.52	0.95	31%	1.69	0.42	0.0592	2,578	1.62	11.59	1.30	0.69	2.36	1.06
Horsepen Creek-Slate River	09-048.AR1	09-048.AR1	1.29	0.04	32%	1.71	0.22	42%	1.10	0.95	27%	4.10	0.36	0.1230	5,357	3.37	24.08	2.69	1.68	5.36	2.67
Horsepen Creek-Slate River	09-051.AR1	09-051.AR1	0.85	0.04	73%	0.00	0.22	0%	0.31	0.95	26%	1.16	0.28	0.0273	1,188	0.75	5.34	0.60	0.48	1.39	0.79
Jennings Branch	07-001.AR1-AR 9	07-001.AR1-AR 9	1.18	0.03	57%	0.28	0.19	13%	0.62	0.95	30%	2.08	0.33	0.0568	2,475	1.55	11.12	1.24	0.85	2.62	1.38
Jennings Branch	07-001-A011.AR-AR 1	07-001-A011.AR-AR 1	0.86	0.03	73%	0.01	0.20	1%	0.31	0.95	26%	1.19	0.28	0.0273	1,191	0.75	5.35	0.60	0.49	1.40	0.80
Jennings Branch	07-001-A011-AR 1	07-001-A011-AR 1	0.43	0.03	76%	0.00	0.00	0%	0.13	0.95	24%	0.56	0.25	0.0117	508	0.32	2.28	0.26	0.23	0.62	0.37
Jennings Branch	07-001-AR 3	07-001-AR 3	2.50	0.03	73%	0.02	0.20	1%	0.92	0.95	27%	3.44	0.28	0.0798	3,475	2.18	15.62	1.75	1.41	4.10	2.35
Jennings Branch	07-001-AR 6	07-001-AR 6	0.01	0.03	85%	0.00	0.00	0%	0.00	0.95	15%	0.02	0.17	0.0003	11	0.01	0.05	0.01	0.01	0.02	0.01
Jim Dave Run-Back Creek	06-001-C004.AR3	06-001-C004.AR3	1.03	0.02	39%	0.89	0.20	34%	0.69	0.95	27%	2.61	0.33	0.0714	3,110	1.95	13.98	1.56	1.07	3.29	1.73
Jim Dave Run-Back Creek	06-001-C026.AR2	06-001-C026.AR2	0.80	0.02	70%	0.03	0.15	3%	0.31	0.95	27%	1.15	0.28	0.0263	1,145	0.72	5.15	0.58	0.47	1.35	0.78
Lick Run-Stuart Run	36-001.AR1	36-001.AR1	4.63	0.04	73%	0.00	0.00	0%	1.67	0.95	27%	6.30	0.28	0.1476	6,431	4.04	28.91	3.23	2.58	7.52	4.29
Lick Run-Stuart Run	36-001.AR2	36-001.AR2	0.29	0.04	74%	0.00	0.00	0%	0.10	0.95	26%	0.39	0.27	0.0087	381	0.24	1.71	0.19	0.16	0.45	0.26
Lick Run-Stuart Run	36-016.AR2	36-016.AR2	1.46	0.04	69%	0.08	0.24	4%	0.58	0.95	27%	2.12	0.30	0.0528	2,300	1.45	10.34	1.16	0.87	2.58	1.43
Lick Run-Stuart Run	36-039.AR1	36-039.AR1	0.89	0.04	68%	0.06	0.16	5%	0.36	0.95	28%	1.31	0.30	0.0326	1,418	0.89	6.37	0.71	0.54	1.59	0.88
Lick Run-Stuart Run	36-059.AR1	36-059.AR1	0.14	0.02	43%	0.08	0.15	25%	0.10	0.95	32%	0.33	0.35	0.0095	414	0.26	1.86	0.21	0.13	0.42	0.21
Little Creek-Deep Creek	12-047-AR 1	12-047-AR 1	1.44	0.03	73%	0.01	0.20	1%	0.53	0.95	27%	1.98	0.28	0.0458	1,995	1.25	8.96	1.00	0.81	2.35	1.35
Little Creek-Flat Creek	12-012-AR 1	12-012-AR 1	1.30	0.02	74%	0.00	0.00	0%	0.47	0.95	26%	1.77	0.27	0.0396	1,727	1.08	7.76	0.87	0.73	2.08	1.21
Little Willis River	09-129-AR 2	09-129-AR 2	1.71	0.04	72%	0.03	0.22	1%	0.64	0.95	27%	2.38	0.29	0.0566	2,466	1.55	11.09	1.24	0.97	2.85	1.61
Little Willis River	10-007-AR 1	10-007-AR 1	0.52	0.04	58%	0.14	0.22	15%	0.24	0.95	27%	0.90	0.31	0.0234	1,019	0.64	4.58	0.51	0.37	1.11	0.60
Lower Tarrara Creek	25-001-B047.AR 1	25-001-B047.AR 1	0.00	0.00	0%	0.76	0.22	71%	0.31	0.95	29%	1.07	0.43	0.0383	1,666	1.05	7.49	0.84	0.44	1.50	0.66
Lower Tarrara Creek	25-048-AR 1	25-048-AR 1	0.05	0.05	77%	0.00	0.00	0%	0.02	0.95	23%	0.07	0.26	0.0015	66	0.04	0.30	0.03	0.03	0.08	0.05

HUC-12 Watershed	Workspace	Access Road Category	Land Cover Summary											Treatment Volume and Nutrient Loads				80% of Pre-Development TP Load Reduction Required (lb/yr)	Allowable TP Load (lb/yr)	Post-Development TP Load Reduction Required (lb/yr) *See Table 9.2 Part 3 of 3*	Re-Development TP Load Reduction Required (lb/yr)
			Forest/Open Space Cover (acres)	Weighted Rv (forest)	% Forest	Managed Turf Cover (acres)	Weighted Rv (turf)	% Managed Turf	Impervious Cover (acres)	Rv (impervious)	% Impervious	Site Area (acres)	Site Rv	Treatment Volume (acre-ft)	Treatment Volume (cubic feet)	TP Load (lb/yr)	TN Load (lb/yr) (Informational Purposes Only)				
Meadow Creek-North River	09-040.AR-AR 1	09-040.AR-AR 1	0.15	0.04	78%	0.00	0.00	0%	0.04	0.95	22%	0.19	0.24	0.0039	170	0.11	0.76	0.09	0.08	0.21	0.12
Meadow Creek-North River	09-040.AR-AR 4	09-040.AR-AR 4	0.22	0.03	75%	0.00	0.00	0%	0.07	0.95	25%	0.29	0.26	0.0063	274	0.17	1.23	0.14	0.12	0.33	0.20
Meadow Creek-North River	09-040-A001-AR 1	09-040-A001-AR 1	0.90	0.03	70%	0.04	0.20	3%	0.35	0.95	27%	1.29	0.28	0.0305	1,329	0.84	5.98	0.67	0.53	1.54	0.87
Meadow Creek-North River	09-048.AR1	09-048.AR1	0.00	0.00	0%	0.02	0.25	63%	0.01	0.95	37%	0.03	0.51	0.0014	61	0.04	0.28	0.03	0.01	0.05	0.02
Mill Swamp-Fontaine Creek	15-055-AR 1	15-055-AR 1	0.75	0.04	72%	0.02	0.22	2%	0.28	0.95	27%	1.05	0.29	0.0251	1,093	0.69	4.91	0.55	0.43	1.26	0.71
Mill Swamp-Fontaine Creek	15-067-AR 1	15-067-AR 1	0.36	0.04	21%	0.72	0.22	43%	0.61	0.95	36%	1.69	0.44	0.0626	2,725	1.71	12.25	1.37	0.69	2.42	1.05
Mill Swamp-Fontaine Creek	15-072-AR 1	15-072-AR 1	0.42	0.05	15%	1.43	0.23	53%	0.86	0.95	32%	2.71	0.43	0.0967	4,210	2.65	18.92	2.12	1.11	3.82	1.70
Red Oak Creek-Nottoway River	14-003-AR 1	14-003-AR 1	0.00	0.00	0%	0.06	0.20	61%	0.04	0.95	39%	0.11	0.49	0.0043	187	0.12	0.84	0.09	0.04	0.15	0.06
Reedy Creek	14-096-AR 1	14-096-AR 1	0.83	0.04	57%	0.25	0.23	17%	0.39	0.95	26%	1.47	0.31	0.0382	1,666	1.05	7.49	0.84	0.60	1.82	0.98
Reedy Creek	14-103-AR 1	14-103-AR 1	1.72	0.04	46%	0.99	0.21	26%	1.05	0.95	28%	3.76	0.34	0.1067	4,648	2.92	20.89	2.34	1.54	4.81	2.47
Ripley Creek-Walton Fork	09-005-AR 3	09-005-AR 3	0.40	0.03	52%	0.14	0.20	18%	0.24	0.95	31%	0.78	0.34	0.0222	966	0.61	4.34	0.49	0.32	0.99	0.51
Round Gut-Nottoway River	25-066-AR 1	25-066-AR 1	0.82	0.04	74%	0.00	0.00	0%	0.29	0.95	26%	1.11	0.28	0.0256	1,114	0.70	5.01	0.56	0.45	1.31	0.75
Round Gut-Nottoway River	25-074-AR 3	25-074-AR 3	0.20	0.05	75%	0.00	0.00	0%	0.07	0.95	25%	0.27	0.28	0.0063	275	0.17	1.23	0.14	0.11	0.32	0.18
Saylers Creek	11-040.AR-AR 1	11-040.AR-AR 1	0.41	0.02	60%	0.08	0.15	12%	0.19	0.95	27%	0.68	0.29	0.0166	724	0.46	3.26	0.36	0.28	0.82	0.46
Scotchtown Draft-Cowpasture River	36-027.AR1	36-027.AR1	0.52	0.03	60%	0.10	0.20	11%	0.26	0.95	29%	0.88	0.32	0.0232	1,010	0.63	4.54	0.51	0.36	1.10	0.59
Slagles Lake-Three Creek	14-103-AR 1	14-103-AR 1	0.00	0.00	0%	0.34	0.20	61%	0.21	0.95	39%	0.55	0.49	0.0224	976	0.61	4.38	0.49	0.23	0.83	0.34
Slagles Lake-Three Creek	14-106-AR 1	14-106-AR 1	0.00	0.00	0%	0.15	0.22	60%	0.10	0.95	40%	0.24	0.51	0.0104	454	0.29	2.04	0.23	0.10	0.37	0.14
Sycamore Creek-James River	08-214-B004-AR 1	08-214-B004-AR 1	2.59	0.04	74%	0.00	0.00	0%	0.92	0.95	26%	3.51	0.28	0.0812	3,535	2.22	15.89	1.78	1.44	4.15	2.38
Sycamore Creek-James River	09-001-A001.AR2	09-001-A001.AR2	0.91	0.04	19%	2.50	0.22	53%	1.32	0.95	28%	4.72	0.39	0.1540	6,710	4.22	30.16	3.37	1.93	6.40	3.02
Sycamore Creek-James River	09-001-A011-AR 1	09-001-A011-AR 1	0.31	0.03	16%	0.30	0.21	16%	1.30	0.95	68%	1.91	0.68	0.1086	4,730	2.97	21.26	2.38	0.78	3.39	1.01
Sycamore Creek-James River	09-005-AR 3	09-005-AR 3	0.00	0.03	95%	0.00	0.20	4%	0.00	0.95	1%	0.00	0.05	0.0000	0	0.00	0.00	0.00	0.00	0.00	0.00
Union Camp Holding Pond-Blackwater River	26-001.AR1	26-001.AR1	2.26	0.04	54%	0.83	0.17	20%	1.12	0.95	27%	4.21	0.31	0.1082	4,714	2.96	21.19	2.37	1.72	5.18	2.81
Waqua Creek	14-020-AR 1	14-020-AR 1	2.02	0.03	73%	0.02	0.25	1%	0.74	0.95	27%	2.79	0.28	0.0644	2,805	1.76	12.61	1.41	1.14	3.31	1.90
Warm Springs Run-Jackson River	36-014.AR2	36-014.AR2	1.18	0.03	35%	1.00	0.20	30%	1.14	0.95	34%	3.31	0.40	0.1096	4,772	3.00	21.45	2.40	1.36	4.52	2.12
West Creek	12-028-AR 1	12-028-AR 1	0.39	0.03	48%	0.21	0.20	26%	0.21	0.95	26%	0.81	0.32	0.0213	928	0.58	4.17	0.47	0.33	1.00	0.54
Whispering Creek-Willis River	09-113-AR 1	09-113-AR 1	0.15	0.03	74%	0.00	0.00	0%	0.05	0.95	26%	0.20	0.27	0.0045	194	0.12	0.87	0.10	0.08	0.23	0.13

FIGURES

Figure 1 Drainage Basin Map Book

Figure 2.1 Culvert and Ditch Analysis Map Book for Permanent Access Roads, Pre-Development Conditions

Figure 2.2 Culvert and Ditch Analysis Map Book for Permanent Access Roads, Post-Development Conditions

Figure 2.3 Culvert and Ditch Analysis Map Book for Temporary Access Roads, Development Conditions

Figure 3.1 Water Quality Map Book, Pre-Development Conditions

Figure 3.2 Water Quality Map Book, Post-Development Conditions

FIGURE 1

Drainage Basin Map Book