0044

CO-OP MINING CO.

P.O. Box 15809
Salt Lake City, Utah 84115
Phone (801) 467-4003

RECEIVED
AUG 9 1983
DIV. OIL, GAS, MINING

August 25, 1983

Dave Darby
Division of Oil Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

RE: NOV N83-5-5-3 #2
NOV N83-5-2-2 #2
NOV N83-5-8-3, #3

Dear Mr. Darby;

As discussed in our meeting of Aug. 24, 1983, we have, with additional information furnished by Mr. Wimmer, prepared a map to reference the subject matter in the hydrologic calculations. Reference numbers have been assigned to the various existing and proposed hydrologic structures and areas referred to in the computations. These correspond to the numbers indicating the location on the map. We hope this will serve the purpose as requested.

All ditches will be constructed with a minimum of .3 foot freeboard in addition to the sizing recommended in Mr. Wimmers calculations. We are preparing a new corrected plate of the catch basin (pond B) indicating the rectangular shape and the minimum distance from the stream channel as we discussed in our meeting. This will be ready to send to you in a few days.

If you have any other questions concerning the hydrology, please call myself of call Mr. Wimmer direct.

Thank you;

Wendell Owen

Wendell Owen

Refer to Expandable
file in C/015/025, 1983, Incoming
for additional information

HORROCKS & CAROLLO ENGINEERS
A JOINT VENTURE
ONE WEST MAIN
P. O. BOX 377
AMERICAN FORK, UTAH 84003

July 8, 1983

Mr. Wendell Owen
Co-Op Mining Company
P.O. Box 1245
Huntington, Utah 84528

Subject: Bear Creek Canyon Mine Site
Hydrology Computations

Dear Mr. Owen:

As discussed with you in our meeting Monday, June 6, 1983, and subsequent discussions I have performed hydrologic calculations for sediment storage and runoff at the subject site and have the following results and conclusions:

1. The computed volume for sedimentation in Pond A (the larger pond) is 76,621 cubic feet. If the pond can be constructed 8' deep this would require a pond approximately 120 feet by 80 feet. If, however, the pond can only be constructed 6' deep it would require a pond of 140 feet by 91 feet. Pond B (the smaller pond) needs to have 9,309 cubic feet of storage and this pond could be 4' deep and approximately 50 feet by 50 feet.

2. Based on the calculations I would recommend that the downspout #1 (the upper downspout) be constructed to conform to the grade of the existing contours on the hillside and be constructed of 15" corragated metal pipe. Particular care should be paid to the construction of the inlet to this pipe as it will probably be subseptible to plugging from debris. The lower downspout should be constructed of 18" corragated metal pipe laid to conform to the existing ground contours.

3. The drainage berm or ditch to convey the water to the sediment pond for the "A" area could be constructed of a V-type ditch with one to one side slopes at least 1½ feet deep at a grade of 6%.

4. For the spillway needed on the sediment storage ponds, I would recommend an 18" riser pipe connected to an 18" CMP outlet pipe laid at a minimum of 6% slope.

Map reference numbers( ) *

Pond A (1)

Pond B (2)

Spout 1 (3)

Spout 2 (4)

(5)

(6)

* Map reference numbers are not part of the original work by Mr. Wimmer and have been added for clarification as required by the Division of O G M and with the consent of Mr. Wimmer. None of the text has been altered.

Reference No.

5. The ditch to convey the water to the upper downspout could be constructed of a V-type ditch with one to one side slopes at least 1 foot deep at an average slope of 6%. A greater slope than 6% should be avoided to prevent errosion upstream of the downspout. If it is necessary to construct this channel at a greater slope, it should be riprapped or reinforced with Gabions to prevent errosion. (7)

The ditch to convey the water from the end of the upper downspout to the lower downspout can be constructed of V-type ditch with one to one side slopes at least 1½ feet deep. Again, this ditch will need to be riprapped if constructed at a greater slope than 6%. (8)

The area next to the 15" outlet from the 15" pipe will need to be riprapped to reduce the outlet velocity of 12.4 feet per second without creating errosion. This riprap should meet specifications for NCSA No. R-6 with an average partical size of 12", or by the use of Gabions. (9)

6. The capacity of the 10" culverts on the upper access road is 3.76 cubic feet per second when flowing full, which is adequate. (10)

7. The capacity of the 12" culverts on the upper access road is 6.12 cubic feet per second when full, which is adequate. (11)

8. I have reviewed the calculations on the existing culverts which provided drainage for the undisturbed areas through the disturbed areas and find that the 18" culvert located near the middle of the plot plan on the north side of the stream is adequate to convey the flows with a minimum headwater over the top of pipe depth of 20". (12)

The existing 60" culvert in the mainstream channel is adequate to convey the flows with a minimum headwater depth of 84" over the top of the pipe. (13)

I have attatched to this letter my engineering calculations and backup reference data for your files.

If you desire clarification or have additional questions or need additional information please contact me.

Very truly yours,

HORROCKS ENGINEERS

H. Lee Wimmer

H. Lee Wimmer, P.E.
Hydrologist

HLW:map

Enclosures

Bear Canyon Site Plan

Sediment Storage from disturbed area

Design data

Site elevation : 7150 feet (U.S.G.S.)
Runoff Area : see 1"=50' Map for individual areas
Average Slope length : see table below
Average Slope gradient : " " "
6 hour - 10 year Storm : 1.4 inches
Soil characteristics : 12% silt, 24% fine sand, 36% sand, 0% organic matter, course graded soil, moderate permeability

Table

Area #	Area* (acres)	Average Slope length (feet)	Average Slope gradient (%)
A1	2.24	420	36
A2	4.96	560	14
A3	3.51	640	11
B	1.79	520	10

(15) (16) (17) (18)

*By Planimeter

Determinations

Use Uniform Soil Loss Equation, $A = RKLSPC$

R : From figure 1 "Universal Soil Loss Equation", SCS Jan. 1976
Use $R = 40$

K : From "A soil erodability nomograph ...", where % silt plus % fine sand = 36%, % sand = 36%
$K = 0.32$

LS : From Table 1; "Universal soil Loss Equation", SCS Jan. 1976 (see table above) For A1, $LS = 22.06$
A2, $LS = 5.42$
A3, $LS = 4.14$
B, $LS = 3.12$

C : Assume bare ground, use $C = 1$
P : Assume no erosion control, use $P = 1$

$\Rightarrow A_{A1} = (40)(0.32)(22.06)(1)(1) = 282.4$ tons/acre/year
$A_{A2} = (40)(0.32)(5.42)(1)(1) = 69.4$ " " "
$A_{A3} = (40)(0.32)(4.14)(1)(1) = 53.0$ " " "
$A_B = (40)(0.32)(3.12)(1)(1) = 39.9$ " " "

Company

Bear Canyon site Plan

Surface runoff into diversions around site cont.

For required ditch cross section area, use Manning equation, $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

For earth lined channel, $n = 0.035$

Try channel of 1:1 side slopes, 2' deep
Average slope of ditch - 6%+

For shape shown, $P = 2\sqrt{8}$, $A = 4 ft^2 \Rightarrow R = 0.71$

$$Q = \frac{1.486}{0.035}(4)(0.71)^{2/3}(0.06)^{1/2} = 33.0 \text{ cfs}$$

Try channel of 1:1 side slopes, 1½ feet deep, $P = 3$, $A = 2.25 ft^2$
$\Rightarrow R = 0.75$

$$Q = \frac{1.486}{0.035}(2.25)(0.75)^{2/3}(0.06)^{1/2} = 19.3 \text{ cfs}$$, ok

→ Use a ditch with 1:1 side slopes at least 1½ feet deep

19

- - - - -

For spillway on sediment storage pond,

Use an 18" riser and 18" CMP outlet pipe at 6% grade?

$\Rightarrow Q = 13.97$ cfs ok
(see computer printout)

6

Bear Canyon Site Plan

Sediment storage from disturbed area cont.

For areas, 3 years (OSM regulations 817.46(b)(1)),
Soil = 90 lbs / ft^3

$V_{A1} = (282.4)(2.24)(3)(\frac{2000}{1})(\frac{1}{90}) = 42,172\ ft^3$ *
$V_{A2} = (69.4)(4.96)(3)(\frac{2000}{1})(\frac{1}{90}) = 22,948\ ft^3$
$V_{A3} = (53.0)(3.51)(3)(\frac{2000}{1})(\frac{1}{90}) = 12,402\ ft^3$
$V_B = (39.9)(1.79)(3)(\frac{2000}{1})(\frac{1}{90}) = 4,761\ ft^3$

* To high, this calculated figure is higher than will ever occur in practice because the soil type for this hillside would consist of large rocks and other particle sizes being larger also. I would recommend reducing this figure to the amount calculated for one (1) year, 14,057 ft^3

⇒ For $A_1+A_2+A_3$, sediment storage volume =
$14,057 + 22,948 + 12,402 = \underline{49,407\ ft^3}$ (1)

For B, sediment storage = $\underline{4,761\ ft^3}$ (2)

Bear Canyon Site Plan

Surface runoff into diversions around site

Design Data

Area : See previous Table
Slope : " " "
Maximum Length : $A_1 = 480'$, $A_2 = 660'$, $A_3 = 1040'$, $B = 520'$
Runoff Coefficient : 0.40
25 Yr-24hr Storm : Hiawatha data by E. Arlo Richardson, State Climatologist

Determinations

Use Rational equation, $Q = CIA$
For Area A_1 use $T_c = 5$ min $\Rightarrow I_{max} = 2.76$ in/hr
For other Areas use $T_c = 10$ min $\Rightarrow I_{max} = 2.10$ in/hr

$Q_{A1} = (0.40)(2.76)(2.24) = 2.47$ cfs

$\longrightarrow$ Use 15" CMP for downspout #1 — (3)

check Headwater depth - UDOT Chart 2-53
need Hw of 12 inches ±, OK

$Q_{A2} = (0.40)(2.10)(4.96) = 4.17$ cfs

Total Q @ downspout #2 $\approx Q_{A1} + Q_{A2} = 2.47 + 4.17 = 6.64$ cfs

$\longrightarrow$ Use 18" CMP for downspout #2 — (4)

Hw = 20" or 2" over top of pipe, OK

$Q_{A3} = (0.40)(2.10)(3.[illegible]) = 2.95$ cfs

Total Q in ditch $\approx Q_{A1} + Q_{A2} + Q_{A3} = 9.6$ cfs

Bear Canyon Site Plan

Ditch Size to convey runoff to downspouts

Design Data

As before, $Q_1 = 2.47$ cfs, $Q_2 = 6.64$ cfs

Determinations

For ditch size to convey runoff to upper downspout use Manning Equation, $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

For earth lined channel, $n = 0.035$

Try channel of 1:1 side slopes, 1' deep
Try average slope of 6% ± (greater slope will probably cause erosion)

For slope shown, $P = 2\sqrt{2}$, $A = 1\ ft^2 \Rightarrow R = A/P = 0.35$

$Q = \frac{1.486}{0.035}(1)(0.35)^{2/3}(0.06)^{1/2} = 5.16$ cfs, ok

→ Use a ditch with 1:1 side slopes at least 1 foot deep with slope of 6% to channel runoff to upper downspout

7

check need for riprap below downspout

9

outlet velocity = 12.4 ft/sec (see computer printout)

⇒ Need riprap NCSA No. R-6 (average particle size of 12 inches) or use Gabions

To convey runoff to lower downspout

→ Use a ditch with 1:1 side slopes at least 1½ feet deep with slope of 6%

8

Bear Canyon Site Plan

Runoff storage from disturbed area

Design Data

24 hour - 10 year storm : 2.25 inches

Determinations

CN = 80 ±, From Table 9.1, "SCS National Engineering Handbook", Section 4, "Hydrology"

Runoff from figure 10.1, reference as above = 0.7 inches

⇒ Volume of runoff in ft^3

(15) $V_{A1} = (2.24)(43{,}560)(0.7)(1/12) = 5{,}692\ ft^3$

(16) $V_{A2} = (4.96)(43{,}560)(0.7)(1/12) = 12{,}603\ ft^3$

(17) $V_{A3} = (3.51)(43{,}560)(0.7)(1/12) = 8{,}919\ ft^3$

(18) $V_B = (1.79)(43{,}560)(0.7)(1/12) = 4{,}548\ ft^3$

$\Big\rangle\ 27{,}214\ ft^3$

⇒ Total Volume in ponds required for sediment and runoff:

Pond A = 49,407 + 27,214 = 76,621 ft^3 — (1)

Pond B = 4,761 + 4,548 = 9,309 ft^3 — (2)

Bear Canyon Site Plan

Surface runoff from undisturbed hillsides

<u>Design Data</u>

Area : LA = 953 acres , LB = 21.4 acres
Average Elevation : (9,200 + 7,200)/2 = 8,200 feet (USGS)
Design Charts : Utah Department of Transportation (UDOT) Roadway Drainage Manual
Flood Frequency : 20 year return period (USC 25)

<u>Determinations</u>

Use UDOT small area runoff method, $Q = (Q_c)(LF)(FF)$
1 hour - 25 year rainfall = 0.78 in/hr.
From Table 2-05 , K = 0.13
From chart 2-07 , Q_c = 202 cfs for LA
Q_c = 10 cfs for LB
From Table 2-08 , LF = 1.2
FF = I_{design}/I_{25} = 1 for 25 year return period

$\Rightarrow Q = (202)(1.2)(1) = 242$ cfs for LA (60" CMP)
$Q = (10)(1.2)(1) = 12$ cfs for LB (18" CMP)

From computer print out
for 60" CMP full , Q_{max} = 261 cfs , OK

check headwater depth for 242 cfs
UDOT chart 2.53
$\rightarrow H_w$ = 144 inches or 84" over top of pipe

(13)

for 18" CMP full , Q max = 22 cfs , OK

(12)

check headwater depth for 12 cfs
$\rightarrow H_w$ = 38 inches or 20" over top of pipe

The culvert crossing the road conveying the drainage from disturbed area B will need to carry a volume of 2 cfs. The existing 15" culvert is adequate.

Prepared under the direction of
Harold Wimmer, Professional Engineer
by Wendell Owen

Wendell Owen

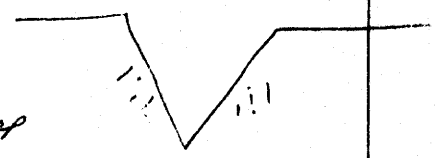
Company | Lee Wilson

Bear Canyon Site Plan

culverts under access roadway (cont)

Find required ditch cross section:

use Manning equation, $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$



for earth lined channel, $n = 0.035$

Try channel of 1:1 side slopes, 2' deep
Average slope of ditch = 6%

for shape shown, $P = 2\sqrt{8}$, $A = 4\,ft^2 \Rightarrow R = 0.71$

$Q = \frac{1.486}{0.035}(4)(0.71)^{2/3}(0.06)^{1/2} = 33.0$ cfs

Try channel of 1:1 side slopes, 1½ feet deep
$P = 3$, $A = 2.25\,ft^2 \Rightarrow R = 0.75$

$Q = \frac{1.486}{0.035}(2.25)(0.75)^{2/3}(0.06)^{1/2} = 19.3$ cfs, OK

$\Rightarrow$ use a ditch with 1:1 side slopes at least 1½ feet deep — 20

check size for 4% slope of ditch
Try 2 feet deep

$Q = \frac{1.486}{0.035}(4)(0.71)^{2/3}(0.04)^{1/2} = 27.0$ cfs, OK