CM-25 MINE PERMIT AMENDMENT APPLICATION PERMIT No. M-1977-307

Response to Adequacy Review #2

January 2013

Prepared by Cotter Corporation (N.S.L.)

AND

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Cotter Corporation N.S.L. (Cotter) submits this response to the November 20, 2012 letter from Dustin Czapla, Division of Reclamation, Mining and Safety ("DRMS") to Glen Williams, Cotter. The DRMS' comments are in italics and Cotter's responses are in bold.

CM-25 Mine, File No. M-1977-307, Amendment (AM1) Application Adequacy Review (2)

1. *Page ESWMP-2, third paragraph and Sheets 2 and 3 – Waste rock stockpile. The waste rock stockpile discussed in these two paragraphs is not labeled on either Sheet 2 or 3, unless the Applicant is referring to the "Reclaimed Waste Pile". Please clarify where the waste rock stockpile and other facilities mentioned in the second paragraph are to be located and identify this area on Sheet 2 and 3.*
    a. *The third paragraph states clay will be placed on the waste rock stockpile. Please clarify as to whether this clay is intended to be a liner, cap or both; and provide some engineering details (e.g., thickness, compaction, permeability, etc.)*

    The waste rock stockpile discussed in the report refers to future waste rock to be placed on the site once mining production resumes and will be located within the topographic "bowl" existing around the old portal area, bounded by the mine access roadways, the natural hillside to the north, and the proposed berm and retention pond to the east. The proposed locations of the waste rock stockpile, ore stockpile area, and retention pond are shown on the attached revised Sheets 2 and 3 in Attachment 4.

    a. The discussion regarding clay refers to a possible liner to be installed over the top of the waste rock to separate it from the temporary ore pile and placed only in a limited area to restrict possible leachate from entering the underlying waste rock until the ore is shipped out for processing. The maximum size of the ore stock pile and corresponding clay liner of 60' x 60' is indicated on the attached revised Sheets 2 and 3 in Attachment 4. A generic detail and specification for the installation is included with this response (see enclosures).

2. *Page ESWMP-5, third paragraph.*
    a. *This paragraph states the surface soils at the site are considered Hydrologic Soils Group (HSG) B, but no specific references are given. The soil group on Figure T3 indicates the natural soils in the area defined by the three subasins analyzed*

are "23" Bodot. According to the soil survey in Exhibit B, the soil profile is described as "0 to 3 inches Cobbly clay loam", and "3 to 30 inches Cobbly silty clay". Both clay loam and silty clay are considered HSG D. Furthermore, the Soil Survey of San Miguel Area, Colorado Parts of Dolores, Montrose, and San Miguel Counties lists the Bodot series runoff class as "very high". Please revise the selected curve numbers (CN) to reflect HSG D (CN = 89/90 = poor/fair), or provide documentation to substantiate the claim of HSG B.

b. Assuming the disturbed areas dicussed in the onsite basins are also soil group 23 and are "void of vegetation" the CN for these areas should be 94 (TR-55 Table 2-2b, fallow, bare soil) instead of 75. Please revise the selected CNs to reflect HSG D and bare soil (CN = 94), or provide documentation to substantiate the claim of HSG B. Also note "void of vegetation" is not the same as "poor vegetation".

a. The mine sites evaluated by this office were visited on multiple occasions by experienced personnel. During these visits, part of the observations included evaluation of the vegetative cover and the general soils types found there for future quantification of runoff. These observations were not only performed for the specific mine site, but also for the probable watersheds thought to affect the site. Drainage evaluation and selection of runoff and roughness coefficients is a very subjective process. Our office selected values that tended to err on the conservatively high side relative to the overall runoff. We do not, however, wish to present numbers which, in our experience, produce results so conservative as to create unnecessary expenditures for our clients, or the public in general. Broad-based soil evaluations, such as the one included in the Soil Survey of San Miguel Area, Colorado Parts of Dolores, Montrose, and San Miguel Counties document, tend to cover very large areas of a regional analysis. While the Type 23, Bodot description includes cobbly clay loam, and cobbly silty clay, our observations of the specific sites did not find hydraulically "tight" soils. On the contrary, we found the soils to be on the sandy side, and appeared to be well-drained. The NRCS description of these soils states that the Drainage Class of Type 23 Bodot soil is well drained. Soils on the slopes are generally comprised of colluvium derived from sandstone and shale units that weathering conditions of rainfall, sheet flow, and soil creep have preferentially removed finer-grain clays leaving coarse, more permeable soils. We were onsite in a variety of

conditions, including recent rainfall and snowfall events, and at no time did we observe soils throughout the sites which could be classified as Hydrologic Soils Goup "D" (per the original SCS TR-55 classification – "High runoff potential. Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material"). This would be an inaccurate description of the existing soils for the purpose of hydrologic evaluation. Our selection of CN and Manning's "N" coefficients involves looking at a variety and range of possible values found in several reliable and respected resources such as: tables from the SCS TR-55 Manual (Urban Hydrology for Small Watersheds), the National Engineering Handbook (Section 4, Hydrology), V.T. Chow (Open Channel Hydraulics), and the Mesa County Stormwater Management Manual which includes tables from many of these sources. Copies of the tables referred to here are included with this response in Attachment 1. In addition, soil descriptions contained within the USDA Soils Report section of our overall document (Exhibit B) contain the following for Type 23, (Bodot, dry-Ustic Torriorthents complex): "Drainage Class: Well drained", and "Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high". Furthermore, soils descriptions found in the same Exhibit B for the Pinyon-Juniper rangelands associated with the site indicate soils typical of the following: Gravelly sandy loams, well drained, with moderate to moderately high permeability. In one case, page 7 of Type 326 (semi desert sandy loam), specifically states: "soils in this site are grouped into "A" and "B" hydrologic groups. In summary, after careful reevaluation of the possible CN values for this site, we believe the original values selected in our drainage report are accurate and applicable based on the aforementioned statements and tables included in the enclosures.

b. Relative to the previous discussion and explanation of CN selection and the fact that the onsite basin currently consists of waste rock with areas of undisturbed sandy material, it is our opinion that the originally selected value of 75 is actually high. Mined waste rock comes from strata consisting of high percentages of sandstone and sandy material. It has been broken up by the mining process and appears to be a fairly free-draining material even

when stockpiled. This is the reason for specifying a low-permeability native clay liner over the top of these permeable waste rock and soils where ore is to be temporarily stored prior to transport for processing. Selection of CN is rarely based strictly on any one specific category or classification, but more typically by a comparison of several categories of material with similar traits. It is even sometimes chosen by elimination of certain ranges and comparison of values that do not match the characteristics of the soil under evaluation. In this case, the suggested value of CN=94 is very close to that of asphalt (CN=98), and would not in any way be appropriate for the conditions of a mine site similar to that of CM-25.

3. *Page ESWP-6, first paragraph and FlowMaster output pages. It is stated "no velocities exceeded 5 feet-per-second for the 100-year flows". A Manning's n = 0.035 is used for the design analysis. However, no rationale is provided for the selected roughness coefficient, which implies a rough cut in bedrock or rock in the channel. Because channel roughness is seldom uniform, the DRMS requires channels be evaluated for both stability and capacity, i.e., minimum and maximum expected roughness. For example, an excavated earth channel, after weathering would be expected to have a minimum n = 0.018 (use to evaluate stability or maximum expected velocity); and a maximum n = 0.025 (use to evaluate capacity). In addition, the DRMS requires channel freeboard be evaluated; channels shall be designed with a minimum of 0.5 feet of freeboard unless the velocity head ($v^2/2g$) is significant, then the minimum required freeboard is half the velocity head, or $v^2/4g$.*
    a. *Please provide a rationale for the selected roughness coefficients, and evaluate each designated channel/ditch design slope for both capacity and stability.*
    b. *Please design all the ditches and the appropriate freeboard and provide channel design depths for construction.*

Similar to our response to the previous comment (#2), we selected Manning's "n" values which, in our opinion, closely match the expected conditions produced by the existing channels we observed, and consequently by proposed channels of similar construction. Our selection of n=0.035 is a good match for the cobbly channels with exposed rock which we observed. It was chosen to be conservatively high for the analysis of capacity. We continue to support this value. As suggested, however, we have reanalyzed the channels for velocity with

a lower value (we selected n=0.025 to give a conservatively high velocity, in our opinion). Analysis was performed for both "n" values at maximum and minimum slopes. These new calculations indicated a need to increase the channel depths by 0.2' in some circumstances to provide the required freeboard. Revised calculations and details are included in Attachment 1.

4. *Page ESWMP-6, second paragraph and Retention Pond Drainage Design Plan (Sheet 5 of 5). The 100-year, 24-year runoff volume criteria used for sizing storage in the pond is acceptable. However, a spillway is necessary to pass runoff from successive storms as there is no way presented in the Retention Pond design plan to drain the pond via gravity. As such, the emergency spillway for the pond needs to be designed to convey 100-year peak flow, assuming the ponds are full (to the spillway invert elevation) at the onset of the design storm. Please provide analyses and designs to demonstrate the spillway has the capacity to pass the peak flow resulting from the 100-year, 24-hour design storm. (Note – The DRMS checked with the Colorado Division of Water Resources District 60 water commissioner (Aaron Todd) regarding the status of the San Miguel River appropriations. Mr. Todd stated that the San Miguel River is not currently over appropriated and as such, DWR has no current requirement to release retained stormwater within 72 hours. He also indicated this is subject to change.)*

We have revised the retention pond details to incorporate a spillway capable of passing the 100-year runoff. The bottom of the spillway has been set at the elevation of the 10-year storm storage, with rock armoring the channel bottoms and sides (rock is on top of the channel bottom, above the 10-year elevation). Analysis for a broad-crested weir of the dimensions specified was used to verify the capacity. The weir is capable of passing more than the projected 100-year event with the pond providing retention of the 10-year volume. Analysis was completed using the 24-hour rainfalls provided by the NOAA Atlas for the area.

5. *Page ESWMP-7, last paragraph. This paragraph references the Enviromental Protection Plan for details related to the reclamation of stormwater features. The DRMS could find no discussion of stormwater feature reclamation in Exhibit T, nor any discussion of the retention pond in the Exhibit D Reclamation Plan. Please indicate whether the retention pond will be left in place, breached, filled in, etc.*

The pond, diversion berms and channels are intended to remain in-place after reclamation. This is stated in Section D (Reclamation Plan), page D-2, paragraph E, of the original permit amendment. These are passive improvements with no mechanical structures to wear out and are capable of providing continued stormwater management for an indefinite period of time, well after reclamation.

6. *Sheets 1 and 2. Please discuss why no stormwater management is proposed or discussed for the "Reclaimed Waste Pile".*

   Stormwater management is not proposed or discussed for the "Reclaimed Waste Pile" shown on sheets 1 and 2 of the Drainage Plans because it is an area that has been previously reclaimed and stormwater management on the pocked and re-vegetated "Reclaimed Waste Area" is not considered to be an issue. It lies on a steep hillside, below the proposed mine yard and above the existing Uravan Disposal Site. The containment berm shown on the eastern side of the retention pond and mine yard is located at the top of the hill, immediately above the area in question and will prevent site runoff from going over the hill and entering the area by diverting it to the retention pond.

7. *Sheet 4. Please provide some material and compaction specifications for the berm and the retention pond embankment.*

   Material and compaction specifications are provided in Attachment 2 for the proposed containment berm and pond embankment.

8. *Sheet 5. Please provide spillway location, designs (sections and profile), and specifications sufficient to convey the design flow to the toe of the embankment.*

   New spillway design details and broad-crested weir calculations are included in Attachment 3.

9. *No calculations were found related to estimate the capacity or expected velocity for flows diverted to the retention pond by the proposed berm. There are two steep sections (measured to be approximately 26 and 58 percent longitudinal slope), as well as*

relatively flat sections. Please provide hydraulic analyses addressing the conveyance capacity and stability of the proposed berm.

The containment berm is located in an area that will contain only a very small percentage of the site runoff. Most of the site runoff will run directly to the pond with no contact of the berm. The runoff that does contact the berm will be generally "sheet flow" with very little depth. The berm is there mainly to protect the hillside below it from the small amount of runoff that might otherwise flow over the hill. (See #6 above).

10. *Page ESWMP-4, paragraph 7. The NRCS is referenced as the "National Resource Conservation Service". The "N" stands for "Natural", not "National".*

Reference to NRCS has been corrected to reflect "Natural", instead of "National".

11. *Page ESWMP-5, last word. Velocities based on design storm events are "estimated", not "Actual", which suggests the velocities were measured.*

We agree that velocities based on design storm events are not "actual", but should instead be referred to as "estimated", or "calculated". We will revise this reference, also.

Attachment 1

Type.... Master Network Summary
Name.... Watershed
File.... \\VBOXSVR\Documents\Cotter Corp\CM-25\CM-25.PPW

Page 2.01

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Cotter Uravan

Return Event	Total Depth in	Rainfall Type	RNF ID
100	3.0000	Synthetic Curve	TypeII 24hr
10	1.9000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol cu.ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage cu.ft	
*OUT OFF 10	JCT	100	3767		12.0000	1.40			CN = 69
*OUT OFF 10	JCT	10	1027		12.0500	.26			
*OUT OFF 20	JCT	100	7025		12.0000	2.38			CN = 64
*OUT OFF 20	JCT	10	1407		12.0500	.14			
*POND ON 30 IN	POND	100	9835		11.9500	3.84			CN = 75
*POND ON 30 IN	POND	10	3410		12.0000	1.18			
*POND ON 30 OUT	POND	100	0		10.9000	.00	5711.01	9329	
*POND ON 30 OUT	POND	10	0		11.7500	.00	5709.77	3329	
SUBAREA OFF 10	AREA	100	3767		12.0000	1.40			
SUBAREA OFF 10	AREA	10	1027		12.0500	.26			
SUBAREA OFF 20	AREA	100	7025		12.0000	2.38			
SUBAREA OFF 20	AREA	10	1407		12.0500	.14			
SUBAREA ONSITE30	AREA	100	9835		11.9500	3.84			
SUBAREA ONSITE30	AREA	10	3410		12.0000	1.18			

ORIGINAL DESIGN

S/N: 721001007097
PondPack Ver. 9.0046

O'Connor Design Group
Time: 2:02 PM

Date: 12/14/2012

STORMWATER MANAGEMENT MANUAL

RUNOFF CURVE NUMBERS

Land Use or Surface Characteristic	Average Imperv. (%)	Runoff Curve Number Soil Complex A	B	C	D
Business					
Commercial Areas	85	89	92	94	95
Neighborhood Areas	70	80	87	91	93
Residential					
Single Family (note 1)	(note 1)				
Multi-unit (detached)	60	74	83	88	91
Multi-unit (attached)	75	83	89	92	94
Apartments	80	86	91	93	94
Industrial					
Light	80	86	91	93	94
Heavy	90	92	94	96	96
Parks, cemeteries →	5	42	63	75	81
Playgrounds →	10	45	65	76	82
Schools	50	69	80	86	89
Railroad yards	15	48	67	78	83
Irrigated Areas					
Lawns, parks, golf course	0	39	61	74	80
Agriculture	0	39	61	74	80
Undeveloped Areas					
Pre-development conditions →	2	40	62	74	80
Greenbelts, agriculture →	2	40	62	74	80
Off-site analysis when land use → Unknown	45	66	78	85	88
Outcrops	70	80	87		94
Streets/Roads					
Paved	100	98	98	98	98
Gravel	40	63	76	84	87
Drives/Walks	90	92	94	96	96
Roofs	90	92	94	96	96

NOTE:
ESTIMATE IMPERVIOUS FROM FIGURES 703, 704, 705. THEN COMPUTE CURVE NUMBER, CN, FROM EQUATION 708, BASED ON NRCS SOILS TYPE. USE OF THIS TABLE IS LIMITED TO EVALUATION OF IMPERVIOUSNESS FOR FUTURE DEVELOPMENT PROJECTIONS WITHIN REGIONAL WATERSHED MASTER PLANS, OR IN CONCEPTUAL DRAINAGE PLANS.

Revision	Date
ORIGINAL ISSUE	3/27/(

WRC ENGINEERING, INC.

REFERENCE: SCS TECHNICAL RELEASE NO. 55 (1986)

TABLE 704

FROM: SCS TR-55

Table 2-2.--Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land[1/]: without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover[2/]	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
good condition: grass cover on 75% or more of the area	39	61	74	80
fair condition: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	93
Residential:[3/]				
Average lot size — Average % Impervious[4/]				
1/8 acre or less — 65	77	85	90	92
1/4 acre — 38	61	75	83	87
1/3 acre — 30	57	72	81	86
1/2 acre — 25	54	70	80	85
1 acre — 20	51	68	79	84
Paved parking lots, roofs, driveways, etc.[5/]	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers[5/]	98	98	98	98
gravel	76	85	89	91
dirt	72	82	87	89

[1/] For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

[2/] Good cover is protected from grazing and litter and brush cover soil.

[3/] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[4/] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

[5/] In some warmer climates of the country a curve number of 95 may be used.

STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

TYPE OF CHANNEL AND DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plans in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040 *
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040 *
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same as above, but highest state of flow	0.045	0.070	0.110
4. Dense brush, high state	0.080	0.100	0.140

Revision	Date
ORIGINAL ISSUE	3/27/(

WRC ENGINEERING, INC.

REFERENCE: CHOW, V.T., OPEN CHANNEL HYDRAULICS McGRAW HILL BOOK COMPANY 1959

TABLE 802A

STORMWATER MANAGEMENT MANUAL

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

TYPE OF CHANNEL AND DESCRIPTION	MINIMUM	NORMAL	MAXIMUM
LINED OR BUILT-UP CHANNELS			
a. CONCRETE			
1. TROWEL FINISH	0.011	0.013	0.015
2. FLOAT FINISH	0.013	0.015	0.016
3. GUNITE, GOOD SECTION	0.016	0.019	0.023
4. GUNITE, WAVY SECTION	0.018	0.022	0.023
b. CONCRETE BOTTOM FLOAT FINISHED WITH SIDE OF			
1. DRESSED STONE IN MORTAR	0.015	0.017	0.020
2. RANSOM STONE IN MORTAR	0.017	0.020	0.024
3. DRY RUBBLE OR RIPRAP	0.020	0.030	0.035
c. GRAVEL BOTTOM WITH SIDES OF			
1. FORMED CONCRETE	0.017	0.020	0.025
2. RANDOM STONE IN MORTAR	0.020	0.023	0.026
3. DRY RUBBLE OR RIPRAP	0.023	0.033	0.036
d. ASPHALT			
1. SMOOTH	0.013	0.013	--
2. ROUGH	0.016	0.016	--
e. GRASSED	→ 0.030	0.040	0.050 *

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WRC ENGINEERING, INC

REFERENCE: CHOW, V.T., OPEN CHANNEL HYDRAULICS McGRAW HILL BOOK COMPANY 1959

TABLE 802C

Worksheet for Broad Crested Weir - 1

Project Description		
Flow Element:	Broad Crested Weir	
Solve For:	Headwater Elevation	
Input Data		
Discharge:	6.62 > Q_{100} = 3.84	ft^3/s
Crest Elevation:	5711.56	ft
Tailwater Elevation:	5712.06	ft
Crest Surface Type:	Gravel	
Crest Breadth:	15.00	ft
Crest Length:	4.00	ft
Results		
Headwater Elevation:	5712.27	ft
Headwater Height Above Crest:	0.71	ft
Tailwater Height Above Crest:	0.50	ft
Weir Coefficient:	2.76	US
Submergence Factor:	1.00	
Adjusted Weir Coefficient:	2.76	US
Flow Area:	2.85	ft^2
Velocity:	2.33	ft/s
Wetted Perimeter:	5.42	ft
Top Width:	4.00	ft

OFFSITE 10: MAX. N (0.035)
MIN. S (0.50%)

Worksheet for Triangular Channel - 1

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.035	
Channel Slope:	0.00500	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	1.40	ft³/s
Results		
Normal Depth:	0.60	ft
Flow Area:	1.08	ft²
Wetted Perimeter:	3.79	ft
Top Width:	3.60	ft
Critical Depth:	0.42	ft
Critical Slope:	0.03214	ft/ft
Velocity:	1.30	ft/s
Velocity Head:	0.03	ft
Specific Energy:	0.63	ft
Froude Number:	0.42	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.60	ft
Critical Depth:	0.42	ft
Channel Slope:	0.00500	ft/ft
Critical Slope:	0.03214	ft/ft

OFFSITE 10: MAX. N (0.035)
MAX. S (8.89%)

Worksheet for Triangular Channel - 2

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Roughness Coefficient:	0.035	
Channel Slope:	0.08890	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	1.40	ft^3/s

Results		
Normal Depth:	0.35	ft
Flow Area:	0.37	ft^2
Wetted Perimeter:	2.21	ft
Top Width:	2.10	ft
Critical Depth:	0.42	ft
Critical Slope:	0.03214	ft/ft
Velocity:	3.82	ft/s
Velocity Head:	0.23	ft
Specific Energy:	0.58	ft
Froude Number:	1.61	
Flow Type:	Supercritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.35	ft
Critical Depth:	0.42	ft
Channel Slope:	0.08890	ft/ft
Critical Slope:	0.03214	ft/ft

OFFSITE 10: MIN. N (0.025)
MAX. S (8.89%)

Worksheet for Triangular Channel - 3

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient	0.025	
Channel Slope:	0.08890	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	1.40	ft^3/s
Results		
Normal Depth:	0.31	ft
Flow Area:	0.28	ft^2
Wetted Perimeter:	1.95	ft
Top Width:	1.85	ft
Critical Depth:	0.42	ft
Critical Slope:	0.01540	ft/ft
Velocity:	4.92	ft/s
Velocity Head:	0.38	ft
Specific Energy:	0.68	ft
Froude Number:	2.21	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.31	ft
Critical Depth:	0.42	ft
Channel Slope:	0.08890	ft/ft
Critical Slope:	0.01540	ft/ft

OFFSITE ~~2~~. 10: MIN. N (0.025)
MIN. S (0.50%)

Worksheet for Triangular Channel - 4

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Roughness Coefficient:	0.025	
Channel Slope:	0.00500	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	1.40	ft³/s

Results		
Normal Depth:	0.53	ft
Flow Area:	0.84	ft²
Wetted Perimeter:	3.34	ft
Top Width:	3.17	ft
Critical Depth:	0.42	ft
Critical Slope:	0.01640	ft/ft
Velocity:	1.67	ft/s
Velocity Head:	0.04	ft
Specific Energy:	0.57	ft
Froude Number:	0.57	
Flow Type:	Subcritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.53	ft
Critical Depth:	0.42	ft
Channel Slope:	0.00500	ft/ft
Critical Slope:	0.01640	ft/ft

OFFSITE 20: MAX. N (0.035)
MAX. S (6.67%)

Worksheet for Triangular Channel - 1

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient	0.035	
Channel Slope:	0.06667	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	2.38	ft³/s
Results		
Normal Depth:	0.45	ft
Flow Area:	0.61	ft²
Wetted Perimeter:	2.85	ft
Top Width:	2.70	ft
Critical Depth:	0.52	ft
Critical Slope:	0.02995	ft/ft
Velocity:	3.92	ft/s
Velocity Head:	0.24	ft
Specific Energy:	0.69	ft
Froude Number:	1.46	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.45	ft
Critical Depth:	0.52	ft
Channel Slope:	0.06667	ft/ft
Critical Slope:	0.02995	ft/ft

OFFSITE 20: MAX. N (0.035)
MIN. S (2.00%)

Worksheet for Triangular Channel - 2

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.035	
Channel Slope:	0.02000	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	2.38	ft^3/s
Results		
Normal Depth:	0.56 ←	ft
Flow Area:	0.95	ft^2
Wetted Perimeter:	3.57	ft
Top Width:	3.38	ft
Critical Depth:	0.52	ft
Critical Slope:	0.02995	ft/ft
Velocity:	2.49 ←	ft/s
Velocity Head:	0.10	ft
Specific Energy:	0.66	ft
Froude Number:	0.83	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.56	ft
Critical Depth:	0.52	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.02995	ft/ft

OFFSITS 20: MIN. N (0.025)
MIN. S (2.00%)

Worksheet for Triangular Channel - 3

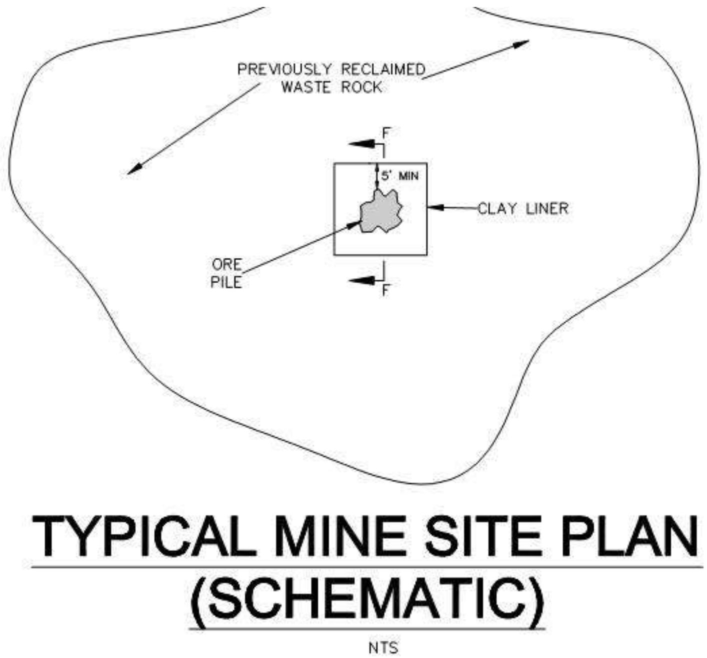
Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.025	
Channel Slope:	0.02000	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	2.38	ft³/s
Results		
Normal Depth:	0.50 ←	ft
Flow Area:	0.74	ft²
Wetted Perimeter:	3.14	ft
Top Width:	2.98	ft
Critical Depth:	0.52	ft
Critical Slope:	0.01528	ft/ft
Velocity:	3.21 ←	ft/s
Velocity Head:	0.16	ft
Specific Energy:	0.66	ft
Froude Number:	1.14	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.50	ft
Critical Depth:	0.52	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.01528	ft/ft

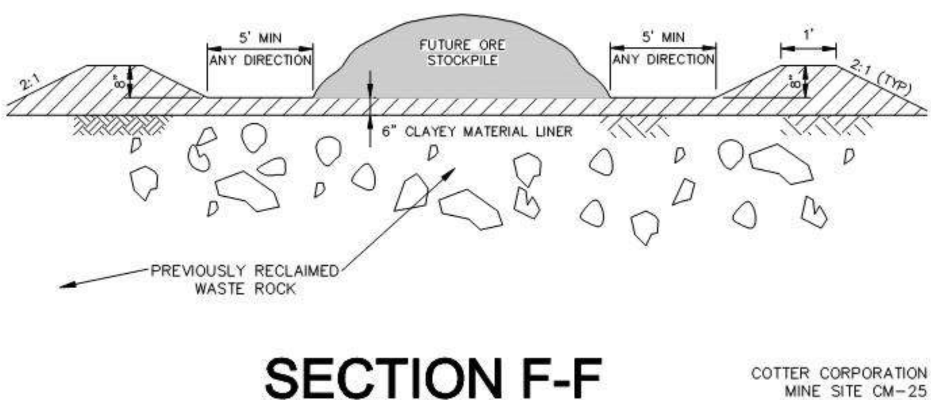
OFFSITE 20: MIN. N (0.025)
MAX. S (6.67%)

Worksheet for Triangular Channel - 4

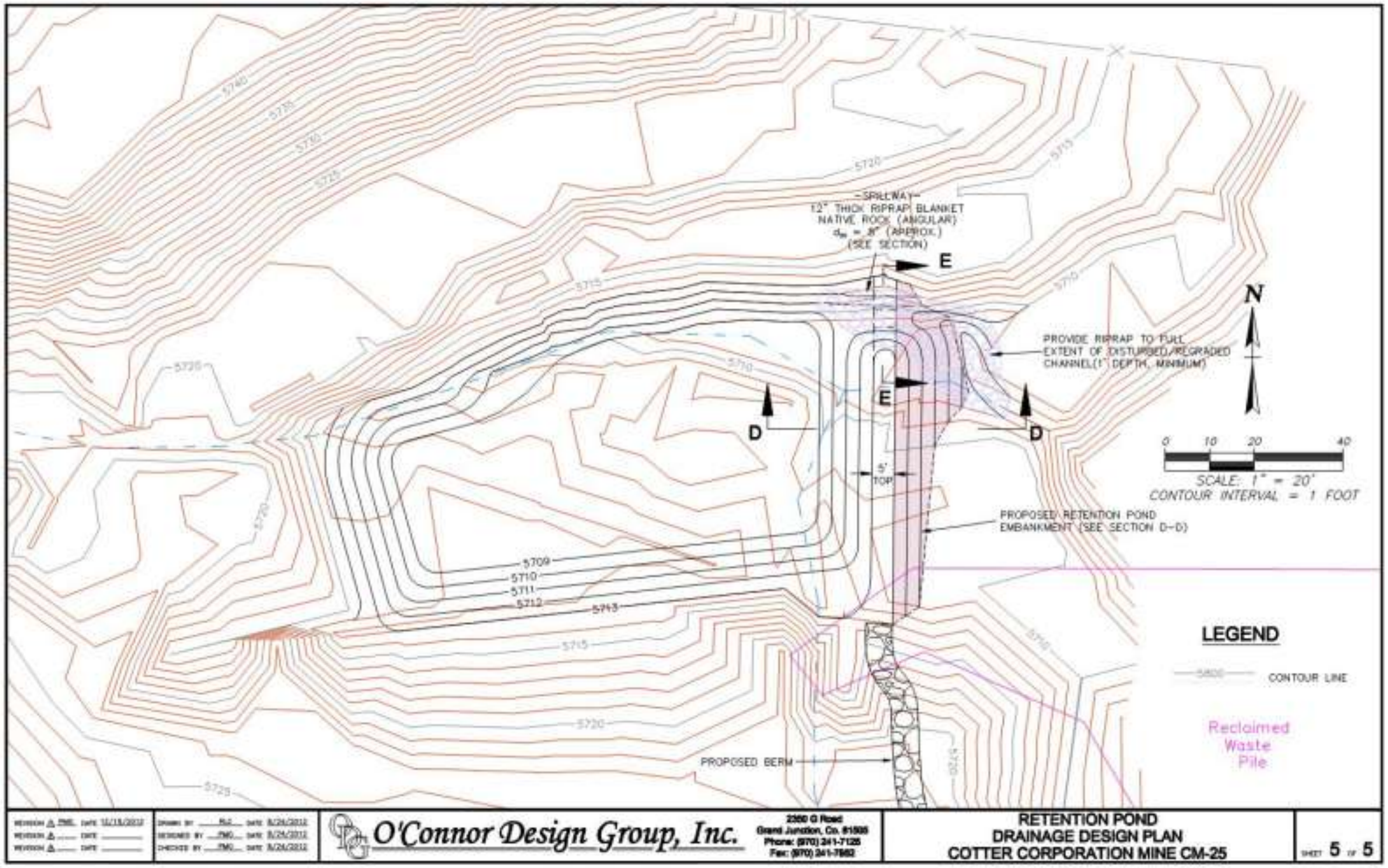
Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient	0.025	
Channel Slope:	0.06670	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	2.38	ft³/s
Results		
Normal Depth:	0.40	ft
Flow Area:	0.47	ft²
Wetted Perimeter:	2.51	ft
Top Width:	2.38	ft
Critical Depth:	0.52	ft
Critical Slope:	0.01528	ft/ft
Velocity:	5.04	ft/s
Velocity Head:	0.39	ft
Specific Energy:	0.79	ft
Froude Number:	1.99	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.40	ft
Critical Depth:	0.52	ft
Channel Slope:	0.06670	ft/ft
Critical Slope:	0.01528	ft/ft

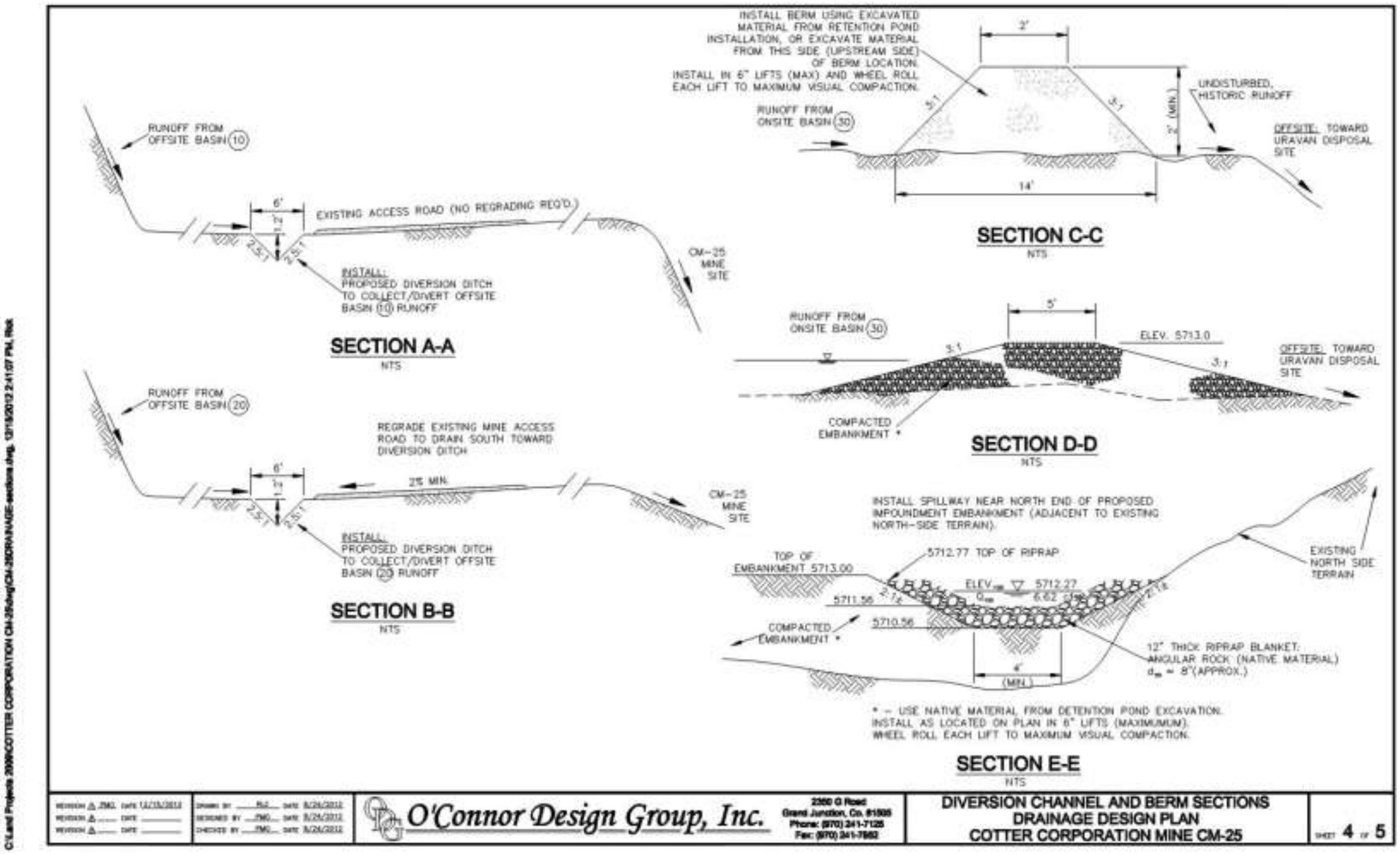
Attachment 2



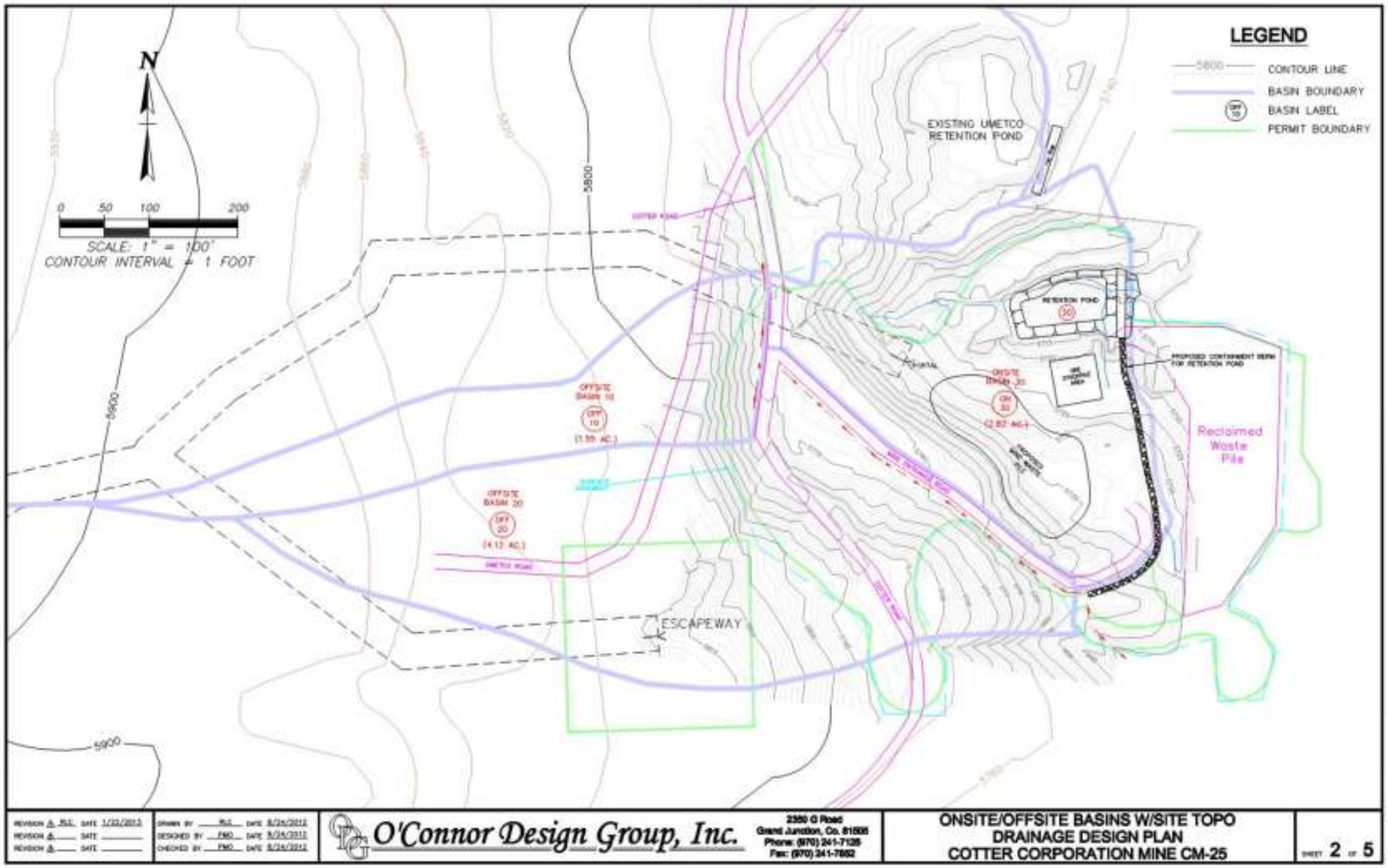


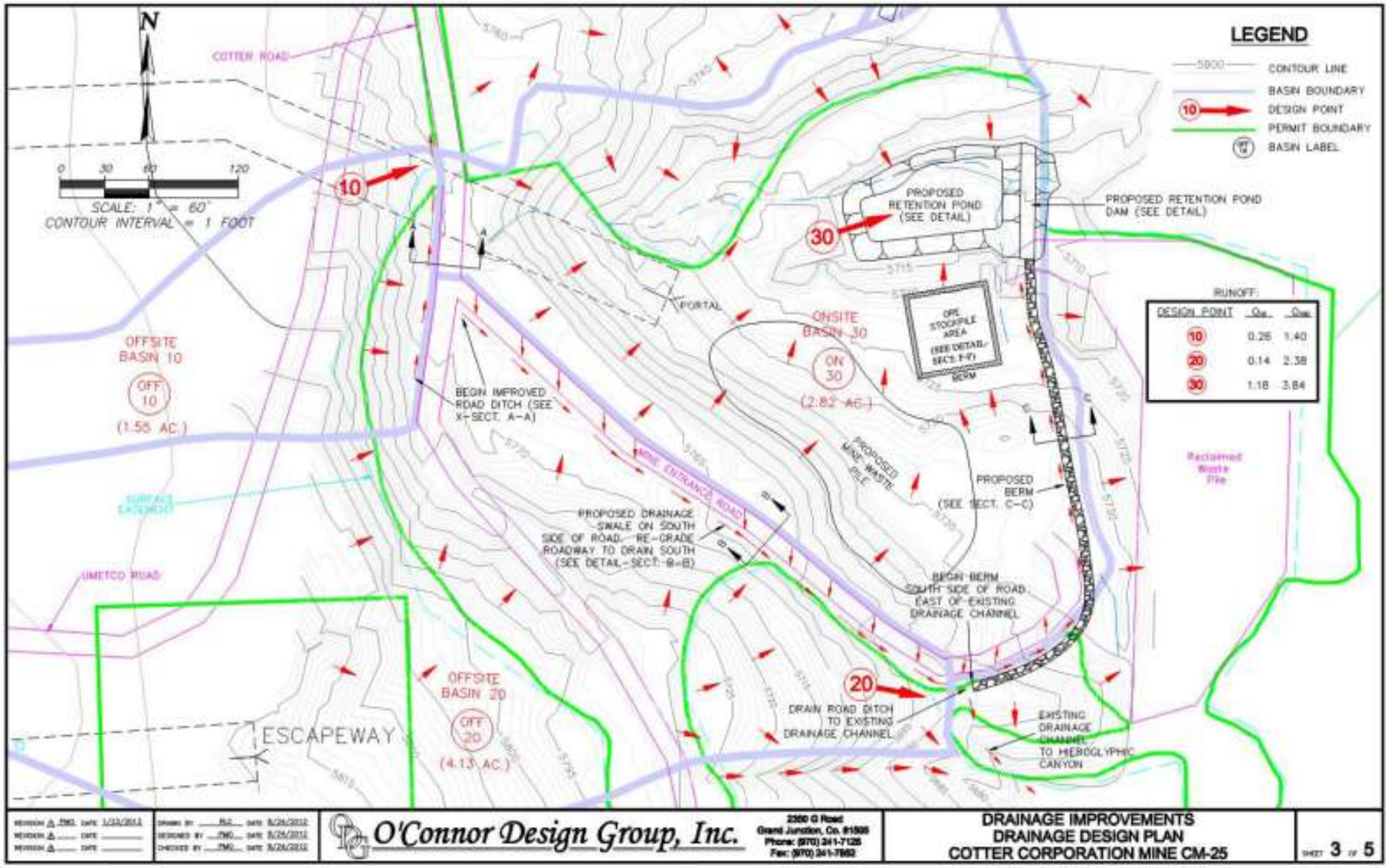
Attachment 3




SECTION A-A
NTS
RUNOFF FROM OFFSITE BASIN 10
EXISTING ACCESS ROAD (NO REGRADING REQ'D.)
INSTALL: PROPOSED DIVERSION DITCH TO COLLECT/DIVERT OFFSITE BASIN 10 RUNOFF
CM-25 MINE SITE
SECTION B-B
NTS
RUNOFF FROM OFFSITE BASIN 20
REGRADE EXISTING MINE ACCESS ROAD TO DRAIN SOUTH TOWARD DIVERSION DITCH
2% MIN.
INSTALL: PROPOSED DIVERSION DITCH TO COLLECT/DIVERT OFFSITE BASIN 20 RUNOFF
CM-25 MINE SITE
SECTION C-C
NTS
INSTALL BERM USING EXCAVATED MATERIAL FROM RETENTION POND INSTALLATION, OR EXCAVATE MATERIAL FROM THIS SIDE (UPSTREAM SIDE) OF BERM LOCATION.
INSTALL IN 6" LIFTS (MAX) AND WHEEL ROLL EACH LIFT TO MAXIMUM VISUAL COMPACTION.
RUNOFF FROM ONSITE BASIN 30
UNDISTURBED, HISTORIC RUNOFF
OFFSITE: TOWARD URAVAN DISPOSAL SITE
SECTION D-D
NTS
RUNOFF FROM ONSITE BASIN 30
ELEV. 5713.0
OFFSITE: TOWARD URAVAN DISPOSAL SITE
COMPACTED EMBANKMENT *
SECTION E-E
NTS
INSTALL SPILLWAY NEAR NORTH END OF PROPOSED IMPOUNDMENT EMBANKMENT (ADJACENT TO EXISTING NORTH-SIDE TERRAIN).
TOP OF EMBANKMENT 5713.00
5712.77 TOP OF RIPRAP
5712.27
5711.56
5710.56
COMPACTED EMBANKMENT *
EXISTING NORTH SIDE TERRAIN
12" THICK RIPRAP BLANKET: ANGULAR ROCK (NATIVE MATERIAL)
* – USE NATIVE MATERIAL FROM DETENTION POND EXCAVATION. INSTALL AS LOCATED ON PLAN IN 6" LIFTS (MAXIMUMUM). WHEEL ROLL EACH LIFT TO MAXIMUM VISUAL COMPACTION.
O'Connor Design Group, Inc.
DIVERSION CHANNEL AND BERM SECTIONS
DRAINAGE DESIGN PLAN
COTTER CORPORATION MINE CM-25
4 of 5

Attachment 4





LEGEND
CONTOUR LINE
BASIN BOUNDARY
DESIGN POINT
PERMIT BOUNDARY
BASIN LABEL
SCALE: 1" = 60'
CONTOUR INTERVAL = 1 FOOT
COTTER ROAD
OFFSITE BASIN 10
(1.55 AC.)
PROPOSED RETENTION POND (SEE DETAIL)
PROPOSED RETENTION POND DAM (SEE DETAIL)
PORTAL
ONSITE BASIN 30
(2.82 AC.)
ORE STOCKPILE AREA
BEGIN IMPROVED ROAD DITCH (SEE X-SECT. A-A)
MINE ENTRANCE ROAD
PROPOSED MINE WASTE PILE
PROPOSED BERM (SEE SECT. C-C)
PROPOSED DRAINAGE SWALE ON SOUTH SIDE OF ROAD. RE-GRADE ROADWAY TO DRAIN SOUTH (SEE DETAIL-SECT. B-B)
BEGIN BERM SOUTH SIDE OF ROAD EAST OF EXISTING DRAINAGE CHANNEL
UMETCO ROAD
OFFSITE BASIN 20
(4.13 AC.)
ESCAPEWAY
DRAIN ROAD DITCH TO EXISTING DRAINAGE CHANNEL
EXISTING DRAINAGE CHANNEL TO HIEROGLYPHIC CANYON
RUNOFF:
DESIGN POINT
10 0.26 1.40
20 0.14 2.38
30 1.18 3.84
O'Connor Design Group, Inc.
DRAINAGE IMPROVEMENTS
DRAINAGE DESIGN PLAN
COTTER CORPORATION MINE CM-25
3 of 5

Photos

Near SE corner at end of offsite 20 diversion ditch, looking SE.


Near S side mine yard looking north.

Near SE corner looking west.

Near south side looking north across mine yard.

Near SW corner looking north across mine yard.

Above mine yard looking south.

Above mine yard looking SE.