Module 12: Erosion and Sedimentation Controls
[§§77.458/77.461/77.466/77.525/77.527/77.531/Chapter 102]

12.1 Diversion Controls

Provide a plan for the collection and conveyance to a natural drainageway of the runoff from upslope undisturbed areas. Provide a separate general design for a temporary highwall diversion which limits the amount of runoff which can enter the pit (where applicable). Include design criteria, capacity calculations, profile of proposed channel slopes, typical cross-sections, required channel linings and applicable details on 12.1 Data Sheet.

During Phase 1, diversion ditch DD-1 will be installed to minimize the drainage area to SP-1. DD-1 will discharge via an energy dissipator to Rhoades Creek. During Phase 2, diversion ditches DD-2 and DD-3 will be installed to minimize the drainage area to SP-2. Also, at this time, DD-1 will be directed into SP-2, to act as a collection ditch. DD-2 will discharge via an energy dissipator to Rhoades Creek. DD-3 will discharge via an energy dissipator towards the Casselman River. All design criteria, calculations, and details are attached. See Exhibit 9 for the locations of the proposed diversion ditches.

A safety berm will be continuously maintained above all highwalls. These safety berms will also act as a diversion to limit the amount of runoff that can enter the pit.

12.2 Erosion and Sediment Control

Provide a plan for the control of erosion and sedimentation for lands within the permit area to be disturbed by mining activities. Include a narrative describing the implementation of the plan, and detailed design and construction plans and specifications for structures or facilities used in the plan. The plan must include each phase or phases of mining. Include design criteria, capacity calculations, profile of proposed channel slopes, typical cross-sections, required channel linings and applicable details on 12.1 Diversion/Collection Ditch Data Sheet for collection and interceptor ditches. Provide documentation of the capacity of the existing drainage system and the effect proposed mining activities will have on the drainage. Show discharge points to natural drainageways and culverts that intercept upslope drainage or carry drainage away from the site. Show facilities to scale on Modules 9 and 16 as appropriate.

See Exhibit 9 for locations of all erosion and sedimentation controls.

Before Phase 1 mining operations commence, sediment pond SP-1 will be constructed. Collection ditches CD-1A and CD-2 and Culvert CULV-1 will be constructed to convey runoff into SP-1 after SP-1 is functional. DD-1 will be constructed to act as a diversion ditch during this time. Sediment pond SP-1 will control all runoff from the process pad and mining area up to DD-1. SP-1 will control all runoff from Phase 1 at this time.

Before Phase 2 mining operations commence, sediment pond SP-2 must be constructed. After SP-2 becomes functional, DD-1 should be directed into SP-2 to change its purpose from a diversion ditch to a collection ditch. Collection ditch CD-3 will also be installed at this time to convey runoff to SP-2. DD-2 and DD-3 will be constructed at this time. SP-2 will control runoff from all of Phase 2 and the portion of Phase 1 to the east of the First Energy High Point-Rockwood 115 kV transmission line at this time. SP-1 will continue to control the portion of Phase 1 to the west of the above-mentioned transmission line.

Before future Phase 3 mining operations commence, collection ditch CD-1B will be constructed to convey runoff from this area to SP-1. SP-1 and SP-2 will each control runoff from a portion of Phase 3.

All ditches may be constructed as mining progresses, as long as all sediment-laden runoff gets collected and conveyed to the sediment ponds.

Calculations for all erosion and sedimentation controls are attached. All ditches were designed to convey the 10-year, 24-hour storm event and contain a proper lining. Grass-lined ditches will have R-4 rip-rap placed at any abrupt changes in ditch direction. All culverts will be designed to convey the design flow of the ditch(es) that flow to them, or the 10-year, 24-hour storm event. Rip-rap aprons or channels will provide outlet protection for all culverts. All sediment ponds have been designed to have a storage capacity of a minimum of 7,000 cubic feet per acre (2,000 c.f./acre sediment storage and 5,000 c.f./acre dewatering zone).

Alternate E&S controls consisting of compost filter sock will be utilized downgrade of all proposed ponds before any earth disturbance occurs. Compost filter socks will only receive sediment-laden runoff during the construction or reclamation of the ponds. During the time when the ponds are functional and stabilized, there is no need for alternate E&S controls. All compost filter socks were designed in accordance with Chapter 102 requirements.

12.3 Haul Roads

Provide the following information for each haul road to be constructed, reconstructed or used in the operation:

Note: Activities proposed to be conducted under General permit for Temporary Road Crossings (BMR-GP-101) and General Permit for Access Road Crossings (BMR-GP-102) must include a completed Notification Form, with attachments, for the respective General Permit (i.e., Form 5600-FM-MR0054 for BMR-GP-101 and Form 5600-FM-MR0059 for BMR-GP-102). BMR-GP-102 may not be used for haul roads.

a) **Location; show on Exhibit 9 (and Exhibit 18 if road will remain as part of postmining land use);**
Please see Exhibit 9 for the location of the haul road and Exhibit 18 for the location of the haul road to remain.

b) **Description and typical cross-sections showing the construction of the haul road including existing ground, grades, slopes, culvert locations, outlet protection and other drainage control;**
The proposed haul road will connect the proposed processing pad to the common use road and mining area. The travelway width will be 30' from the processing pad to the common use road and 50' from the processing pad to the mining area. The haul road will not have a slope exceeding 15% and will have a 1-2% cross slope for drainage. A safety berm will be installed along all edges where vehicle overturnment is possible. A culvert will be installed at the location(s) where a collection ditch crosses the haul road.

c) **Measures to control and prevent erosion and sedimentation; include proposed spacing of sediment traps, turnouts, culverts, check dams, etc.;**
Collection ditches will be installed to collect runoff from the haul roads and convey it to either SP-1 or SP-2. The haul road will be topped with a non-acid producing stone to prevent soils and other material from accumulating on the public roadway. The portion of the haul road that is downgrade of CD-1A will be controlled by sediment trap ST-1. Collection ditch CD-4 will be installed to convey runoff to the trap. The haul road will have a cross slope towards CD-4.

d) **Plan for reclamation after mining is completed;**
N/A - The haul road is proposed to remain after mining is completed.

e) **If the haul road involves the crossing of any intermittent or perennial stream or wetland include Module 14 Streams/Wetlands;**
N/A - The haul road does not cross any intermittent or perennial streams or wetlands.

f) **Will a PennDOT highway occupancy permit be needed?** ☐ Yes ☒ No

If yes, PennDOT Occupancy Permit number must be submitted prior to permit activation.

NOAA Atlas 14, Volume 2, Version 3
Location name: Rockwood, Pennsylvania, USA*
Latitude: 39.8999°, Longitude: -79.1426°
Elevation: 2217 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.302 (0.273-0.336)	0.359 (0.324-0.400)	0.434 (0.390-0.482)	0.494 (0.443-0.548)	0.574 (0.512-0.635)	0.638 (0.567-0.704)	0.703 (0.622-0.775)	0.774 (0.680-0.852)	0.874 (0.760-0.960)	0.952 (0.823-1.05)
10-min	0.470 (0.424-0.522)	0.560 (0.506-0.624)	0.674 (0.606-0.749)	0.763 (0.684-0.845)	0.878 (0.783-0.972)	0.967 (0.860-1.07)	1.06 (0.936-1.17)	1.16 (1.02-1.27)	1.28 (1.12-1.41)	1.39 (1.20-1.52)
15-min	0.576 (0.520-0.640)	0.685 (0.619-0.763)	0.828 (0.744-0.920)	0.938 (0.842-1.04)	1.08 (0.968-1.20)	1.20 (1.06-1.32)	1.32 (1.16-1.45)	1.44 (1.26-1.58)	1.60 (1.40-1.76)	1.73 (1.50-1.90)
30-min	0.762 (0.688-0.847)	0.917 (0.828-1.02)	1.13 (1.02-1.26)	1.30 (1.17-1.44)	1.53 (1.37-1.70)	1.71 (1.52-1.89)	1.90 (1.68-2.09)	2.10 (1.84-2.31)	2.37 (2.07-2.61)	2.60 (2.24-2.85)
60-min	0.930 (0.840-1.03)	1.12 (1.02-1.25)	1.42 (1.28-1.58)	1.66 (1.49-1.84)	1.99 (1.77-2.20)	2.25 (2.00-2.49)	2.54 (2.24-2.80)	2.85 (2.50-3.13)	3.28 (2.86-3.61)	3.65 (3.15-4.01)
2-hr	1.09 (0.977-1.20)	1.31 (1.18-1.45)	1.66 (1.49-1.84)	1.96 (1.75-2.16)	2.38 (2.12-2.62)	2.75 (2.43-3.01)	3.14 (2.76-3.44)	3.57 (3.12-3.91)	4.21 (3.63-4.60)	4.76 (4.06-5.19)
3-hr	1.18 (1.06-1.31)	1.42 (1.28-1.58)	1.78 (1.61-1.98)	2.09 (1.88-2.32)	2.55 (2.27-2.82)	2.94 (2.61-3.24)	3.37 (2.97-3.70)	3.84 (3.35-4.22)	4.54 (3.92-4.98)	5.15 (4.40-5.64)
6-hr	1.45 (1.30-1.63)	1.73 (1.56-1.95)	2.16 (1.94-2.42)	2.53 (2.26-2.83)	3.07 (2.72-3.42)	3.53 (3.12-3.92)	4.04 (3.54-4.47)	4.60 (4.00-5.08)	5.44 (4.66-5.98)	6.16 (5.23-6.76)
12-hr	1.76 (1.58-2.01)	2.10 (1.88-2.39)	2.60 (2.33-2.96)	3.04 (2.71-3.44)	3.70 (3.28-4.16)	4.27 (3.75-4.79)	4.90 (4.26-5.48)	5.60 (4.83-6.24)	6.66 (5.67-7.40)	7.58 (6.38-8.41)
24-hr	2.06 (1.90-2.25)	2.46 (2.27-2.70)	3.05 (2.81-3.34)	3.57 (3.28-3.90)	4.36 (3.96-4.75)	5.05 (4.55-5.49)	5.82 (5.19-6.32)	6.68 (5.89-7.25)	7.98 (6.92-8.68)	9.12 (7.76-9.94)
2-day	2.42 (2.24-2.63)	2.88 (2.68-3.14)	3.56 (3.30-3.87)	4.14 (3.82-4.49)	5.00 (4.58-5.43)	5.75 (5.22-6.24)	6.58 (5.91-7.14)	7.48 (6.65-8.14)	8.85 (7.71-9.65)	10.0 (8.59-11.0)
3-day	2.61 (2.42-2.82)	3.11 (2.89-3.36)	3.81 (3.54-4.12)	4.40 (4.08-4.75)	5.28 (4.85-5.69)	6.01 (5.49-6.49)	6.81 (6.16-7.36)	7.68 (6.87-8.32)	8.96 (7.86-9.75)	10.1 (8.69-11.0)
4-day	2.80 (2.61-3.02)	3.33 (3.10-3.59)	4.06 (3.78-4.37)	4.67 (4.33-5.02)	5.55 (5.12-5.96)	6.27 (5.75-6.74)	7.05 (6.41-7.59)	7.88 (7.08-8.51)	9.07 (8.02-9.86)	10.1 (8.80-11.0)
7-day	3.35 (3.14-3.58)	3.98 (3.73-4.25)	4.78 (4.48-5.10)	5.44 (5.08-5.80)	6.36 (5.92-6.77)	7.10 (6.57-7.57)	7.87 (7.24-8.41)	8.67 (7.90-9.30)	9.78 (8.79-10.5)	10.8 (9.55-11.7)
10-day	3.90 (3.68-4.14)	4.62 (4.35-4.91)	5.47 (5.15-5.80)	6.15 (5.78-6.52)	7.07 (6.62-7.49)	7.79 (7.27-8.27)	8.52 (7.92-9.06)	9.26 (8.54-9.87)	10.3 (9.36-11.0)	11.2 (10.1-12.0)
20-day	5.54 (5.28-5.83)	6.50 (6.18-6.84)	7.50 (7.13-7.89)	8.29 (7.87-8.72)	9.32 (8.83-9.81)	10.1 (9.56-10.7)	10.9 (10.2-11.5)	11.7 (10.9-12.3)	12.6 (11.7-13.4)	13.4 (12.3-14.3)
30-day	7.00 (6.67-7.36)	8.18 (7.80-8.61)	9.33 (8.88-9.81)	10.2 (9.73-10.8)	11.4 (10.8-12.0)	12.3 (11.6-12.9)	13.1 (12.4-13.8)	13.9 (13.1-14.7)	15.0 (14.0-15.9)	15.7 (14.6-16.8)
45-day	8.98 (8.58-9.41)	10.5 (10.0-11.0)	11.8 (11.3-12.4)	12.9 (12.3-13.5)	14.2 (13.5-14.9)	15.2 (14.4-15.9)	16.1 (15.2-16.9)	17.0 (16.0-17.9)	18.0 (16.9-19.1)	18.8 (17.6-20.0)
60-day	10.8 (10.4-11.3)	12.6 (12.1-13.2)	14.1 (13.5-14.7)	15.3 (14.6-16.0)	16.7 (16.0-17.5)	17.8 (16.9-18.6)	18.8 (17.8-19.7)	19.7 (18.6-20.7)	20.8 (19.6-21.9)	21.6 (20.3-22.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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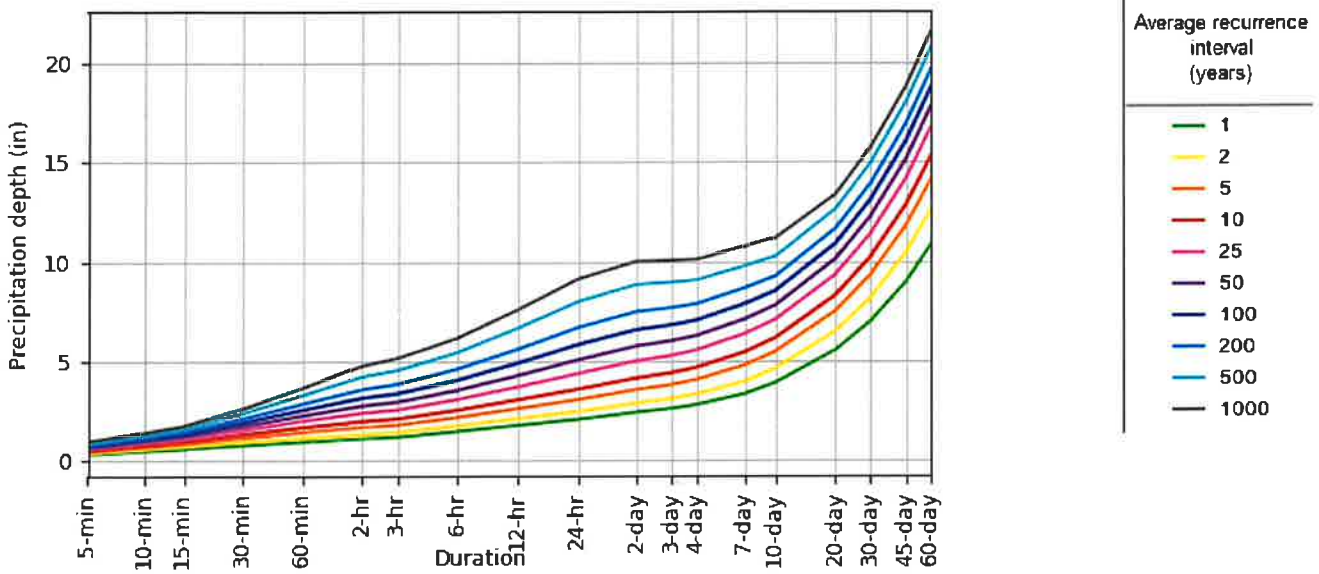
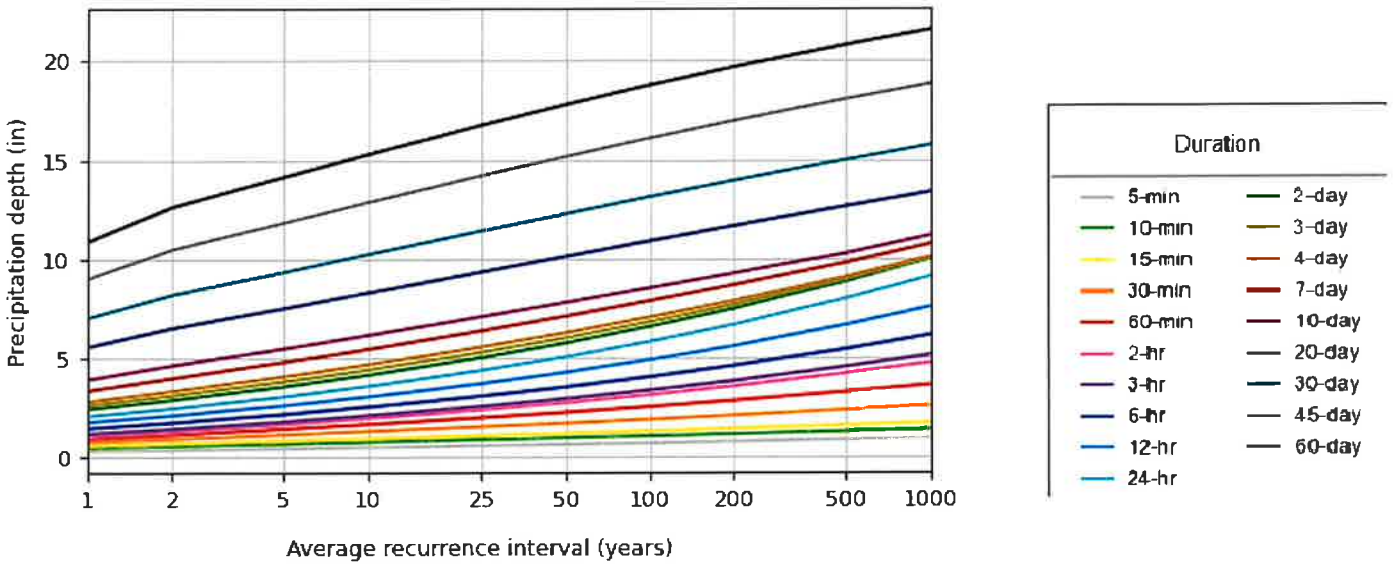
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.8999°, Longitude: -79.1426°





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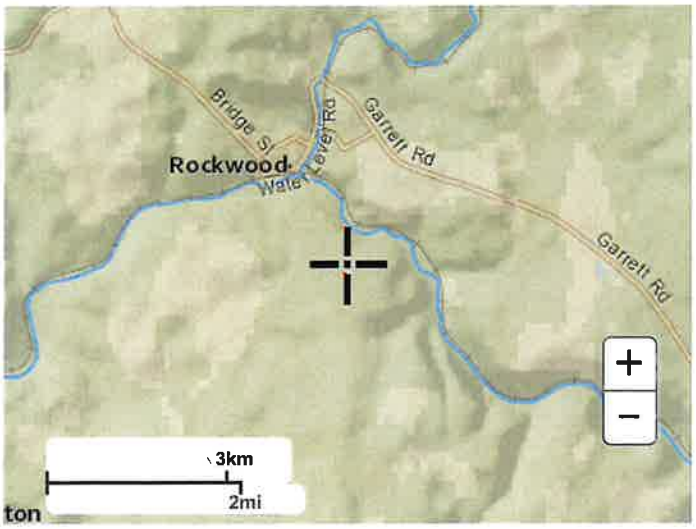
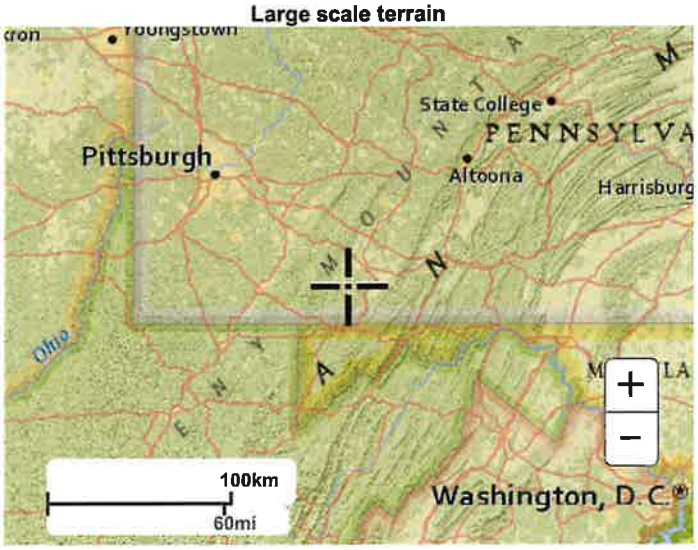
Maps & aerials

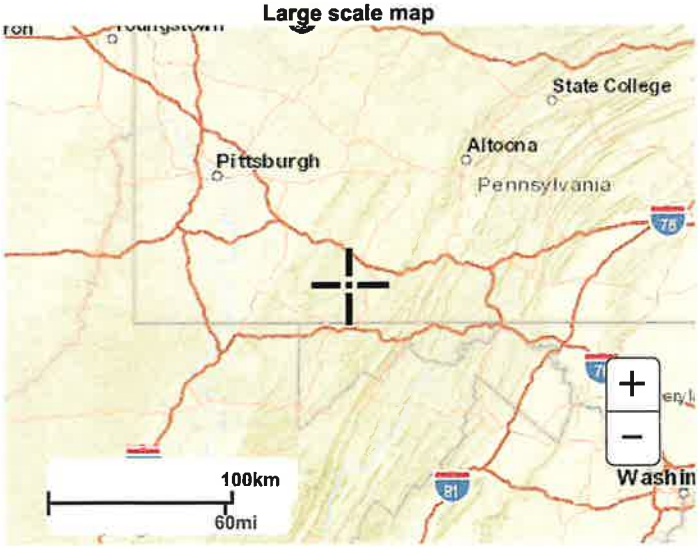
Small scale terrain



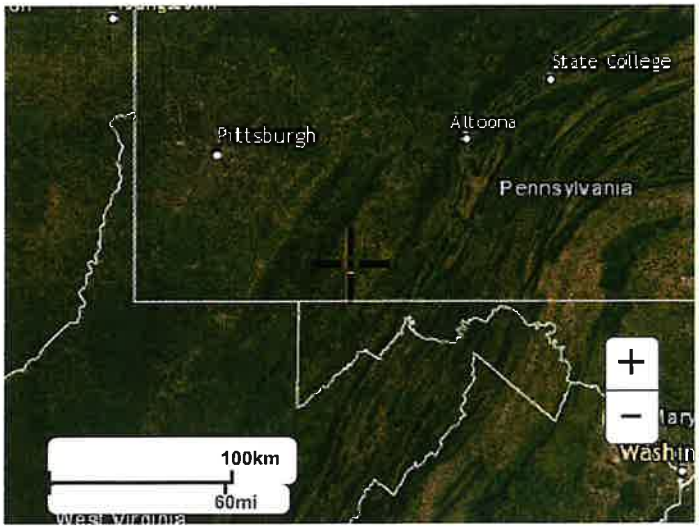
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

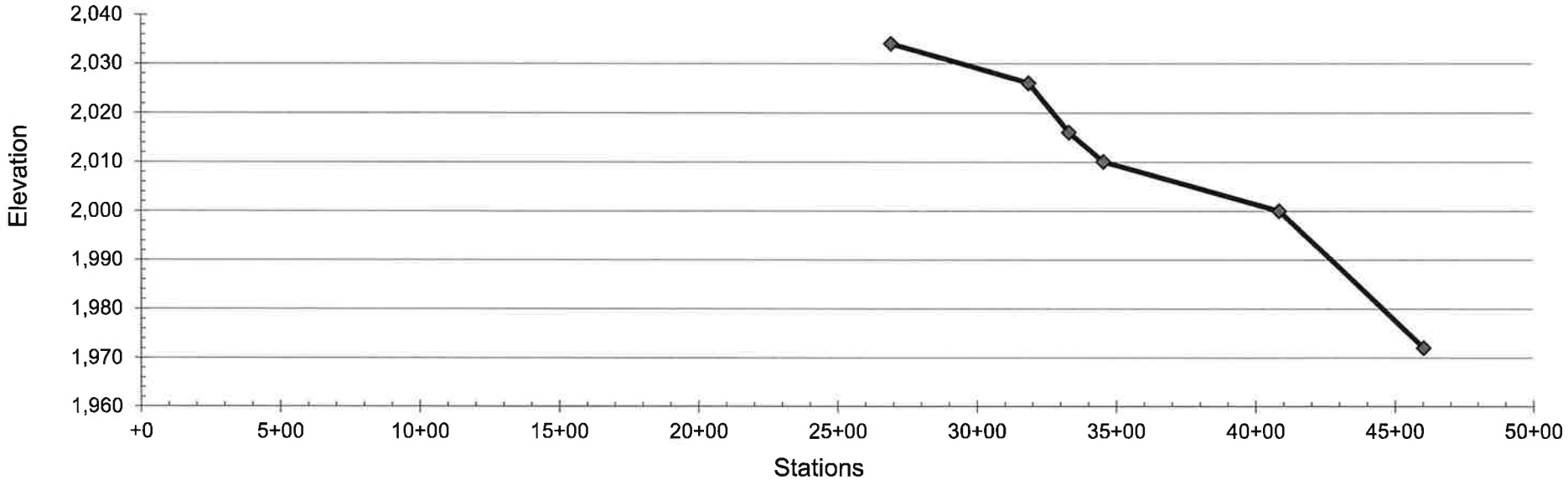
Disclaimer

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
COLLECTION DITCH CD-1A	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
26 + 93		2034.0																					
31 + 87		2026.0	2.8	2.8	10	6.0%	85	5.1	50.5	1.6%	0.4	R-3	0.035	5.0	2 : 1	10.9	1.40	10.6	5.28	57.7	1.75	12.0	88.6
33 + 31		2016.0	0.4	3.2	10	6.0%	85	0.7	51.2	6.9%	0.5	R-4	0.047	5.0	2 : 1	7.9	1.10	9.4	7.09	56.2	1.60	11.4	113.9
34 + 54		2010.0	0.5	3.7	10	6.0%	85	0.9	52.1	4.9%	0.5	R-4	0.046	5.0	2 : 1	8.9	1.20	9.8	6.38	56.6	1.70	11.8	109.8
40 + 85		2000.0	11.1	14.8	10	6.0%	85	17.9	70.0	1.6%	0.5	R-3	0.034	5.0	2 : 1	13.1	1.60	11.4	5.72	75.0	2.10	13.4	127.9
46 + 04		1972.0	7.0	21.8	10	6.0%	85	10.7	80.7	5.4%	0.5	R-4	0.045	5.0	2 : 1	10.9	1.40	10.6	7.56	82.6	1.90	12.6	149.0

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1A**				**Peak Disch & Base Flow:**	**5.1**	**45.4**
Section Number:	**1**				**Peak Discharge (Cum):**	**50.5**	
End Station:	**31**	**+**	**87**		**Drainage Acreage:**	**2.8**	
End Elevation:	**2,026.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.4	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.035	
Channel Slope, s (ft/ft)	=	1.62%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	57.68	cfs	
Q =	88.59	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.28	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	1.41	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	10.92	sq.ft.	
A =	14.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	11.26	feet	
P =	12.83	feet	WITH FREEBOARD

$r = A/P$

r =	0.97	feet	
r =	1.16	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	10.60	feet	
T =	12.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1A**				**Peak Disch & Base Flow:**	**0.7**	
Section Number:	**2**				**Peak Discharge (Cum):**	**51.2**	
End Station:	**33**	**+**	**31**		**Drainage Acreage:**	**0.4**	
End Elevation:	**2,016.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.1	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.047	
Channel Slope, s (ft/ft)	=	6.94%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	56.17	cfs	
Q =	113.88	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	7.09	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	4.77	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	7.92	sq.ft.	
A =	13.12	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.92	feet	
P =	12.16	feet	WITH FREEBOARD

$r = A/P$

r =	0.80	feet	
r =	1.08	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	9.40	feet	
T =	11.40	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1A**				**Peak Disch & Base Flow:**	**0.9**	
Section Number:	**3**				**Peak Discharge (Cum):**	**52.1**	
End Station:	**34**	**+**	**54**		**Drainage Acreage:**	**0.5**	
End Elevation:	**2,010.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.2	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.046	
Channel Slope, s (ft/ft)	=	4.88%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	56.61	cfs	
Q =	109.81	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.38	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	3.65	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	8.88	sq.ft.	
A =	14.28	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	10.37	feet	
P =	12.60	feet	WITH FREEBOARD

$r = A/P$

r =	0.86	feet	
r =	1.13	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	9.80	feet	
T =	11.80	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1A**				**Peak Disch & Base Flow:**	**17.9**	
Section Number:	**4**				**Peak Discharge (Cum):**	**70.0**	
End Station:	**40**	**+**	**85**		**Drainage Acreage:**	**11.1**	
End Elevation:	**2,000.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.6	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.034	
Channel Slope, s (ft/ft)	=	1.58%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	75.03	cfs	
Q =	127.88	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.72	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	1.58	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	13.12	sq.ft.	
A =	19.32	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	12.16	feet	
P =	14.39	feet	WITH FREEBOARD

$r = A/P$

r =	1.08	feet	
r =	1.34	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	11.40	feet	
T =	13.40	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1A**				**Peak Disch & Base Flow:**	**10.7**	
Section Number:	**5**				**Peak Discharge (Cum):**	**80.7**	
End Station:	**46**	**+**	**04**		**Drainage Acreage:**	**7.0**	
End Elevation:	**1,972.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.4	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.045	
Channel Slope, s (ft/ft)	=	5.39%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	82.59	cfs	
Q =	149.00	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	7.56	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	4.71	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	10.92	sq.ft.	
A =	16.72	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	11.26	feet	
P =	13.50	feet	WITH FREEBOARD

$r = A/P$

r =	0.97	feet	
r =	1.24	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	10.60	feet	
T =	12.60	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 11:00:16 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1A(1) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 2.8000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 27.80 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 556.500

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 5.058

Time of Concentration (SCS) Mon Jan 20 10:42:21 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1A(1) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 3187.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.463 hrs, 27.8 mins

Graphical Peak Discharge Mon Jan 20 11:01:45 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1A(2) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 0.4000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 28.80 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 546.041

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 0.709

Time of Concentration (SCS) Mon Jan 20 10:43:16 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1A(2) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 3331.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.480 hrs, 28.8 mins

Graphical Peak Discharge Mon Jan 20 11:01:21 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1A(3) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 0.5000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 29.60 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 537.932

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 0.873

Time of Concentration (SCS) Mon Jan 20 10:43:47 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1A(3) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 3454.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.494 hrs, 29.6 mins

Graphical Peak Discharge Mon Jan 20 11:02:27 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1A(4) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 11.1000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 33.90 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 497.788

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 17.936

Time of Concentration (SCS) Mon Jan 20 10:44:42 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1A(4) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 4085.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.565 hrs, 33.9 mins

Graphical Peak Discharge Mon Jan 20 11:03:01 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1A(5) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 7.0000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 37.30 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 471.368

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 10.711

Time of Concentration (SCS) Mon Jan 20 10:45:13 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1A(5) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 4604.00 ft
Average Land Slope : 6.00 %

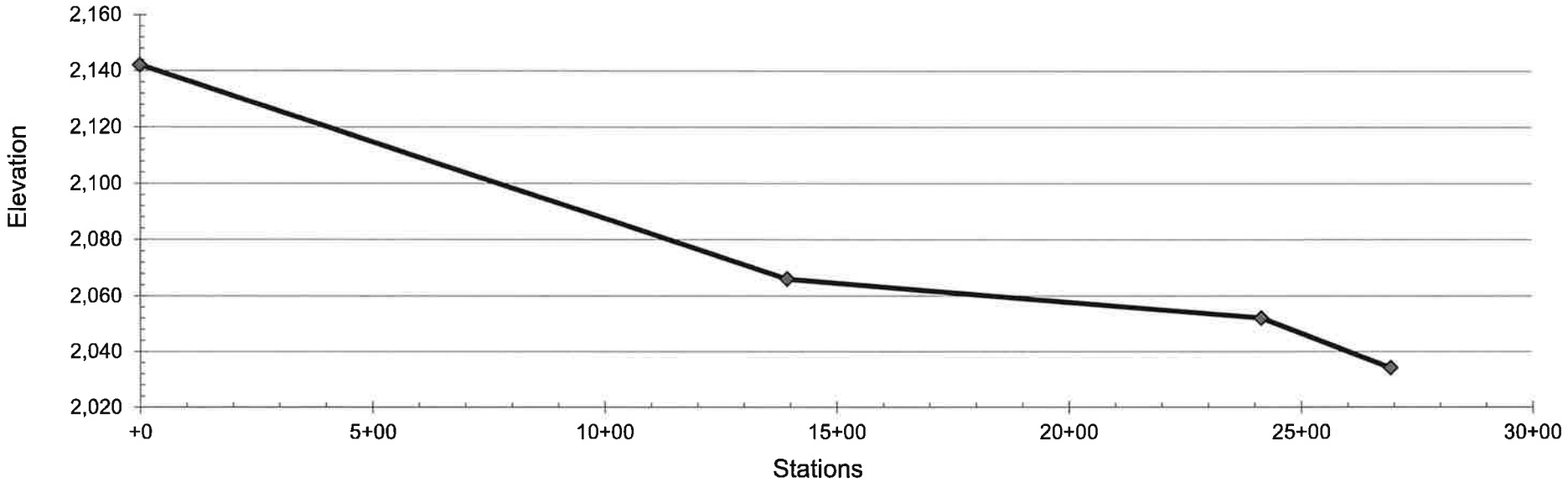
Time of Concentration : 0.622 hrs, 37.3 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
COLLECTION DITCH CD-1B	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
0 + 00		2142.0																					
13 + 93		2066.0	6.2	6.2	10	6.0%	85	15.1	15.1	5.5%	0.2	R-3	0.041	5.0	2 : 1	3.7	0.60	7.4	5.16	19.2	0.75	8.0	28.5
24 + 14		2052.0	13.1	19.3	10	6.0%	85	26.4	41.5	1.4%	0.5	GRASS	0.060	5.0	2 : 1	14.3	1.70	11.8	3.15	45.0	2.20	13.8	74.9
26 + 93		2034.0	2.0	21.3	10	6.0%	85	3.9	45.4	6.5%	0.5	R-4	0.047	5.0	2 : 1	7.9	1.10	9.4	6.84	54.1	1.60	11.4	109.8

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1B**				**Peak Disch & Base Flow:**	**15.1**	
Section Number:	**1**				**Peak Discharge (Cum):**	**15.1**	
End Station:	**13**	**+**	**93**		**Drainage Acreage:**	**6.2**	
End Elevation:	**2,066.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	0.6	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.041	
Channel Slope, s (ft/ft)	=	5.46%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	19.21	cfs	
Q =	28.53	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.16	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	2.04	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	3.72	sq.ft.	
A =	4.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	7.68	feet	
P =	8.35	feet	WITH FREEBOARD

$r = A/P$

r =	0.48	feet	
r =	0.58	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.40	feet	
T =	8.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1B**				**Peak Disch & Base Flow:**	**26.4**	
Section Number:	**2**				**Peak Discharge (Cum):**	**41.5**	
End Station:	**24**	**+**	**14**		**Drainage Acreage:**	**13.1**	
End Elevation:	**2,052.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.7	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.060	
Channel Slope, s (ft/ft)	=	1.37%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	45.03	cfs	
Q =	74.91	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	3.15	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	1.45	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	14.28	sq.ft.	
A =	20.68	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	12.60	feet	
P =	14.84	feet	WITH FREEBOARD

$r = A/P$

r =	1.13	feet	
r =	1.39	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	11.80	feet	
T =	13.80	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-1B**				**Peak Disch & Base Flow:**	**3.9**	
Section Number:	**3**				**Peak Discharge (Cum):**	**45.4**	
End Station:	**26**	**+**	**93**		**Drainage Acreage:**	**2.0**	
End Elevation:	**2,034.0**				**Watershed Slope:**	**6.0%**	

Given:			
Flow Depth, d (ft)	=	1.1	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.047	
Channel Slope, s (ft/ft)	=	6.45%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	54.14	cfs
Q =	109.76	cfs WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.84	fps
V_{MAX} =	9.00	fps

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	4.43	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	7.92	sq.ft.	
A =	13.12	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.92	feet	
P =	12.16	feet	WITH FREEBOARD

$r = A/P$

r =	0.80	feet	
r =	1.08	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	9.40	feet	
T =	11.40	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 10:28:16 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1B(1) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 6.2000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 14.30 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 749.404

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 15.082

Time of Concentration (SCS) Mon Jan 20 10:21:56 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1B(1) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 1393.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.239 hrs, 14.3 mins

Graphical Peak Discharge Mon Jan 20 10:29:00 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1B(2) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 13.1000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 22.30 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 621.198

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 26.415

Time of Concentration (SCS) Mon Jan 20 10:24:31 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1B(2) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 2414.00 ft
Average Land Slope : 6.00 %

Time of Concentration : 0.371 hrs, 22.3 mins

Graphical Peak Discharge Mon Jan 20 10:30:14 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-1B(3) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 2.0000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 24.30 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 596.323

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 3.871

Time of Concentration (SCS) Mon Jan 20 10:25:20 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-1B(3) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 2693.00 ft
Average Land Slope : 6.00 %

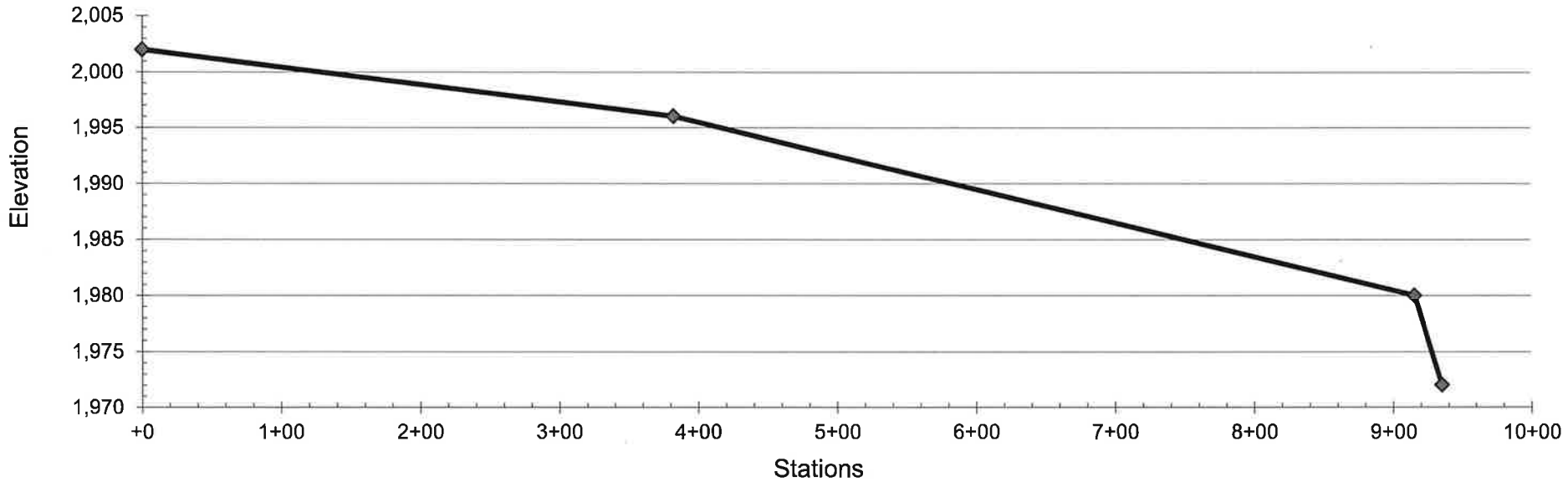
Time of Concentration : 0.405 hrs, 24.3 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
COLLECTION DITCH CD-2	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
0 + 00		2002.0																					
3 + 82		1996.0	3.0	3.0	10	9.0%	85	9.7	9.7	1.6%	0.2	GRASS	0.060	5.0	2 : 1	5.3	0.80	8.2	2.24	11.8	1.00	9.0	17.7
9 + 15		1980.0	8.6	11.6	10	9.0%	85	21.7	31.4	3.0%	0.5	R-3	0.037	5.0	2 : 1	6.5	0.94	8.8	5.43	35.1	1.44	10.8	77.6
9 + 35		1972.0	0.0	11.6	10	9.0%	85	0.0	31.4	40.0%	0.5	R-5	0.071	5.0	2 : 1	4.5	0.70	7.8	8.93	40.0	1.20	9.8	106.6

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-2**				**Peak Disch & Base Flow:**	**9.7**	
Section Number:	**1**				**Peak Discharge (Cum):**	**9.7**	
End Station:	**3**	**+**	**82**		**Drainage Acreage:**	**3.0**	
End Elevation:	**1,996.0**				**Watershed Slope:**	**9.0%**	

Given:			
Flow Depth, d (ft)	=	0.8	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.060	
Channel Slope, s (ft/ft)	=	1.57%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	11.84	cfs	
Q =	17.74	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	2.24	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	0.78	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	5.28	sq.ft.	
A =	7.00	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	8.58	feet	
P =	9.47	feet	WITH FREEBOARD

$r = A/P$

r =	0.62	feet	
r =	0.74	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	8.20	feet	
T =	9.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-2**				**Peak Disch & Base Flow:**	**21.7**	
Section Number:	**2**				**Peak Discharge (Cum):**	**31.4**	
End Station:	**9**	**+**	**15**		**Drainage Acreage:**	**8.6**	
End Elevation:	**1,980.0**				**Watershed Slope:**	**9.0%**	

Given:			
Flow Depth, d (ft)	=	0.94	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.037	
Channel Slope, s (ft/ft)	=	3.00%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	35.09	cfs	
Q =	77.57	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.43	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void}=0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	1.76	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	6.47	sq.ft.	
A =	11.35	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.20	feet	
P =	11.44	feet	WITH FREEBOARD

$r = A/P$

r =	0.70	feet	
r =	0.99	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	8.76	feet	
T =	10.76	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-2**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**3**				**Peak Discharge (Cum):**	**31.4**	
End Station:	**9**	**+**	**35**		**Drainage Acreage:**	**0.0**	
End Elevation:	**1,972.0**				**Watershed Slope:**	**9.0%**	

Given:		
Flow Depth, d (ft)	=	0.7
Bottom Width (ft)	=	5
Side Slopes (H:1)	=	2
What size Rip Rap	=	R-5
d_{50} size (inches)	=	9
Mannings Coefficient	=	0.071
Channel Slope, s (ft/ft)	=	40.00%

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	40.02	cfs	
Q =	106.61	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	8.93	fps	
V_{MAX} =	11.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 27

$A_{void} = 0.4 * b * t$

A_{void} = 4.50 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = -0.02 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.00 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	3.00	psf
Calculated Shear Stress =	N/A	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	4.48	sq.ft.	
A =	8.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	8.13	feet	
P =	10.37	feet	WITH FREEBOARD

$r = A/P$

r =	0.55	feet	
r =	0.86	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.80	feet	
T =	9.80	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 11:47:01 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-2(1) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 3.0000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 6.10 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 995.231

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 9.692

Time of Concentration (SCS) Mon Jan 20 11:45:20 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-2(1) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 618.87 ft
Average Land Slope : 9.00 %

Time of Concentration : 0.102 hrs, 6.1 mins

Graphical Peak Discharge Mon Jan 20 11:47:50 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-2(2) Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 8.6000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 13.00 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 776.905

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 21.688

Time of Concentration (SCS) Mon Jan 20 11:45:57 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-2(2) Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 1580.79 ft
Average Land Slope : 9.00 %

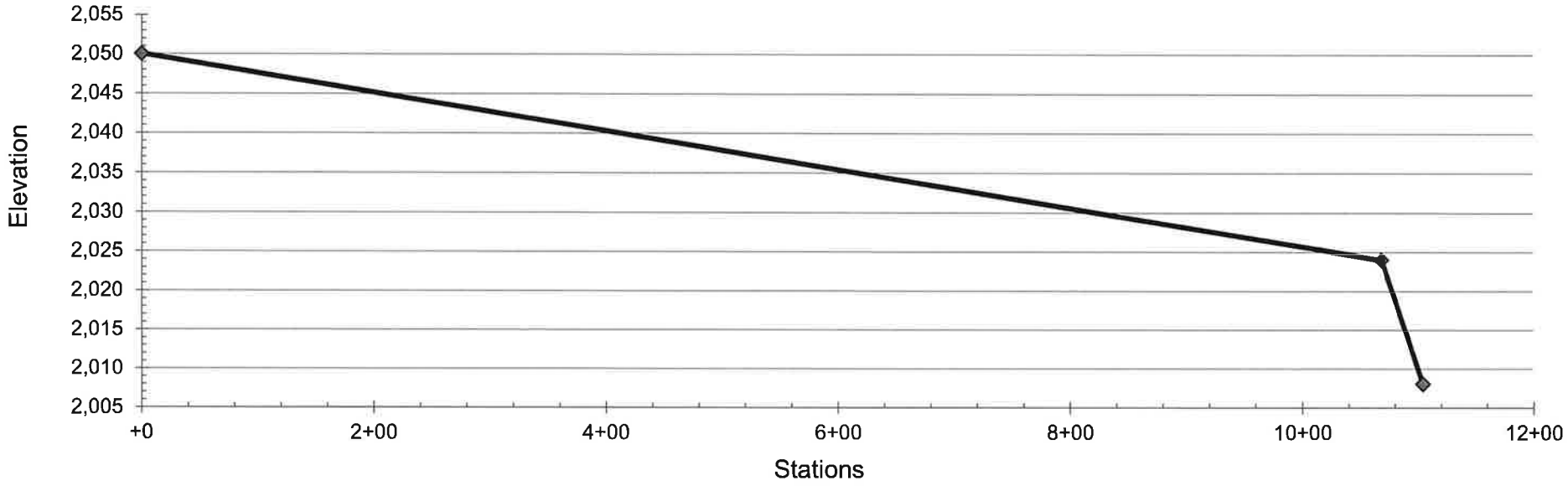
Time of Concentration : 0.216 hrs, 13.0 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
COLLECTION DITCH CD-3	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
0 + 00		2050.0																					
10 + 68		2024.0	10.1	10.1	10	12.0%	85	29.6	29.6	2.4%	0.3	R-3	0.037	5.0	2 : 1	7.0	1.00	9.0	5.11	35.8	1.25	10.0	54.1
11 + 04		2008.0	0.0	10.1	10	12.0%	85	0.0	29.6	44.4%	0.5	R-5	0.071	5.0	2 : 1	4.5	0.70	7.8	9.42	42.2	1.20	9.8	112.4

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-3**				**Peak Disch & Base Flow:**	**29.6**	
Section Number:	**1**				**Peak Discharge (Cum):**	**29.6**	
End Station:	**10**	**+**	**68**		**Drainage Acreage:**	**10.1**	
End Elevation:	**2,024.0**				**Watershed Slope:**	**12.0%**	

Given:			
Flow Depth, d (ft)	=	1	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.037	
Channel Slope, s (ft/ft)	=	2.43%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	35.79	cfs	
Q =	54.10	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.11	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	1.52	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	7.00	sq.ft.	
A =	9.38	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.47	feet	
P =	10.59	feet	WITH FREEBOARD

$r = A/P$

r =	0.74	feet	
r =	0.89	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	9.00	feet	
T =	10.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-3**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**2**				**Peak Discharge (Cum):**	**29.6**	
End Station:	**11**	**+**	**04**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,008.0**				**Watershed Slope:**	**12.0%**	

Given:			
Flow Depth, d (ft)	=	0.7	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-5	
d_{50} size (inches)	=	9	
Mannings Coefficient	=	0.071	
Channel Slope, s (ft/ft)	=	44.44%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	42.19	cfs	
Q =	112.38	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	9.42	fps	
V_{MAX} =	11.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 27

$A_{void} = 0.4 * b * t$

A_{void} = 4.50 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = -0.02 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.00 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	3.00	psf
Calculated Shear Stress =	N/A	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	4.48	sq.ft.	
A =	8.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	8.13	feet	
P =	10.37	feet	WITH FREEBOARD

$r = A/P$

r =	0.55	feet	
r =	0.86	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.80	feet	
T =	9.80	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 12:17:56 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-3 Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 10.1000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 8.40 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 902.915

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 29.602

Time of Concentration (SCS) Mon Jan 20 12:17:04 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: CD-3 Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 1100.00 ft
Average Land Slope : 12.00 %

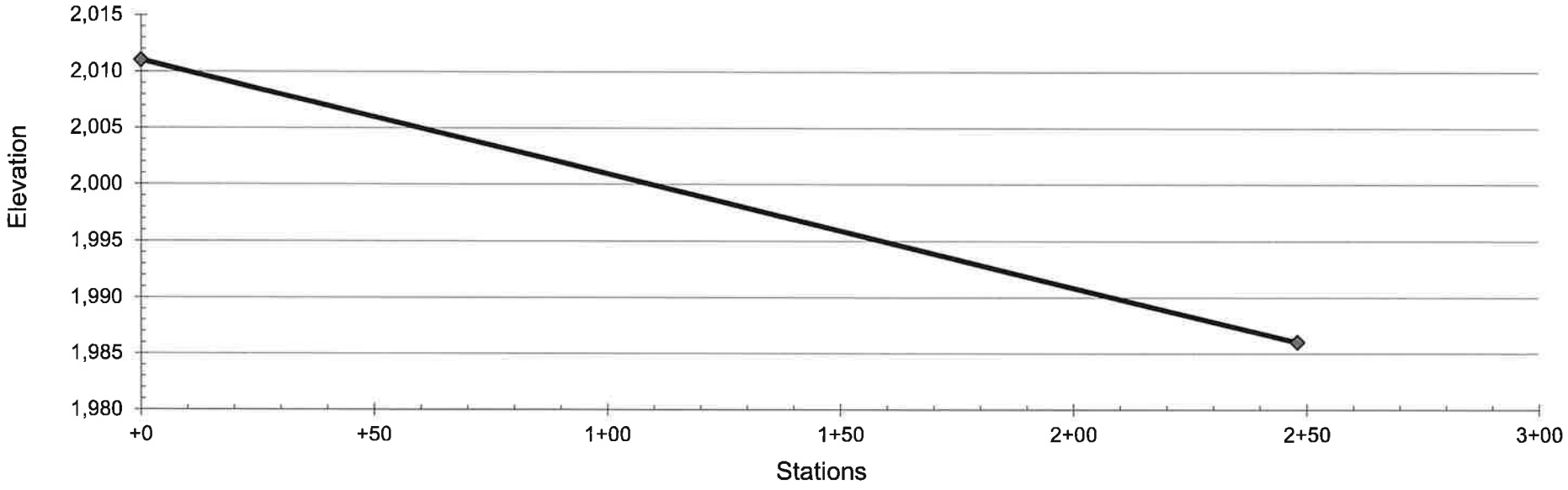
Time of Concentration : 0.140 hrs, 8.4 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
COLLECTION DITCH CD-4	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station			Drainage Area (acres)					Peak Discharge Q (CFS)												With Freeboard		
Start / End	Elevation		Section	Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Section	Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	Channel Depth (ft)	Top Channel Width (ft)	Q Available (CFS)
0 + 00	2011.0																					
2 + 48	1986.0		0.5	0.5	10	10.0%	85	1.6	1.6	10.1%	0.1	R-3	0.052	2.0	2 : 1	0.8	0.30	3.2	3.42	2.7	0.38	3.5	4.0

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**COLLECTION DITCH CD-4**				**Peak Disch & Base Flow:**	**1.6**	
Section Number:	**1**				**Peak Discharge (Cum):**	**1.6**	
End Station:	**2**	**+**	**48**		**Drainage Acreage:**	**0.5**	
End Elevation:	**1,986.0**				**Watershed Slope:**	**10.0%**	

Given:			
Flow Depth, d (ft)	=	0.3	
Bottom Width (ft)	=	2	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.052	
Channel Slope, s (ft/ft)	=	10.08%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	2.67	cfs	
Q =	3.99	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	3.42	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4 * b * t$

A_{void} = 0.60 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.18 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.08 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	0.52	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	0.78	sq.ft.	
A =	1.03	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	3.34	feet	
P =	3.68	feet	WITH FREEBOARD

$r = A/P$

r =	0.23	feet	
r =	0.28	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	3.20	feet	
T =	3.50	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 12:36:29 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: CD-4 Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 0.5000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 6.00 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 1000.000

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

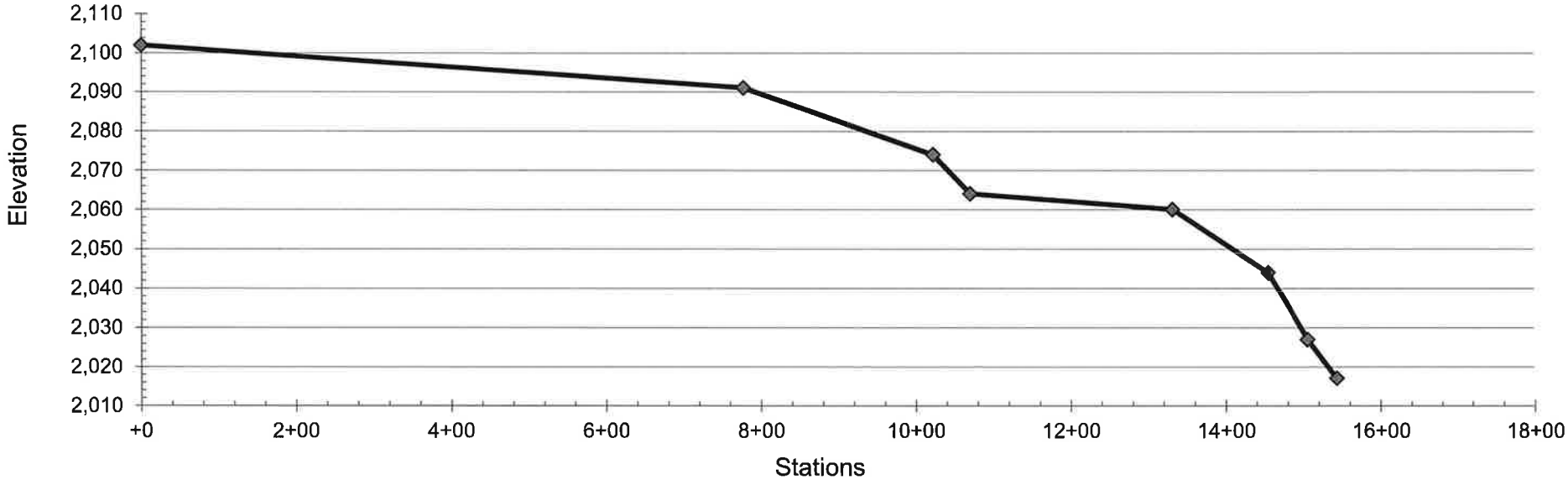
9. Peak Discharge,qp.....cfs = 1.623

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
DIVERSION DITCH DD-1	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
0 + 00		2102.0																					
7 + 77		2091.0	4.1	4.1	10	8.0%	85	10.2	10.2	1.4%	0.2	GRASS	0.070	5.0	2 : 1	6.1	0.90	8.6	1.95	11.9	1.13	9.5	17.9
10 + 22		2074.0	0.0	4.1	10	8.0%	85	0.0	10.2	6.9%	0.5	R-3	0.043	5.0	2 : 1	3.0	0.50	7.0	4.99	15.0	1.00	9.0	51.5
10 + 70		2064.0	0.0	4.1	10	8.0%	85	0.0	10.2	20.8%	0.5	R-3	0.051	5.0	2 : 1	1.8	0.32	6.3	5.71	10.3	0.82	8.3	53.4
13 + 31		2060.0	0.0	4.1	10	8.0%	85	0.0	10.2	1.5%	0.5	GRASS	0.060	5.0	2 : 1	5.3	0.80	8.2	2.22	11.7	1.30	10.2	28.5
14 + 54		2044.0	0.0	4.1	10	8.0%	85	0.0	10.2	13.0%	0.5	R-3	0.048	5.0	2 : 1	2.1	0.36	6.4	5.07	10.4	0.86	8.4	48.1
15 + 05		2027.0	0.0	4.1	10	8.0%	85	0.0	10.2	33.3%	0.5	R-3	0.052	5.0	2 : 1	1.7	0.30	6.2	6.77	11.4	0.80	8.2	62.8
15 + 43		2017.0	0.0	4.1	10	8.0%	85	0.0	10.2	26.3%	0.5	R-3	0.051	5.0	2 : 1	1.7	0.31	6.2	6.22	10.8	0.81	8.2	57.9

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**10.2**	
Section Number:	**1**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**7**	**+**	**77**		**Drainage Acreage:**	**4.1**	
End Elevation:	**2,091.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.9	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.070	
Channel Slope, s (ft/ft)	=	1.42%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	11.92	cfs	
Q =	17.93	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	1.95	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	0.80	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	6.12	sq.ft.	
A =	8.16	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.02	feet	
P =	10.03	feet	WITH FREEBOARD

$r = A/P$

r =	0.68	feet	
r =	0.81	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	8.60	feet	
T =	9.50	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**2**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**10**	**+**	**22**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,074.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.5	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.043	
Channel Slope, s (ft/ft)	=	6.94%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	14.98	cfs	
Q =	51.49	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	4.99	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4*b*t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	2.16	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	3.00	sq.ft.	
A =	7.00	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	7.24	feet	
P =	9.47	feet	WITH FREEBOARD

$r = A/P$

r =	0.41	feet	
r =	0.74	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.00	feet	
T =	9.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**3**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**10**	**+**	**70**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,064.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.32	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.051	
Channel Slope, s (ft/ft)	=	20.83%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	10.31	cfs	
Q =	53.36	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.71	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4 * b * t$

A_{void} = 1.50 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.30 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.06 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	0.77	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	1.80	sq.ft.	
A =	5.44	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	6.43	feet	
P =	8.67	feet	WITH FREEBOARD

$r = A/P$

r =	0.28	feet	
r =	0.63	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	6.28	feet	
T =	8.28	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**4**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**13**	**+**	**31**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,060.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.8	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.060	
Channel Slope, s (ft/ft)	=	1.53%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	11.70	cfs	
Q =	28.51	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	2.22	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	0.77	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	5.28	sq.ft.	
A =	9.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	8.58	feet	
P =	10.81	feet	WITH FREEBOARD

$r = A/P$

r =	0.62	feet	
r =	0.91	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	8.20	feet	
T =	10.20	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**5**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**14**	**+**	**54**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,044.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.36	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.048	
Channel Slope, s (ft/ft)	=	13.01%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	10.44	cfs	
Q =	48.10	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.07	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void}=0.4*b*t$

A_{void} = 1.50 sq.ft.

$A_{in\text{-}channel\ flow}=A-A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.56 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.11 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	0.87	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	2.06	sq.ft.	
A =	5.78	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	6.61	feet	
P =	8.85	feet	WITH FREEBOARD

$r = A/P$

r =	0.31	feet	
r =	0.65	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	6.44	feet	
T =	8.44	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**6**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**15**	**+**	**05**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,027.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.3	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.052	
Channel Slope, s (ft/ft)	=	33.33%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	11.37	cfs	
Q =	62.84	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.77	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4 * b * t$

A_{void} = 1.50 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.18 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.04 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	0.74	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	1.68	sq.ft.	
A =	5.28	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	6.34	feet	
P =	8.58	feet	WITH FREEBOARD

$r = A/P$

r =	0.26	feet	
r =	0.62	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	6.20	feet	
T =	8.20	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-1**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**7**				**Peak Discharge (Cum):**	**10.2**	
End Station:	**15**	**+**	**43**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,017.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.31	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.051	
Channel Slope, s (ft/ft)	=	26.32%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	10.83	cfs	
Q =	57.90	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.22	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4 * b * t$

A_{void} = 1.50 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.24 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.05 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	0.78	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	1.74	sq.ft.	
A =	5.36	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	6.39	feet	
P =	8.62	feet	WITH FREEBOARD

$r = A/P$

r =	0.27	feet	
r =	0.62	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	6.24	feet	
T =	8.24	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Mon Jan 20 13:14:12 2025

Project: ROCKWOOD By: CGY Date: 01/20/25

Location: DD-1 Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 4.1000Acres

   Runoff Curve Number:.....CN = 85

   Time of Concentration:.....Tc = 13.50 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.3529

5. Compute Ia/P..... = 0.0989

6. Unit peak discharge, qu.....csm/in = 766.015

7. Runoff,Q.....in = 2.077

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 10.195

Time of Concentration (SCS) Mon Jan 20 13:10:49 2025

Project: ROCKWOOD By: CGY Date: 01/20/25
Location: DD-1 Checked: Date: 01/20/25
Developed

Curve Number : 85
Length of Flow : 1543.00 ft
Average Land Slope : 8.00 %

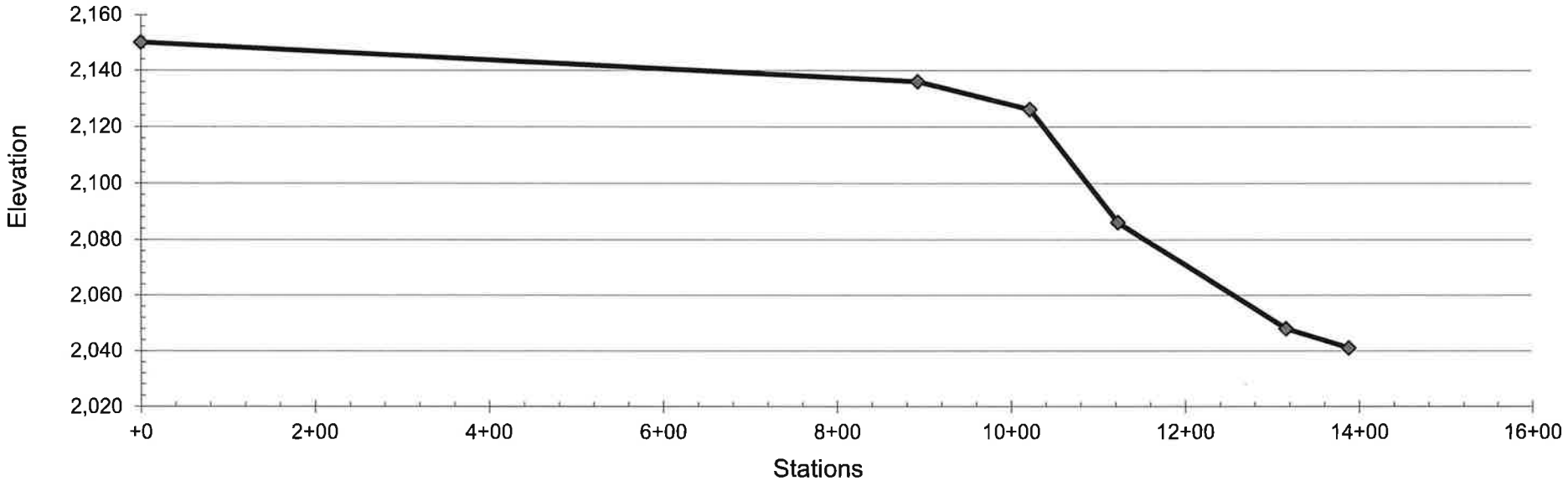
Time of Concentration : 0.225 hrs, 13.5 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
DIVERSION DITCH DD-2	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station Start	Station End	Elevation	Drainage Area (acres) Section	Drainage Area (acres) Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Peak Discharge Q (CFS) Section	Peak Discharge Q (CFS) Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	With Freeboard: Channel Depth (ft)	With Freeboard: Top Channel Width (ft)	With Freeboard: Q Available (CFS)
0 + 00		2150.0																					
8 + 93		2136.0	18.0	18.0	10	8.0%	75	22.1	22.1	1.6%	0.3	GRASS	0.050	5.0	2 : 1	7.9	1.10	9.4	3.20	25.3	1.38	10.5	38.5
10 + 22		2126.0	0.0	18.0	10	8.0%	75	0.0	22.1	7.8%	0.5	R-3	0.041	5.0	2 : 1	3.7	0.60	7.4	6.16	22.9	1.10	9.4	68.2
11 + 23		2086.0	0.0	18.0	10	8.0%	75	0.0	22.1	39.6%	0.5	R-4	0.064	5.0	2 : 1	3.0	0.50	7.0	8.15	24.4	1.00	9.0	84.0
13 + 16		2048.0	0.0	18.0	10	8.0%	75	0.0	22.1	19.7%	0.5	R-4	0.058	5.0	2 : 1	3.7	0.60	7.4	6.94	25.8	1.10	9.4	76.8
13 + 88		2041.0	0.0	18.0	10	8.0%	75	0.0	22.1	9.7%	0.5	R-4	0.055	5.0	2 : 1	4.5	0.70	7.8	5.66	25.4	1.20	9.8	67.5

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-2**				**Peak Disch & Base Flow:**	**22.1**	
Section Number:	**1**				**Peak Discharge (Cum):**	**22.1**	
End Station:	**8**	**+**	**93**		**Drainage Acreage:**	**18.0**	
End Elevation:	**2,136.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	1.1	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.050	
Channel Slope, s (ft/ft)	=	1.57%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	25.35	cfs	
Q =	38.47	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	3.20	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	1.08	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	7.92	sq.ft.	
A =	10.66	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	9.92	feet	
P =	11.15	feet	WITH FREEBOARD

$r = A/P$

r =	0.80	feet	
r =	0.96	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	9.40	feet	
T =	10.50	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-2**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**2**				**Peak Discharge (Cum):**	**22.1**	
End Station:	**10**	**+**	**22**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,126.0**				**Watershed Slope:**	**8.0%**	

Given:

Flow Depth, d (ft)	=	0.6	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-3	
d_{50} size (inches)	=	3	
Mannings Coefficient	=	0.041	
Channel Slope, s (ft/ft)	=	7.75%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	22.90	cfs	
Q =	68.16	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.16	fps	
V_{MAX} =	6.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 9

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	1.00	psf
Calculated Shear Stress =	2.90	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	3.72	sq.ft.	
A =	7.92	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	7.68	feet	
P =	9.92	feet	WITH FREEBOARD

$r = A/P$

r =	0.48	feet	
r =	0.80	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.40	feet	
T =	9.40	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-2**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**3**				**Peak Discharge (Cum):**	**22.1**	
End Station:	**11**	**+**	**23**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,086.0**				**Watershed Slope:**	**8.0%**	

Given:

Flow Depth, d (ft)	=	0.5
Bottom Width (ft)	=	5
Side Slopes (H:1)	=	2
What size Rip Rap	=	R-4
d_{50} size (inches)	=	6
Mannings Coefficient	=	0.064
Channel Slope, s (ft/ft)	=	39.60%

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	24.44	cfs	
Q =	84.00	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	8.15	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void} = 0.4 * b * t$

A_{void} = 3.00 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.00 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.00 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	N/A	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	3.00	sq.ft.	
A =	7.00	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	7.24	feet	
P =	9.47	feet	WITH FREEBOARD

$r = A/P$

r =	0.41	feet	
r =	0.74	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.00	feet	
T =	9.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-2**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**4**				**Peak Discharge (Cum):**	**22.1**	
End Station:	**13**	**+**	**16**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,048.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.6	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.058	
Channel Slope, s (ft/ft)	=	19.69%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	25.81	cfs	
Q =	76.83	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	6.94	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap

if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void} = 0.4 * b * t$

A_{void} = 3.00 sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = 0.72 sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = 0.14 ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	1.68	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	3.72	sq.ft.	
A =	7.92	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	7.68	feet	
P =	9.92	feet	WITH FREEBOARD

$r = A/P$

r =	0.48	feet	
r =	0.80	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.40	feet	
T =	9.40	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**GREATER THAN 10% SLOPE**
SHEAR STRESS CHECK =	**PASS**
OVERALL CHECK =	**PASS**

Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-2**				**Peak Disch & Base Flow:**	**0.0**	
Section Number:	**5**				**Peak Discharge (Cum):**	**22.1**	
End Station:	**13**	**+**	**88**		**Drainage Acreage:**	**0.0**	
End Elevation:	**2,041.0**				**Watershed Slope:**	**8.0%**	

Given:			
Flow Depth, d (ft)	=	0.7	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	R-4	
d_{50} size (inches)	=	6	
Mannings Coefficient	=	0.055	
Channel Slope, s (ft/ft)	=	9.72%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	25.35	cfs	
Q =	67.53	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	5.66	fps	
V_{MAX} =	9.00	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = 18

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	2.00	psf
Calculated Shear Stress =	4.25	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	4.48	sq.ft.	
A =	8.88	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	8.13	feet	
P =	10.37	feet	WITH FREEBOARD

$r = A/P$

r =	0.55	feet	
r =	0.86	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	7.80	feet	
T =	9.80	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Fri Dec 6 10:20:53 2024

Project: ROCKWOOD QUARRY By: CGY Date: 12/06/24

Location: DD-2 Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 18.0000Acres

   Runoff Curve Number:.....CN = 75

   Time of Concentration:.....Tc = 22.10 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.6667

5. Compute Ia/P..... = 0.1867

6. Unit peak discharge, qu.....csm/in = 580.427

7. Runoff,Q.....in = 1.352

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 22.064

Time of Concentration (SCS) Fri Dec 6 10:19:38 2024

Project: ROCKWOOD QUARRY By: CGY Date: 12/06/24
Location: DD-2 Checked: Date: 12/06/24
Developed

Curve Number : 75
Length of Flow : 1930.72 ft
Average Land Slope : 8.00 %

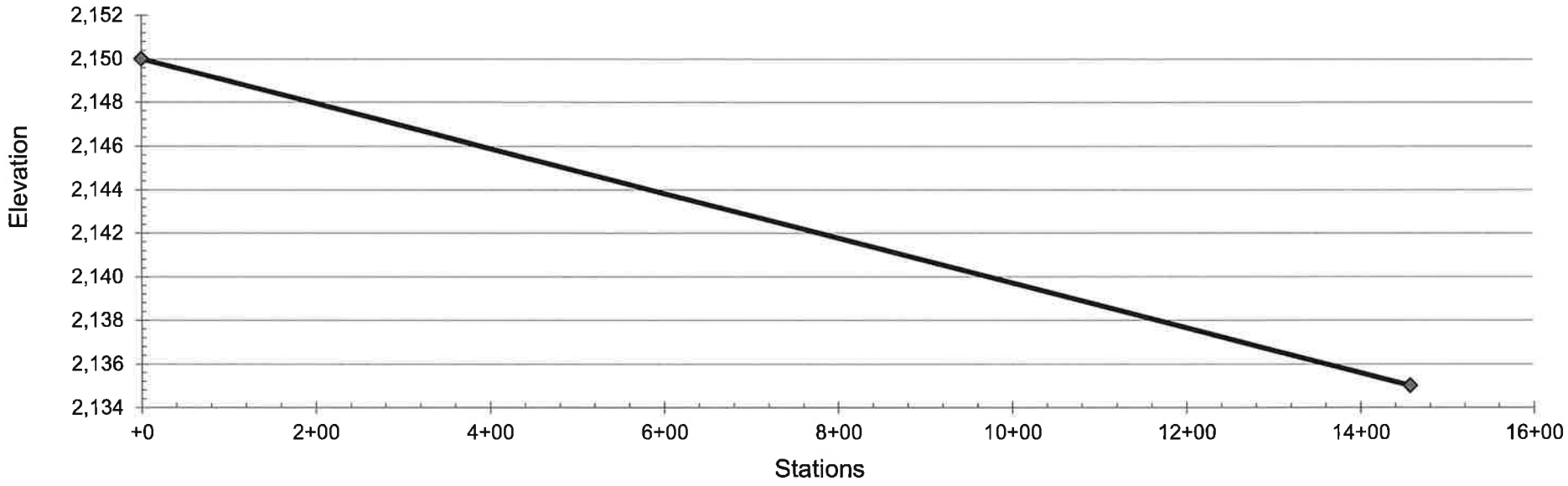
Time of Concentration : 0.368 hrs, 22.1 mins

12.1 Diversion/Collection Ditch Data Sheet

Title:	Site:	Company:	Permit Number:
DIVERSION DITCH DD-3	ROCKWOOD QUARRY	ROCKWOOD STONE, LLC	
Prepared By: Earthtech, Inc. Initials: CGY	Telephone Number: (814)266-6402	Date: JANUARY 2025	Sheet 1 of 1

Station			Drainage Area (acres)					Peak Discharge Q (CFS)												With Freeboard		
Start / End	Elevation		Section	Cum.	Design Storm (yrs)	Average Watershed Slope (%)	Curve Number	Section	Cum.	Channel Bed Slope (%)	Free-board (ft)	Channel Lining (specify average rock size)	Manning's Coefficient (n)	Channel Bottom Width (ft)	Channel Side Slopes (H : V)	Flow Area (sq ft)	Flow Depth (ft)	Top Flow Width (ft)	Flow Velocity (ft/sec)	Q Available (CFS)	Channel Depth (ft)	Top Channel Width (ft)	Q Available (CFS)
0 + 00	2150.0																					
14 + 57	2135.0		109.4	109.4	10	5.0%	75	72.9	72.9	1.0%	0.6	GRASS	0.060	5.0	2 : 1	23.5	2.40	14.6	3.29	77.4	3.00	17.0	122.6

Ditch Profile



Trapezoidal/Triangle Section Ditch

Channel Name:	**DIVERSION DITCH DD-3**				**Peak Disch & Base Flow:**	**72.9**	
Section Number:	**1**				**Peak Discharge (Cum):**	**72.9**	
End Station:	**14**	**+**	**57**		**Drainage Acreage:**	**109.4**	
End Elevation:	**2,135.0**				**Watershed Slope:**	**5.0%**	

Given:			
Flow Depth, d (ft)	=	2.4	
Bottom Width (ft)	=	5	
Side Slopes (H:1)	=	2	
What size Rip Rap	=	GRASS	
d_{50} size (inches)	=	#N/A	
Mannings Coefficient	=	0.060	
Channel Slope, s (ft/ft)	=	1.03%	

Flow Rate, Q_{design} (cfs)

$Q = (1.486/n) \times a \times r^{2/3} \times s^{1/2}$

Q =	77.38	cfs	
Q =	122.58	cfs	WITH FREEBOARD

Velocity, V (fps)

Use V to size rip rap if s < 10%, grouted, or $d_{actual} \leq 0$

$V = Q/A$

V =	3.29	fps	
V_{MAX} =	3.50	fps	

Account for 40% Void Space in Rip Rap if s ≥ 10%

Rip Rap Thickness, t (inches) = #N/A

$A_{void} = 0.4 * b * t$

A_{void} = N/A sq.ft.

$A_{in\text{-}channel\ flow} = A - A_{void}$

$A_{in\text{-}channel\ flow}$ = #VALUE! sq.ft.

$$d_{in-channel\ flow} = \frac{-b + \sqrt{b^2 + 4 * z * A_{in-channel\ flow}}}{2 * z}$$

$d_{in\text{-}channel\ flow}$ = #VALUE! ft

Shear Stress Calculation

Use Sh to size rip rap if s > 10%

$Sh = 62.4 \times d_{in\text{-}channel\ flow} \times s$

Allowable Shear Stress =	#N/A	psf
Calculated Shear Stress =	1.54	psf

Cross Sectional Area, Wetted Perimeter & Hydraulic Radius

$A = bd + zd^2$

A =	23.52	sq.ft.	
A =	33.00	sq.ft.	WITH FREEBOARD

$P = b + 2d\ SQRT(z^2+1)$

P =	15.73	feet	
P =	18.42	feet	WITH FREEBOARD

$r = A/P$

r =	1.49	feet	
r =	1.79	feet	WITH FREEBOARD

Top Width (feet)

$T = b + 2*z*d$

T =	14.60	feet	
T =	17.00	feet	WITH FREEBOARD

Ditch Sizing Check

Q CHECK =	**PASS**
VELOCITY CHECK =	**PASS**
SHEAR STRESS CHECK =	**USE VELOCITY**
OVERALL CHECK =	**PASS**

Graphical Peak Discharge Fri Dec 6 11:53:16 2024

Project: ROCKWOOD QUARRY By: CGY Date: 12/06/24

Location: DD-3 Checked: Date:

Developed

1. Data:

   Drainage area:.....A = 109.4000Acres

   Runoff Curve Number:.....CN = 75

   Time of Concentration:.....Tc = 65.10 min

   Storm Type:..... = II

   Pond and swamp areas spread
   throughout watershed..... = 0.00 percent of A
   0.0000 Acres

2. Frequency.....yr = 10

3. Rainfall,P(24-hour).....in = 3.570

4. Initial abstraction, Ia..... = 0.6667

5. Compute Ia/P..... = 0.1867

6. Unit peak discharge, qu.....csm/in = 315.538

7. Runoff,Q.....in = 1.352

8. Pond & swap adjustment factor,...Fp = 1.00

9. Peak Discharge,qp.....cfs = 72.901

Time of Concentration (SCS) Fri Dec 6 11:52:05 2024

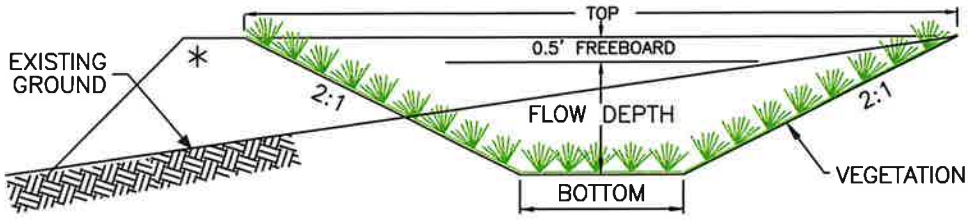
Project: ROCKWOOD QUARRY By: CGY Date: 12/06/24
Location: DD-3 Checked: Date: 12/06/24
Developed

Curve Number : 75
Length of Flow : 5563.50 ft
Average Land Slope : 5.00 %

Time of Concentration : 1.086 hrs, 65.1 mins

TYPICAL DITCH NOTES:

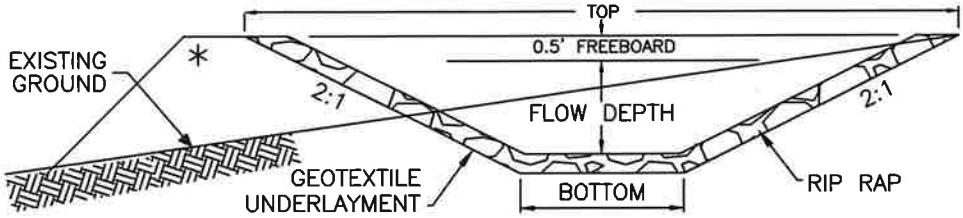
- THE DITCHES SHALL BE CONSTRUCTED TO THE DESIGN SPECIFICATIONS IN MODULE 12. THE MINIMUM DITCH SIZE IS REFLECTED IN THE MODULE 12.
- VEGETATIVE DITCHES SHALL BE SEEDED AND MULCHED WITH HAY/STRAW AFTER COMPLETION. THIS WILL ACHIEVE VEGETATION AS SOON AS POSSIBLE.
- ANY AREAS OF SIGNIFICANT EROSION WITHIN THE DITCH WILL BE REPAIRED WITH R-4 RIP RAP. THE RIP RAP WILL BE PLACED IN A WAY THAT THE DITCH SIZE WILL NOT BE DECREASED.
- VEGETATIVE DITCHES SHALL HAVE R-4 RIP RAP PLACED AT ABRUPT CHANGES IN DIRECTION TO DISSIPATE ENERGY.



TYPICAL GRASS-LINED DITCH

N.T.S.

*SIDECAST MATERIAL COMPACTED AS NECESSARY.



TYPICAL ROCK-LINED DITCH

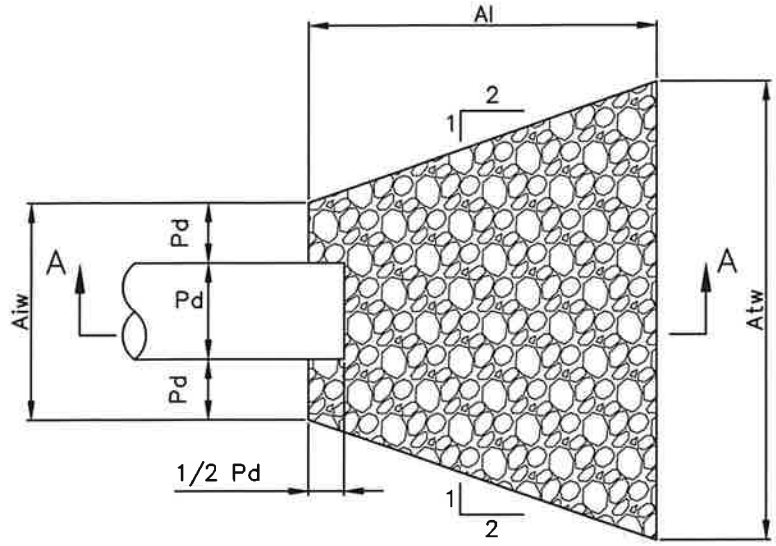
N.T.S.

REVISED 2-2019

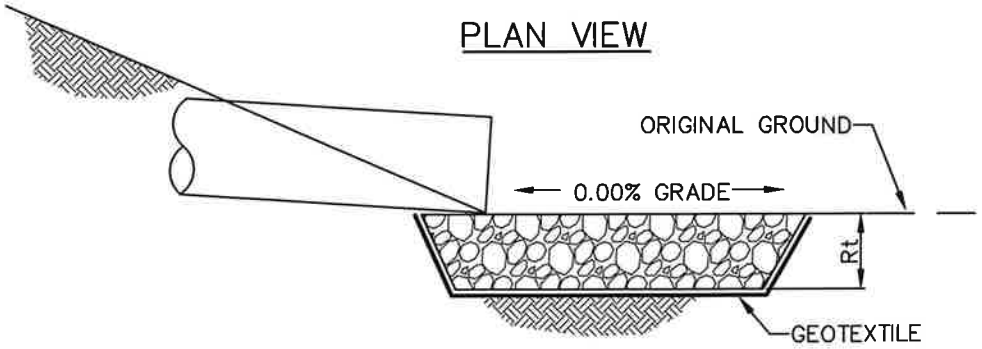
CULV-1 Design Wed Jan 22 17:05:08 2025

Design Parameters

Section		
Shape:	Circular	
Material:	HDPE	
Diameter:	36.00	in
Manning's n:	0.0120	
Number of Barrels:	1	
Inlet		
Inlet Type:	Square Edge, 90 Degree Headwall or 90 and 15 Degree Wingwall Flares	
Ke:	0.50	
Inverts		
Inlet Invert Elevation:	2011.500	ft
Outlet Invert Elevation:	2010.900	ft
Length:	60.000	ft
Slope:	1.00	%
Culvert Calculation		
Discharge:	51.40	cfs
Headwater Elevation:	2016.000	ft
Tailwater Elevation:	0.000	ft
Downstream Velocity:	11.09	ft/s
Downstream Flow Depth:	1.870	ft
Critical Flow Depth:	2.332	ft
Normal Flow Depth:	1.870	ft
Flow Control Type:	Inlet Control, Submerged	



PLAN VIEW



SECTION A–A

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP		APRON		
		SIZE R––	THICK. Rt (IN)	LENGTH Al (FT)	INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)
CULV–1	36	5	27	20	9	29
SP–1 PRINCIPAL	18	4	18	8	4.5	12.5
SP–2 PRINCIPAL	(2X) 18	4	18	12	7	19
DD–1	N/A	3	9	10	5	15
DD–2	N/A	4	18	16	5	21
DD–3	N/A	3	9	26	5	31

NOTES:

ALL APRONS SHALL BE CONSTRUCTED TO THE DIMENSIONS SHOWN. TERMINAL WIDTHS SHALL BE ADJUSTED AS NECESSARY TO MATCH RECEIVING CHANNELS.

ALL APRONS SHALL BE INSPECTED AT LEAST WEEKLY AND AFTER EACH RUNOFF EVENT. DISPLACED RIPRAP WITHIN THE APRON SHALL BE REPLACED IMMEDIATELY.

EXTEND RIPRAP ON BACK SIDE OF APRON TO AT LEAST 1/2 DEPTH OF PIPE ON BOTH SIDES TO PREVENT SCOUR AROUND THE PIPE.

STANDARD CONSTRUCTION DETAIL #9-2
RIPRAP APRON AT PIPE OUTLET
NO FLARED ENDWALL

NOT TO SCALE

STANDARD E&S WORKSHEET # 19
Sediment Trap Design Data

PROJECT NAME: ROCKWOOD STONE, LLC - ROCKWOOD QUARRY
LOCATION: BLACK TOWNSHIP, SOMERSET COUNTY
PREPARED BY: CGY DATE: JANUARY 2025
CHECKED BY: BV DATE: JANUARY 2025

TRAP NUMBER		ST-1	
DRAINAGE AREA (5 ACRES MAX)	(AC)	0.5	
REQUIRED CAPACITY (2,000 CF/AC) (CF)		1,000	
CAPACITY PROVIDED AT ELEVATION h	(CF)	1,158	
SOIL TYPES IN DRAINAGE AREA		SILT LOAM	
REQUIRED SURFACE AREA (5,300 x AC)[1] (SQ. FT)		N/A	
* AVERAGE BOTTOM LENGTH	(FT)	28	
* AVERAGE BOTTOM WIDTH	(FT)	5	
* AVERAGE TRAP LENGTH AT ELEVATION h	(FT)	40	
* AVERAGE TRAP WIDTH AT ELEVATION h	(FT)	17	
SURFACE AREA AT ELEVATION h	(SQ FT)	680	
BOTTOM ELEVATION	(FT)	1981.5	
CLEAN-OUT ELEVATION (@ 700 CF/AC)[2]	(FT)	1983.0	
TOP OF EMBANKMENT ELEVATION[3]	(FT)	1986.0	
EMBANKMENT HEIGHT	(FT)	4.5	
CREST OF SPILLWAY ELEVATION[4]	(FT)	1984.5	
FLOW LENGTH AT ELEVATION h	(FT)	40	
FLOW LENGTH/WIDTH RATIO AT ELEV. h[5]	(2:1 MIN)	2.35:1	

1 If sandy clays, silty clays, silty clay loams, clay loams, or clays predominate soil types.
2 Minimum 12" above bottom of trap
3 Minimum 12" above elevation at which 1.5 cfs/acre discharge capacity is provided.
4 Minimum 24" above bottom of trap
5 4:1 Flow Length:Width ratio required for HQ and EV watersheds.

EMBANKMENT SPILLWAYS

OUTLET WIDTH (2 x # ACRES MIN.)[1]	(FT)	N/A	
SPILLWAY HEIGHT h	(FT)	N/A	
OUTLET SIDE SLOPES	(2H:1V MAX.)	N/A	
SPILLWAY OUTSIDE SLOPE Z1	(2 MIN.)	N/A	
SPILLWAY INSIDE SLOPE Z2	(2 MIN.)	N/A	

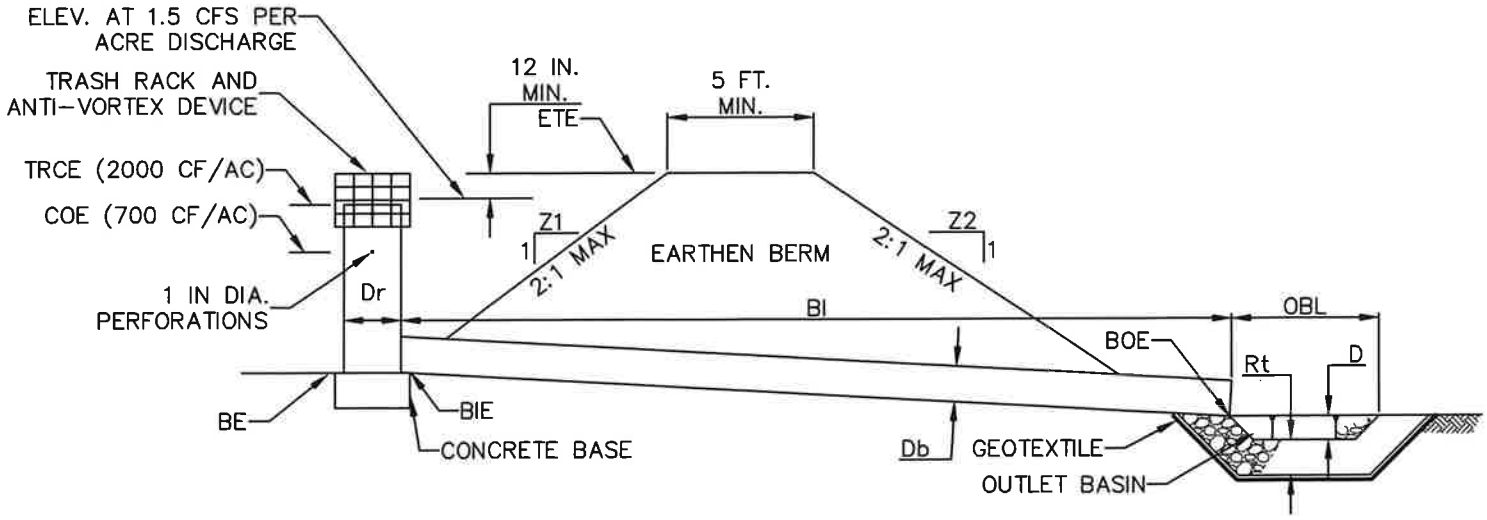
1 6 x # Acres Min. if not discharging directly to a waterway

RISER PIPE SPILLWAYS

Dr (RISER DIAMETER, 8" MIN.)	(IN)	8	
Db (BARREL DIAMETER, 6" MIN.)	(IN)	6	
SPILLWAY CAPACITY WITH 12" FREEBOARD	(CFS)	1.19	
BARREL OUTLET ELEVATION	(FT)	1980.0	1980.0
MAX WATER SURFACE ELEVATION (@ 1.5 CFS/AC. DISCHARGE)	(FT)	1985.0	

OUTLET BASIN

LENGTH (6 Db)	(FT)	N/A	
WIDTH (3 Db)	(FT)	N/A	
DEPTH (Db)	(FT)	N/A	
RIPRAP PROTECTION	(R-Size, R-3 min.)	N/A	



TRAP NO.	Z1 (FT)	Z2 (FT)	RISER				BARREL					EMBANKMENT		CLEAN OUT ELEV COE (FT)	BOTTOM ELEV BE (FT)
			MAT'L	DIA Dr (IN)	CREST ELEV RCE (FT)	BOT PERF ELEV (FT)	MAT'L	DIA Bd (IN)	INLET ELEV BIE (FT)	LENGTH BI (FT)	OUTLET ELEV BOE (FT)	TOP ELEV ETE (FT)	TOP WIDTH Etw (FT)		
ST-1	2	3	SLCPP	8	1984.50	1983.00	SLCPP	6	1981.0	70	1980.00	1986.00	5	1983.00	1981.50

TRAP NO.	CONCRETE BASE			OUTLET BASIN				
	LENGTH CBl (IN)	WIDTH CBw (IN)	THICK. CBt (IN)	RIPRAP SIZE (R-_)	ROCK THICK Rt (IN)	DEPTH D (IN)	WIDTH OBW (FT)	LENGTH OBL (FT)
ST-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

SEE DETAIL #8-3 TEMPORARY RISER FOR DETAILS OF THE TEMPORARY RISER CONSTRUCTION.

FILL MATERIAL FOR THE EMBANKMENTS SHALL BE FREE OF ROOTS, OR OTHER WOODY VEGETATION, ORGANIC MATERIAL, LARGE STONES, AND OTHER OBJECTIONABLE MATERIALS. THE EMBANKMENT SHALL BE COMPACTED IN LAYERED LIFTS OF NOT MORE THAN 6 TO 9 IN. THE MAXIMUM ROCK SIZE SHALL BE NO GREATER THAN 2/3 THE LIFT THICKNESS.

UPON COMPLETION, THE EMBANKMENT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED ACCORDING TO THE SPECIFICATIONS OF THE E&S PLAN DRAWINGS.

ALL SEDIMENT TRAPS SHALL BE INSPECTED AT LEAST WEEKLY AND AFTER EACH RUNOFF EVENT.

ACCESS FOR SEDIMENT REMOVAL AND OTHER REQUIRED MAINTENANCE ACTIVITIES SHALL BE PROVIDED.

A CLEAN OUT STAKE SHALL BE PLACED NEAR THE CENTER OF EACH TRAP. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT HAS REACHED THE CLEAN OUT ELEVATION ON THE STAKE AND THE TRAP RESTORED TO ITS ORIGINAL DIMENSIONS. DISPOSE OF MATERIALS REMOVED FROM THE TRAP IN THE MANNER DESCRIBED IN THE E&S PLAN.

CHECK EMBANKMENTS, SPILLWAYS, AND OUTLETS FOR EROSION, PIPING AND SETTLEMENT. CLOGGED OR DAMAGED SPILLWAYS AND/OR EMBANKMENTS SHALL BE IMMEDIATELY RESTORED TO THE DESIGN SPECIFICATIONS.
DISPLACED RIPRAP WITHIN THE OUTLET PROTECTION SHALL BE REPLACED IMMEDIATELY.

ACCUMULATED SEDIMENT SHALL BE REMOVED AND DISTURBED AREAS INSIDE THE TRAP SHALL BE STABILIZED BEFORE CONVERSION TO A STORMWATER MANAGEMENT FACILITY. TO ASSIST IN REMOVING SEDIMENT, WHICH MAY BE SATURATED, A DEVICE SUCH AS IS SHOWN IN STANDARD CONSTRUCTION DETAIL #7-18 MAY BE USED TO DEWATER THE SEDIMENT PRIOR TO ITS REMOVAL.

STANDARD CONSTRUCTION DETAIL #8-2
BARREL/RISER SEDIMENT TRAP

NOT TO SCALE

ST-1 Report Wed Jan 22 15:59:35 2025

Top of dam elevation: 1986.0000
Bottom of pond elevation: 1981.5000
Top of dam width: 5.0000
Cut Slope: 50.00% 2.000:1 26.57°
Fill Slope: 33.33% 3.000:1 18.43°
Interior Slope: 50.00% 2.000:1 26.57°
Existing Surface: Z:\Mining\Rockwood Stone, LLC\Dwgs&Data\TIN Files\2020 PASDA.tin

Pond Earthwork Volumes
Total cut : 4,713.02 C.F., 174.56 C.Y.
Total fill: 419.30 C.F., 15.53 C.Y.

Pond Storage Volumes

Water Elev	Storage(AcreFt)	(C.Y.)	(C.F.)	(Gallons)	Area(Acre)
1981.50	0.00000	0.0	0.0	0.0	0.003
1982.00	0.00200	3.2	87.2	652.1	0.005
1982.50	0.00485	7.8	211.3	1580.9	0.007
1983.00	0.00864	13.9	376.5	2816.4	0.009
1983.50	0.01347	21.7	586.7	4388.6	0.011
1984.00	0.01942	31.3	845.8	6327.3	0.013
1984.50	0.02658	42.9	1158.0	8662.4	0.016
1985.00	0.03506	56.6	1527.2	11424.0	0.018
1985.50	0.04493	72.5	1957.3	14641.9	0.021
1986.00	0.05630	90.8	2452.5	18346.0	0.024

ST-1 Outlet Structure Wed Jan 22 16:07:40 2025
Drop Pipe

Design Parameters

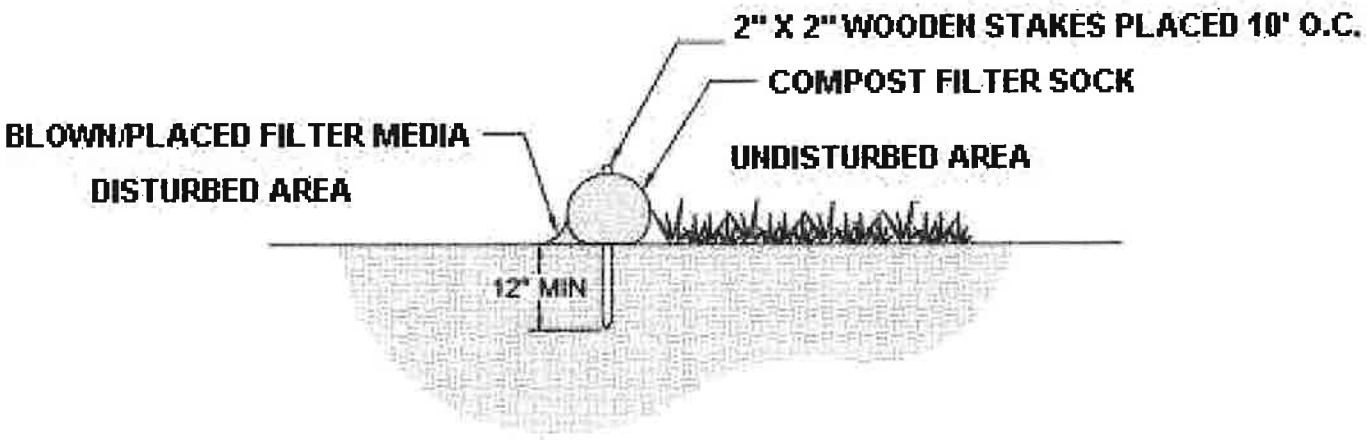
Shape:	Circular	
Riser Top Elev:	1984.500	ft
Riser Base Elev:	1981.000	ft
Riser Diameter:	8.00	in
Orifice Coefficient:	0.60	
Weir Coefficient:	3.33	
Culvert Length:	70.000	ft
Culvert Diameter:	6.00	in
Culvert Invert Out:	1980.000	ft
Culvert Friction Coefficient:	0.012	
Culvert Entrance Loss Coefficient:	0.500	
Culvert Slope :	0.01	

Calculation

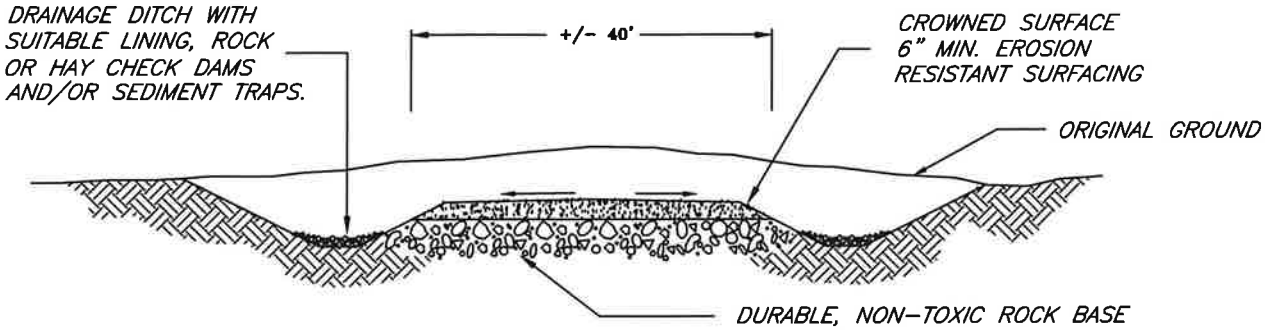
Discharge:	1.19	cfs
Headwater Elevation:	1985.000	ft
Downstream Velocity:	6.11	ft/s

STANDARD E&S WORKSHEET #1
Compost Filter Socks

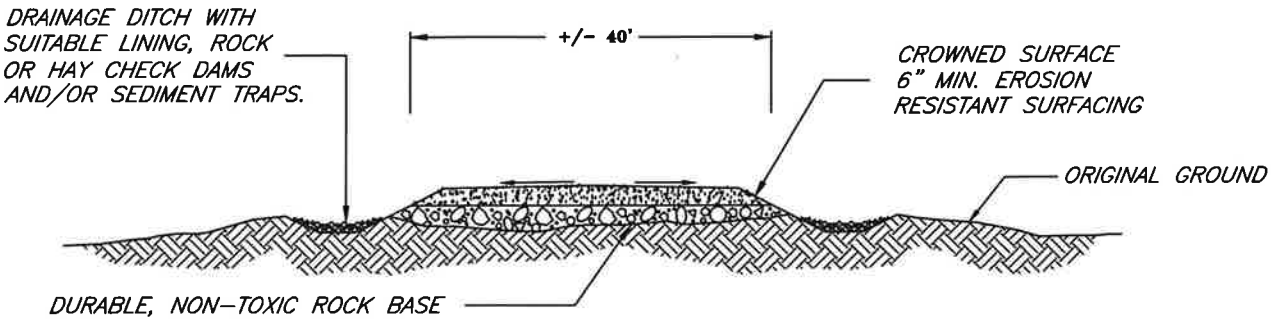
PROJECT NAME: ROCKWOOD STONE, LLC - ROCKWOOD QUARRY
LOCATION: BLACK TOWNSHIP, SOMERSET COUNTY
PREPARED BY: CGY DATE: JANUARY 2025
CHECKED BY: BV DATE: JANUARY 2025



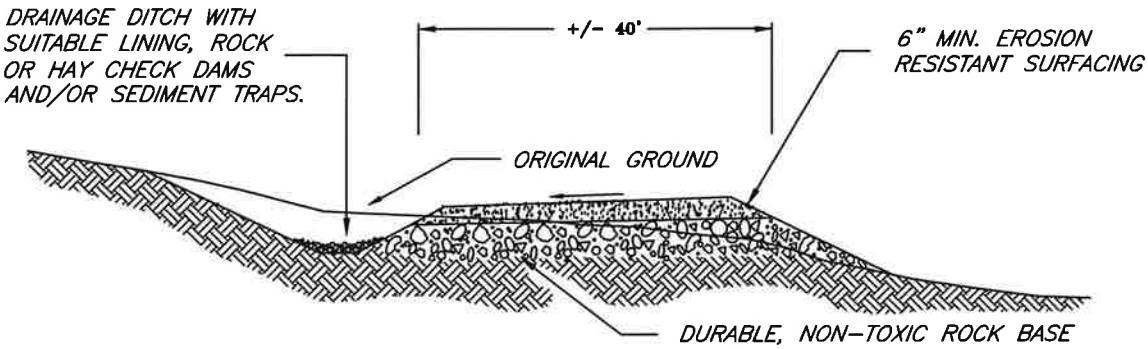
SOCK NO.	Dia. In.	LOCATION	SLOPE PERCENT	SLOPE LENGTH ABOVE BARRIER (FT)
CFS-1	TRIPLE STACK 18	DOWNGRADE OF SP-1	33	140
CFS-2	32	DOWNGRADE OF SP-1	33	100
CFS-3	18	DOWNGRADE OF SP-1	33	52
CFS-4	12	DOWNGRADE OF SP-1	33	29
CFS-5	24	DOWNGRADE OF SP-2	33	80
CFS-6	12	DOWNGRADE OF SP-2	33	20
CFS-7	12	DOWNGRADE OF SP-2	12	35



TYPICAL CUT SECTION



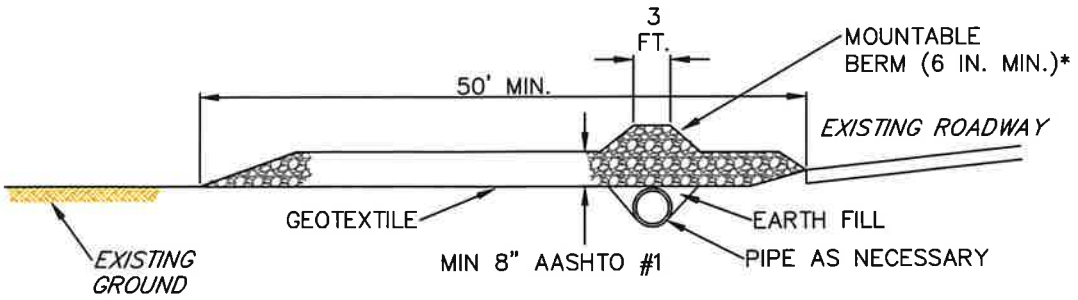
TYPICAL FILL SECTION



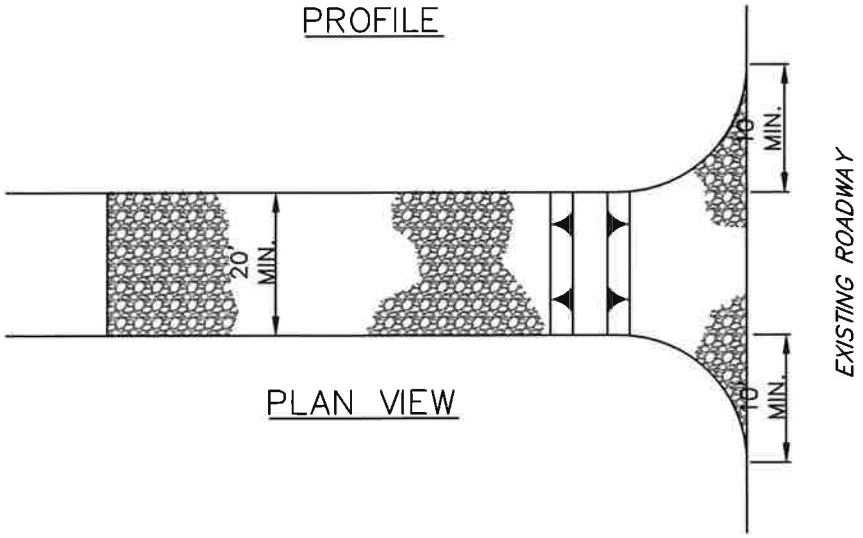
TYPICAL CUT/FILL SECTION

TYPICAL HAUL ROAD CROSS SECTIONS

NOT TO SCALE



PROFILE



PLAN VIEW

* MOUNTABLE BERM USED TO PROVIDE PROPER COVER FOR PIPE

NOTES:

REMOVE TOPSOIL PRIOR TO INSTALLATION OF ROCK CONSTRUCTION ENTRANCE. EXTEND ROCK OVER FULL WIDTH OF ENTRANCE.

RUNOFF SHALL BE DIVERTED FROM ROADWAY TO A SUITABLE SEDIMENT REMOVAL BMP PRIOR TO ENTERING ROCK CONSTRUCTION ENTRANCE.

MOUNTABLE BERM SHALL BE INSTALLED WHEREVER OPTIONAL CULVERT PIPE IS USED AND PROPER PIPE COVER AS SPECIFIED BY MANUFACTURER IS NOT OTHERWISE PROVIDED. PIPE SHALL BE SIZED APPROPRIATELY FOR SIZE OF DITCH BEING CROSSED.

MAINTENANCE: ROCK CONSTRUCTION ENTRANCE THICKNESS SHALL BE CONSTANTLY MAINTAINED TO THE SPECIFIED DIMENSIONS BY ADDING ROCK. A STOCKPILE SHALL BE MAINTAINED ON SITE FOR THIS PURPOSE. ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS SHALL BE REMOVED AND RETURNED TO THE CONSTRUCTION SITE IMMEDIATELY. IF EXCESSIVE AMOUNTS OF SEDIMENT ARE BEING DEPOSITED ON ROADWAY, EXTEND LENGTH OF ROCK CONSTRUCTION ENTRANCE BY 50 FOOT INCREMENTS UNTIL CONDITION IS ALLEVIATED OR INSTALL WASH RACK. WASHING THE ROADWAY OR SWEEPING THE DEPOSITS INTO ROADWAY DITCHES, SEWERS, CULVERTS, OR OTHER DRAINAGE COURSES IS NOT ACCEPTABLE.

STANDARD CONSTRUCTION DETAIL #3-1
ROCK CONSTRUCTION ENTRANCE

NOT TO SCALE