

MRP REVISION/NOV TRACKING FORM

Type of proposal:

COAL NON-COAL

Exploration

NOV abatement, NOV # 83-5-8-3, Abatement deadline 8-14-85: 90TH DAY

MRP revision

Issuing inspector J. WHITEHEAD/KEN WYATT

Title of proposal: # 2 of 3 BEAR CANYON RESPONSE TO SEDIMENT POND (A) DEF.

Company name: COOP

Mine name: BEAR CANYON

File # (PRO/ACT): 015/025

Acreage (Fed/State/Fee): 1

Assigned reviewers: MUNSON, T. (Hydro)
COX, Steve (Wildl.)
_____ (Engine)
_____ (Soils)
_____ (Geolog)

may need extra copies ?? especially if to go into MRP revisions.

DATES:

(a) INITIAL PLAN RECEIVED 8-11-83
Tech review due _____
" " complete 1-30-84 and 2

also for OSM (Dept. Alb.)
State Health
Water Rpts
W

(b) OPERATOR RESUBMISSION 2-29-84 (received DWH)
Tech review due 3-9-84
" " complete _____

(c) FINAL APPROVAL _____
Stipulations due _____
" received _____

BY RESPONSE RECEIVED 3/23/84 HAND DELIVERED
Tech def. LETTER SENT OUT 3/27/84
RESPONSE DUE 4/6/84

17/84

COMMENTS: PTTS RESUBMISSION of 2-29-84, M. BONCEK Response of 1-30-84, T. MUNSON Response of 2-17-84, copy of NOV, RESUBMISSION of 3-1-84, THIS INFO. SUBMITTED TO D.W.H. 2-29-84 JPH

NOTE (INSPECTORS): Please attach a copy of the NOV issued to the abatement plan when received from the operator.

NOTE (REVIEWERS): Please prepare review comments in a format referencing the appropriate regulation or statute. State the deficiency as well as minimum requirement necessary to demonstrate compliance (when possible). Also fill in the number of hours spent in review by discipline. Return the revision/NOV abatement to the Special Permit Supervisor when review is complete.

MRP REVISION/NOV TRACKING FORM

Type of proposal:

COAL NON-COAL

Exploration
 NOV abatement, MRP revision

NOV # 83-5-8-3, Abatement deadline 8-14-85: 90TH DAY

Issuing inspector J. WATCHELAD / KEN WYATT

Title of proposal: # 2 of 3 BEAR CANYON RESPONSE SEDIMENT FOND (A) DEPT.

Company name: COOP Mine name: BEAR CANYON

File # (PRO/ACT): 015/025 Acreage (Fed/State/Fee): 1/1/

Assigned reviewers:	<u>MUNSON, T.</u> (Hydrology)	Review	_____
	<u>COX, Steve</u> (Wildlife/Veg.)	Time (hrs):	_____
	_____ (Engineering)		_____
	_____ (Soils)		_____
	_____ (Geology)		_____

DATES:

(a) INITIAL PLAN RECEIVED 8-11-83 (d) NOV TERMINATION _____
Tech review due _____
" " complete 1-30-84 and 2-17-84, 3-1-84

(b) OPERATOR RESUBMISSION 2-29-84 (received) (e) BOND REVISION _____
Tech review due 3-9-84 (DWH) Amount (\$) _____
" " complete _____

(c) FINAL APPROVAL _____
Stipulations due _____
" received _____
→ MORE INFO REQUESTED IN LETTER OF 3/7/84
BY 3/23/84
RESPONSE RECEIVED 3/23/84 HAND DELIVERED
Tech def. LETTER SENT OUT 3/27/84
RESPONSE DUE 4/6/84

COMMENTS: ATTN: RESUBMISSION of 2-29-84, M. BOLLER Response of 1-30-84,
T. MUNSON response of 2-17-84, copy of NOV, RESUBMISSION of 3-1-84,
THIS INFO. SUBMITTED TO D.W.H. 2-29-84 GJA

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STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS & MINING

1588 West North Temple
Salt Lake City, Utah 84116
Telephone: (801) 533-5771

NOTICE OF VIOLATION NO.N 83-5-5-3

From the STATE OF UTAH
To the Following Permittee or Operator:

NAME C O - O P Mining Company
MINE Bear Canyon Mine SURFACE UNDERGROUND OTHER _____
CATEGORY OF OWNERSHIP: STATE FEDERAL FEE MIXED
OSM MINE NO. _____ STATE PERMIT NO. ACT/015/025 MSHA I.D. NO. _____
COUNTY AND STATE Emery County Utah TELEPHONE _____
MAILING ADDRESS: P.O. Box 1245, Huntington Utah
DATE OF INSPECTION May 12, 19 82.
TIME OF INSPECTION: FROM 11:00 a.m. to 12:30 a.m.
 p.m. to p.m.
NAME OF OPERATOR (if other than permittee) _____
MAILING ADDRESS: _____

Under the authority of the Utah Coal Mining and Reclamation Act of 1979 (Sec. 40-10-1 et seq., Utah Code Annotated, 1953), the undersigned authorized representative of the Director and the Division of Oil, Gas & Mining has conducted an inspection of the above mine on the above date and has found violation(s) of the Act, the regulations or required permit condition(s) listed in the attachment(s). This Notice constitutes a separate Notice of Violation for each violation listed.

You must abate each of these violations within the designated abatement time. You are responsible for doing all work in a safe and workmanlike manner.

The undersigned representative finds that cessation of mining is is not expressly or in practical effect required by this Notice. For this purpose "Mining" means extracting coal from the earth or a waste pile and transporting it within or from the minesite.

This Notice shall remain in effect until it expires as provided on the reverse or is modified, terminated or vacated by written notice of an authorized representative of the Director of the Division of Oil, Gas & Mining. The time for abatement may be extended by the authorized representative for good cause, if a request is made within a reasonable time before the end of the abatement period.

Date of Service May 16, 1983 John J. Whitehead
SIGNATURE OF AUTHORIZED REPRESENTATIVE
Time of Service 4:00 a.m. John J. Whitehead #5
 p.m. NAME AND I. D. NO.
Person Served with Notice mailed to operator
PRINT NAME AND TITLE
Signature _____

IMPORTANT — PLEASE READ REVERSE OF THIS PAGE



DEPARTMENT OF NATURAL RESOURCES - DIVISION OF OIL, GAS AND MINING
1586 West North Temple - Salt Lake City, Utah 84114 (801) 533-5771

STATE OF UTAH

Notice of Violation No. N 817-8-9

Violation No. 2 of 3

Nature of the Violation

Failure to construct sedimentation ponds in accordance with UMC 817.46
Failure to control discharge from sedimentation ponds by energy dissipators, riprap channels etc. in accordance with UMC 817.47 and approved plan.

Provision(s) of the Regulations, Act, or Permit Violated

UMC 817.46
UMC 817.47

Portion of the Operation to which Notice Applies

Main sedimentation pond at the Bear Canyon Mine

Remedial Action Required (including interim steps, if any)

Bring the sedimentation pond into full compliance with all applicable performance standards and applicable regulations.

Time for Abatement (including time for interim steps, if any)

60 days from date of receipt of this notice.

CO-OP MINING COMPANY

P. O. Box 1245

Huntington, Utah 84528

Phone (801)748-5238

March 19, 1984

RECEIVED
MAR 26 1984

Utah Division of Oil, Gas, & Mining
4241 State Office Building
Salt Lake City, Utah 84114

**DIVISION OF
OIL, GAS & MINING**

REF: Bear Canyon Sediment Pond

Dear Tom:

Mr. Wimmer has been commissioned to conduct the embankment stability analysis as indicated in our previous conversation and correspondence. Co-Op Mining Company is committed to having this work completed prior to June 1, 1984. Based on the results of this test and a satisfactory plan approved by the Division, Co-Op will take all necessary steps to bring Sediment Pond "A" Bear Canyon into total compliance during the 1984 construction season.

June - September:

In reference to your comments;

(1) A marker indicating a 60% sediment load.

Co-Op will implement a gauge in the form of a staff extending from the bottom of the pond along the decant device which will be marked off in % from 0 to 100. The staff and the markers will be large enough that the % sediment can be determined by standing on the embankment. When the sediment load approaches the 60% level, the pond will be cleaned as per our agreement.

(2) Clarification of the methodology Mr. Wimmer utilized in determining his results relative to inflow, capacity, etc.

Mr. Wimmer has received a copy of your request with instructions to supply you with all the relative information you have requested, as well as the technical information concerning spillway sizes and rip-rap which will be utilized in construction of

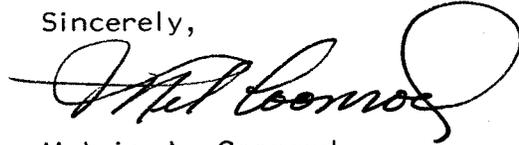
the outflow channel.

(3) Concern relative to an oil skimmer device on the decant inlet.

This was an oversight on our part. The oil skimmer is indicated on the diagram but was not adequately defined in the commentary. The oil skimmer is presently in place and will be maintained as the pond is upgraded. It is my understanding that the Utah Department of Health has approved the present structure. However, Co-Op will seek the necessary approval of the modification once the Division has deemed the changes adequate, and the plans are approved.

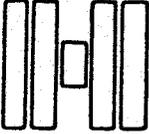
Co-Op appreciates your assistance in laying this issue to rest and is anxious to implement the modifications to insure total compliance.

Sincerely,

A handwritten signature in black ink, appearing to read "Melvin A. Coonrod". The signature is fluid and cursive, with a large loop at the end.

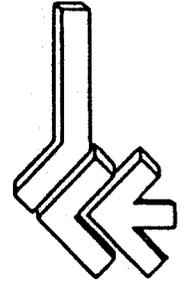
Melvin A. Coonrod
Permitting & Compliance Director

MC/njc



HORROCKS & CAROLLO ENGINEERS

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



March 23, 1984

RECEIVED
MAR 28 1984

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

DIVISION OF
OIL, GAS & MINING

Subject: Bear Creek Canyon Mine Site
Disturbed Area Runoff - Sedimentation Pond A
Oil, Gas & Mining Letter of March 7, 1984

Dear Mr. Owen:

At your request and after talking with Thomas Munson, Reclamation Hydrologist, I have revised the drawing for the reconstructed Sedimentation Pond A and it is transmitted herewith. In addition, I would offer the following comments with respect to the issues raised by the division.

1. Accurate dimensions must be submitted for the inlets and outlets to the pond and a cross-section showing these dimensions will be put on the Sedimentation Pond "A" Plate.

Response:

These dimensions and the cross-sections have been added to the plate.

2. The letter submitted by Co-Op from Mr. H. Lee Wimmer, P.E., to Mr. Wendell Owen, does not adequately explain the engineering calculations submitted to the Division on February 29, 1984. After a phone conversation with Mr. Wimmer on March 7, 1984, it was explained to him what information was needed to make the plan complete. This information will include a narrative tying together the calculations submitted with the background information used in the mine plan. This narrative will also include any coefficients used in computing, also all detailed hydraulic calculations, (i.e) coefficients for the broad crested wier formula, slopes, peak flows, etc.

Response:

As discussed with Mr. Munson on the telephone, the figures used for sizing the reconstructed pond volume for sediment storage and runoff storage was by mutual agreement with the Division, and the numbers used were those computed by John Whitehead of the Division. The coefficient used for computing the flow over the broad crested wier was 3.8 as recommended in the King Handbook of Hydraulics. The rainfall intensity database was based on the Hiawatha data compiled by E. Arlo Richardson, State Climatologist. The method chosen was a

Wendell Owen
Sedimentation Pond A
March 22, 1984

computer method based on unit hydrograph principles of hydrology as refined by the United States Soil Conservation Service, commonly called the SCS method. The peak flows generated by the SCS method for the 25-year storm frequency was a flow of 13.0 cubic feet per second.

3. Adequate protection of the inlet and outlet structures to the pond including rip-rap size and depth based on expected velocities for the 24 hour - 25 year storm.

Response:

The inlet to the pond is also an access for cleaning the pond and is 15' wide with slopes of about 9%. The expected velocities for the design storm on the inlet are 4.2 feet per second. The expected velocities for the design 25-year storm on the outfall structure is 0 since no water is discharged as shown by the hydrograph reservoir routing computations. The 100-year storm frequency does generate a maximum outflow of 2.6 cubic feet per second which would have an expected velocity of 2.2 feet per second. At these low velocities, no rip-rap would be required. The strata of the existing outflow structure is composed of rocks and gravels.

4. Stability Analysis of the outside slopes of the sediment pond based on established engineering criteria must be submitted by June 1, 1984.

Response:

As soon as a sample of the material is delivered, I will perform the necessary laboratory tests to determine the material characteristics including direct shear values and will perform a slope stability analysis. The results can be available prior to June 1, 1984 if a five (5) gallon sample of the material is delivered to me prior to April 20, 1984.

5. Co-Op should realize that the Utah State Health Department may require an effective Oil Skimming Device sufficiently above the designed sediment level in order to be able to decant the pond. They should submit their revised pond drawing to Steve McNeal of State Health.

Response:

I will submit a copy of the drawing directly to Steve McNeal, as we discussed today on the phone.

6. Co-Op will indicate on Sedimentation Pond "A" Pond Plate the accurate sediment level elevation and make a commitment in the plan to mark the 60% sediment pond clean out level with an easily distinguishable marker.

Wendel Owen
Sedimentation Pond A
March 22, 1984

Response:

I have added to the sedimentation pond drawing a positive method by which the sedimentation level could be accurately determined.

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

Very truly yours,

HORROCKS & CAROLLO ENGINEERS



H. Lee Wimmer, P.E.
Professional Engineer

HLW:mp

Enclosures

cc: Thomas Munson ✓

SUMMARY OF GENERAL UNIFORM FLOW CALCULATIONS

**HORROCKS
ENGINEERS**

CO-OP Mine - Sed. Pond "A"
PROJECT No. 8312-42
DATE: 3/23/84

CHANNEL IS TRAPEZOIDAL

SOLVING FOR VELOCITY, DEPTH

VELOCITY fps	DISCHARGE cfs	DEPTH ft.	MANNING COEFF.	SLOPE ft/ft	SIDE SLOPES Z:1	WIDTH ft.
<u>2.21</u>	2.60	.12	.035000	.050000	2.00 2.00	10.00

Pond outlet velocity

FROUDE NUMBER	REYNOLDS NUMBER	LIMIT SLOPE	CRITICAL DISCHARGES
1.159	22894.9	.08301984	0.00 0.00

CRITICAL DEPTH	SEQUENT DEPTH	ALTERNATE DEPTH
.13	.15	.15

THERE ARE NO EXISTING CRITICAL DISCHARGES FOR THIS CHANNEL
SLOPE AND THE RANGE GIVEN.

FOR THE ABOVE-LISTED CONDITIONS, THE FLOW REGIME IS SUPERCRITICAL TURBULENT

SUMMARY OF GENERAL UNIFORM FLOW CALCULATIONS

**HORROCKS
ENGINEERS**

CO-OP Mine - Sed. Pond "A"

PROJECT No. 8312-42

DATE: 3/23/84

CHANNEL IS TRAPEZOIDAL

SOLVING FOR **VELOCITY, DEPTH**

VELOCITY fps	DISCHARGE cfs	DEPTH ft.	MANNING COEFF.	SLOPE ft/ft	SIDE SLOPES Z:1	WIDTH ft.
<u>4.25</u>	13.00	.20	.035000	.090000	2.00 2.00	15.00

Pond inlet velocity

FROUDE NUMBER	REYNOLDS NUMBER	LIMIT SLOPE	CRITICAL DISCHARGES
1.701	75757.7	.08298420	0.00 0.00

CRITICAL DEPTH	SEQUENT DEPTH	ALTERNATE DEPTH
.28	.39	.42

THERE ARE NO EXISTING CRITICAL DISCHARGES FOR THIS CHANNEL
SLOPE AND THE RANGE GIVEN.

FOR THE ABOVE-LISTED CONDITIONS, THE FLOW REGIME IS SUPERCRITICAL TURBULENT

Joe

The _____ Consultant
has not sent me
the Pond design -
I'll send it under a
separate letter

Thanks
Mel.

CO-OP MINING COMPANY

P.O. Box 1245

Huntington, Utah 84528

Tele. (801)748-5238

February 25, 1984

Joe Helfrich
Utah Division of Oil, Gas, & Mining
4241 State Office Building
Salt Lake City, Utah 84114

RECEIVED
MAR 1 1984

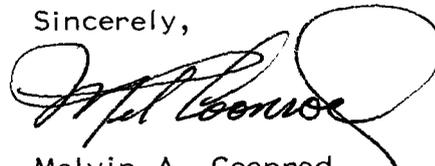
**DIVISION OF
OIL, GAS & MINING**

Dear Joe:

Co-Op is committed to upgrading the existing sediment pond serving the Bear Canyon Mine and bring it into total compliance with UMC 817.46. The present facility has served the operation from its construction in 1980 until the present. From all appearances the embankment appears stable and to a large degree is revegetated. However, Co-Op anticipates enlarging the pond to a total capacity of 84,158 cubic feet. This sizing is in line with UDOGM recommendations relative to containment of 24 hour 100 year storm event (see attached schematic). Mr. Lee Wimmer of the Engineering firm of Horrocks and associates has been commissioned to do a thorough stability analysis of the embankment prior to June 1, 1984. This information will be supplied to the Division immediately upon its arrival to Co-Op Mining. Co-Op is further committed to commence construction upon DOGM's approval of said plans with a completion date prior to September 30, 1984 (assuming the specifications are approved 30 days prior of said date).

Please find attached a copy of the proposed Sediment Control Pond as well as a final reclamation plan for the sediment pond.

Sincerely,



Melvin A. Coonrod
Permitting and Compliance Director

MAC/nc
Enclosure
cc Tom Munson
cc Ken Wyatt

RECLAMATION PLAN - SEDIMENT CONTROL STRUCTURES
BEAR CANYON MINE

The Bear Canyon Mine has two principal sediment control structures:

1. Sediment Retention Pond (A)
2. Sediment Catch Basin (B)

(Note location MRP - Plate 7-2).

The sediment retention pond (schematic attached) is located at the south west margin of the property approximately 75 feet west of Bear Creek. The pond will have a total capacity of 84,158 cu. ft. and accommodates the majority of the disturbed area run-off.

Co-Op is committed to removing all culverts in conjunction with the recontouring of all disturbed areas, and topsoiling. In conjunction with postmining reclamation, the original drainage patterns will to a large degree be restored to the point they intersect the Bear Canyon Mine access road. At this junction the waters will be diverted in the existing disturbed water drainage ditch and passed through the existing sediment pond "A". This pond will remain functional as long as the revegetation effort is in progress. When the balance of the property is revegetated to the 80% comparable ground cover the pond will be cleaned. The decant device will be removed and the associated disturbance reclaimed as outlined in the revegetation section of the MRP (Chapter 9, Section 9.5 Phase 2).

The pond will remain in place and allowed to go through a normal pond succession, wet meadow and eventually reaching a climax vegetative community. During this successional period the riparian habitat established will serve as an enhancement feature for both wildlife and domestic animals.

When the area is fully revegetated the disturbed area drainage maintenance will be altered to reroute the flow directly into Bear Creek at logical points of diversion thus mitigating the potential for a 100

year 24 hour event creating a breaching of the existing pond embankments.

In addition to the course of action outlined, Co-Op has discussed the importation of beavers with the UDWR. This transplant coordinated with a stable vegetation base to provide a food source for a beaver community. It is Co-Op's contention that a beaver community established in this portion of Bear Creek could greatly enhance the vegetation potential of the area as well as lessen the high natural sediment contribution of Bear Creek to Huntington Creek.

Pond B the small catch basin (approximately 9,309 cu. ft. storage) will be maintained until the disturbed area drainage is fully revegetated. At this time a discussion to remove the pond should be made based on whether the sediment load is capable of supporting a vegetative cover. In the event the material is of such poor quality as to prohibit vegetation establishment the pond should be filled with a suitable growth media and planted following the guidelines established in Chapter 9 Section 9.5 Phase 2 MRP submittal.

Both structures should be monitored to insure vegetation establishment and land release.

CO-OP MINING COMPANY

P.O. Box 1245

Huntington, Utah 84528

Tele. (801)748-5238

February 25, 1984

Joe Helfrich
Utah Division of Oil, Gas, & Mining
4241 State Office Building
Salt Lake City, Utah 84114

RECEIVED
FEB. 29 1984

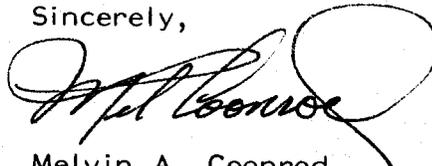
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OIL, GAS & MINING**

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Permitting and Compliance Director

MAC/nc
Enclosure
cc Tom Munson
cc Ken Wyatt

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(Note location MRP - Plate 7-2).

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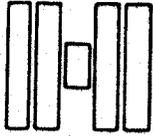
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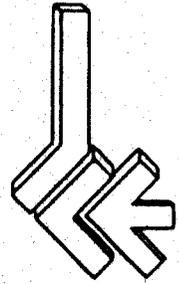
HORROCKS & CAROLLO ENGINEERS

A JOINT VENTURE

ONE WEST MAIN

P. O. BOX 377

AMERICAN FORK, UTAH 84003



February 28, 1984

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

Subject: Bear Creek Canyon Mine Site
Disturbed Area Runoff - Sedimentation Pond "A"

Dear Mr. Owen:

At your request and as a result of the meeting with the State of Utah, Dam, Oil, Gas, and Mining people on February 8, 1984, and subsequent discussions with DOGM staff, I have performed additional hydrologic calculations and designed a reconstructed sediment pond "A" for the runoff from the disturbed area at the subject site and offer the following:

1. By mutual agreement with the Division I have used the figures previously computed by John Whitehead, to size the reconstructed basin. He computed the runoff volume required as 42,714 cubic feet and the sediment storage required as 41,444 cubic feet for a total storage requirement at the spillway lip of 84,158 cubic feet. As you probably remember I had previously computed the storage required to be 76,621 cubic feet or a figure approximately 9% less than that computed by Mr. Whitehead.

2. The pond reconstruction will require that the existing sediment on the bottom be removed and that the bottom of the pond be graded to a uniform elevation of approximately 87.0 (all elevations herein and in the computations relate to the bench mark I set at the site at elevation 100.0 which can be used for construction control at a later date). The interior slopes would be 2 to 1 as I have indicated on the enclosed drawings. The exterior slopes on the south and east (particularly in the southeast corner) would be determined following the results of the stability analysis to be performed at a later date. The other details of the pond are as shown on the drawing. The existing spillway, which functions as a combined principal spillway and an emergency spillway would still be used.

I have attached to this letter my engineering calculations and backup reference data for your files. However, it may be helpful to refer to two previous letters from me dated October 14, 1983 and July 8, 1983.

Wendell Owen
Bear Creek Canyon Mine Site
Page 2

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

Very truly yours,

HORROCKS ENGINEERS



H. Lee Wimmer, P.E.
Professional Engineer

HLW:mp

Enclosures

HYDROLOGICAL STUDY FOR
CO-OP Mine Disturbed Area

Reconstructed Sediment Pond "A"

Bear Canyon Mine Site

BY

HORROCKS & CAROLLO ENGINEERS

ONE WEST MAIN

AMERICAN FORK, UTAH 84003

February 28, 1984



PAGE
HORROCKS ENGINEERS
AMERICAN FORK, UTAH
February 27, 1984

BROAD CRESTED WEIR

WIDTH = 10.00 FEET

ELEV. (FT.) FLOW (CFS)

94.20	0.00
94.30	1.20
94.40	3.40
94.50	6.24
94.60	9.61
94.70	13.44
94.80	17.66
94.90	22.26
95.00	27.19
95.10	32.44
95.20	38.00

FORMULA USED: $Q = C * L * H^{1.5}$

3.8

HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
STAGE, STORAGE & DISCHARGE

POND IDENTIFIER Reconstructed Sed. Pond "A" - Empty -

ELEV	STORAGE (CU.FT.)	OUTFLOW (CFS)	^{For No. 6} 2S/T+0 (CFS)
87.0	0.0	0.0	0.0
88.0	9284.0	0.0	41.3
89.0	19368.0	0.0	86.1
90.0	30284.0	0.0	134.6
91.0	42064.0	0.0	187.0
92.0	54740.0	0.0	243.3
93.0	68344.0	0.0	303.8
94.0	82908.0	0.0	368.5
94.2	85938.6	0.0	381.9
94.7	93691.6	13.4	429.8
95.2	101698.1	38.0	490.0

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 POND DEPTH VS STORAGE PROVIDED**

POND IDENTIFIER Reconstructed Sed. Pond "A" - *Empty* -

ELEV feet	DEPTH feet	AREA sq.ft.	VOLUME cu.ft.	SUM VOL ✓ cu.ft.	OUTFLOW c.f.s.
87.0		8892.0		0.0	0.0
	1.0		9284.0		
88.0		9676.0		9284.0	0.0
	1.0		10084.0		
89.0		10492.0		19368.0	0.0
	1.0		10916.0		
90.0		11340.0		30284.0	0.0
	1.0		11780.0		
91.0		12220.0		42064.0	0.0
	1.0		12676.0		
92.0		13132.0		54740.0	0.0
	1.0		13604.0		
93.0		14076.0		68344.0	0.0
	1.0		14564.0		
94.0		15052.0		82908.0	0.0
	0.2		3030.6		
<u>94.2</u>		15254.0		85938.6	0.0
	0.5		7753.0		
94.7		15758.0		93691.6	13.4
	0.5		8006.5		
95.2		16268.0		101698.1	38.0

HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 POND DEPTH VS STORAGE PROVIDED

POND IDENTIFIER Reconst. Sed. Pond "A"

*With
 - 3 years accumulated Sediment -*

ELEV feet	DEPTH feet	AREA sq.ft.	VOLUME cu.ft.	SUM VOL cu.ft.	OUTFLOW c.f.s.
<u>90.9</u>		12176.0		0.0	0.00
	1.1		13286.7		
92.0		13132.0		13286.7	0.00
	1.0		13604.0		
93.0		14076.0		26890.7	0.00
	1.0		14564.0		
94.0		15052.0		41454.7	0.00
	0.2		3030.6		
94.2		15254.0		44485.3	0.00
	0.5		7753.0		
94.7		15758.0		52238.3	13.44
	0.5		8006.5		
95.2		16268.0		60244.8	35.19

sediment level

PAGE
HORROCKS ENGINEERS
AMERICAN FORK, UTAH
February 27, 1984

**HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
STAGE, STORAGE & DISCHARGE**

POND IDENTIFIER Reconst. Sed. Pond "A"

*With
- 3 years accumulated sediment -*

ELEV	STORAGE (CU.FT.)	OUTFLOW (CFS)	2S/T+0 (CFS)
90.9	0.0	0.0	0.0
92.0	13286.7	0.0	73.8
93.0	26890.7	0.0	149.4
94.0	41454.7	0.0	230.3
94.2	44485.3	0.0	247.1
94.7	52238.3	13.4	303.7
95.2	60244.8	35.2	369.9

HORROCKS & CAROLLO ENGINEERS
 AMERICAN FORK, UTAH
 February 28, 1984

Hiawatha RAINFALL DATA BASE
 RAINFALL INTENSITY (Inches/Hour)

TIME (Min)	STORM FREQUENCY (Years)					
	2	5	10	25	50	100
5.0	0.84	1.56	1.92	2.76	3.12	3.72
6.0	0.79	1.49	1.84	2.63	2.98	3.55
7.0	0.74	1.42	1.76	2.50	2.84	3.38
8.0	0.69	1.35	1.68	2.37	2.70	3.21
9.0	0.64	1.28	1.60	2.24	2.56	3.04
10.0	0.60	1.20	1.50	2.10	2.40	2.88
11.0	0.58	1.16	1.45	2.03	2.32	2.78
12.0	0.56	1.12	1.40	1.96	2.24	2.68
13.0	0.54	1.08	1.35	1.89	2.16	2.58
14.0	0.53	1.04	1.30	1.82	2.08	2.48
15.0	0.52	1.00	1.24	1.76	2.00	2.40
20.0	0.47	0.90	1.11	1.59	1.80	2.16
25.0	0.42	0.80	0.98	1.42	1.60	1.92
30.0	0.36	0.70	0.86	1.24	1.40	1.68
40.0	0.32	0.61	0.76	1.09	1.23	1.48
50.0	0.28	0.52	0.66	0.94	1.06	1.28
60.0	0.23	0.44	0.55	0.78	0.88	1.06
120.0	0.20	0.31	0.38	0.50	0.56	0.65
180.0	0.18	0.26	0.31	0.40	0.44	0.51
240.0	0.17	0.24	0.28	0.36	0.40	0.46
300.0	0.16	0.22	0.25	0.32	0.36	0.41
360.0	0.16	0.20	0.23	0.28	0.32	0.35
480.0	0.14	0.18	0.20	0.25	0.28	0.31
600.0	0.12	0.16	0.17	0.22	0.24	0.27
720.0	0.11	0.13	0.15	0.18	0.20	0.22
1080.0	0.09	0.11	0.12	0.15	0.16	0.18
1440.0	0.07	0.08	0.09	0.11	0.12	0.13

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 S. C. S. HYDROGRAPH**

BASIN IDENTIFICATION Sediment Pond "A"
 BASIN DISCHARGES INTO Spillway

BASIN AREA = 14.35 ACRES *DISTURBED*
 BASIN CURVE NUMBER = 82.00
 24-HOUR PRECIPITATION = 2.60 INCHES
 AVERAGE BASIN SLOPE = 14.0 %
 HYDRAULIC LENGTH = 640.0 FEET
 BASIN LAG = 0.25 HOURS

**HYDROGRAPH RUNOFF VALUES
 25 YEAR STORM FREQUENCY**

TIME HOUR	RUNOFF C.F.S.						
9.20	0.0	9.30	0.0	9.40	0.0	9.50	0.0
9.60	0.0	9.70	0.0	9.80	0.0	9.90	0.0
10.00	0.0	10.10	0.0	10.20	0.0	10.30	0.0
10.40	0.1	10.50	0.1	10.60	0.1	10.70	0.1
10.80	0.2	10.90	0.2	11.00	0.2	11.10	0.3
11.20	0.3	11.30	0.4	11.40	0.5	11.50	0.6
11.60	0.8	11.70	1.6	11.80	2.9	11.90	5.5
12.00	9.6	12.10	<u>13.0</u>	12.20	12.8	12.30	10.1
12.40	7.3	12.50	5.7	12.60	4.6	12.70	3.8
12.80	3.1	12.90	2.6	13.00	2.3	13.10	2.2
13.20	2.0	13.30	1.7	13.40	1.5	13.50	1.5
13.60	1.4	13.70	1.3	13.80	1.2	13.90	1.2
14.00	1.1	14.10	1.1	14.20	1.0	14.30	0.9
14.40	0.9	14.50	0.8	14.60	0.8	14.70	0.8
14.80	0.8	14.90	0.8	15.00	0.8	15.10	0.8
15.20	0.7	15.30	0.6	15.40	0.5	15.50	0.4
15.60	0.3	15.70	0.2	15.80	0.1	15.90	0.0
16.00	0.0	16.10	0.0	16.20	0.0	16.30	0.0

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Reconst. Sed. Pond "A"
 25 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	01	2S2/T +02	02	2S2/T
11.40	0.0	0.5	0.0	0.0	0.5	0.0	0.5
11.50	0.5	0.6	0.5	0.0	1.6	0.0	1.6
11.60	0.6	0.8	1.6	0.0	3.0	0.0	3.0
11.70	0.8	1.6	3.0	0.0	5.4	0.0	5.4
11.80	1.6	2.9	5.4	0.0	9.9	0.0	9.9
11.90	2.9	5.5	9.9	0.0	18.4	0.0	18.4
12.00	5.5	9.6	18.4	0.0	33.6	0.0	33.6
12.10	9.6	13.0	33.6	0.0	56.1	0.0	56.1
12.20	13.0	12.8	56.1	0.0	81.8	0.0	81.8
12.30	12.8	10.1	81.8	0.0	104.7	0.0	104.7
12.40	10.1	7.3	104.7	0.0	122.2	0.0	122.2
12.50	7.3	5.7	122.2	0.0	135.2	0.0	135.2
12.60	5.7	4.6	135.2	0.0	145.5	0.0	145.5
12.70	4.6	3.8	145.5	0.0	153.9	0.0	153.9
12.80	3.8	3.1	153.9	0.0	160.8	0.0	160.8
12.90	3.1	2.6	160.8	0.0	166.4	0.0	166.4
13.00	2.6	2.3	166.4	0.0	171.3	0.0	171.3
13.10	2.3	2.2	171.3	0.0	175.8	0.0	175.8
13.20	2.2	2.0	175.8	0.0	180.0	0.0	180.0
13.30	2.0	1.7	180.0	0.0	183.7	0.0	183.7
13.40	1.7	1.5	183.7	0.0	186.9	0.0	186.9
13.50	1.5	1.5	186.9	0.0	189.9	0.0	189.9
13.60	1.5	1.4	189.9	0.0	192.8	0.0	192.8
13.70	1.4	1.3	192.8	0.0	195.6	0.0	195.6
13.80	1.3	1.2	195.6	0.0	198.1	0.0	198.1
13.90	1.2	1.2	198.1	0.0	200.6	0.0	200.6
14.00	1.2	1.1	200.6	0.0	202.9	0.0	202.9
14.10	1.1	1.1	202.9	0.0	205.1	0.0	205.1
14.20	1.1	1.0	205.1	0.0	207.2	0.0	207.2
14.30	1.0	0.9	207.2	0.0	209.2	0.0	209.2
14.40	0.9	0.9	209.2	0.0	211.0	0.0	211.0
14.50	0.9	0.8	211.0	0.0	212.7	0.0	212.7
14.60	0.8	0.8	212.7	0.0	214.4	0.0	214.4
14.70	0.8	0.8	214.4	0.0	216.0	0.0	216.0
14.80	0.8	0.8	216.0	0.0	217.6	0.0	217.6

**HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area**

BASIN IDENTIFIER Sediment Pond "A"
POND IDENTIFIER Reconst. Sed. Pond "A"
25 YEAR STORM FREQUENCY (CONT'D)

14.90	0.8	0.8	217.6	0.0	219.1	0.0	219.1
15.00	0.8	0.8	219.1	0.0	220.7	0.0	220.7
15.10	0.8	0.8	220.7	0.0	222.3	0.0	222.3
15.20	0.8	0.7	222.3	0.0	223.8	0.0	223.8
15.30	0.7	0.6	223.8	0.0	225.1	0.0	225.1

MAXIMUM OUTFLOW = 0.0 C.F.S.
MAXIMUM STORAGE = 44,485.3 CU FT. ✓
MAXIMUM ELEVATION = 94.2 FEET

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 S. C. S. HYDROGRAPH**

BASIN IDENTIFICATION Sediment Pond "A"
 BASIN DISCHARGES INTO Spillway

BASIN AREA = 14.35 ACRES
 BASIN CURVE NUMBER = 82.00
 24-HOUR PRECIPITATION = 2.90 INCHES
 AVERAGE BASIN SLOPE = 14.0 %
 HYDRAULIC LENGTH = 640.0 FEET
 BASIN LAG = 0.25 HOURS

**HYDROGRAPH RUNOFF VALUES
 50 YEAR STORM FREQUENCY**

TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.
8.80	0.0	8.90	0.0	9.00	0.0	9.10	0.0
9.20	0.0	9.30	0.0	9.40	0.0	9.50	0.0
9.60	0.0	9.70	0.0	9.80	0.0	9.90	0.1
10.00	0.1	10.10	0.1	10.20	0.1	10.30	0.1
10.40	0.2	10.50	0.2	10.60	0.2	10.70	0.2
10.80	0.3	10.90	0.3	11.00	0.4	11.10	0.4
11.20	0.5	11.30	0.6	11.40	0.7	11.50	0.8
11.60	1.2	11.70	2.1	11.80	3.9	11.90	7.1
12.00	12.0	12.10	15.9	12.20	15.6	12.30	12.3
12.40	8.8	12.50	6.8	12.60	5.6	12.70	4.5
12.80	3.7	12.90	3.1	13.00	2.8	13.10	2.6
13.20	2.4	13.30	2.0	13.40	1.8	13.50	1.7
13.60	1.7	13.70	1.6	13.80	1.5	13.90	1.4
14.00	1.3	14.10	1.3	14.20	1.2	14.30	1.1
14.40	1.0	14.50	1.0	14.60	1.0	14.70	0.9
14.80	0.9	14.90	0.9	15.00	0.9	15.10	0.9
15.20	0.8	15.30	0.7	15.40	0.6	15.50	0.5
15.60	0.4	15.70	0.3	15.80	0.2	15.90	0.1
16.00	0.0	16.10	0.0	16.20	0.0	16.30	0.0
16.40	0.0	16.50	0.0	16.60	0.0	16.70	0.0

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Reconst. Sed. Pond "A"
 50 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	O1	2S2/T +O2	O2	2S2/T
11.20	0.0	0.5	0.0	0.0	0.5	0.0	0.5
11.30	0.5	0.6	0.5	0.0	1.7	0.0	1.7
11.40	0.6	0.7	1.7	0.0	3.1	0.0	3.1
11.50	0.7	0.8	3.1	0.0	4.6	0.0	4.6
11.60	0.8	1.2	4.6	0.0	6.7	0.0	6.7
11.70	1.2	2.1	6.7	0.0	9.9	0.0	9.9
11.80	2.1	3.9	9.9	0.0	15.9	0.0	15.9
11.90	3.9	7.1	15.9	0.0	26.8	0.0	26.8
12.00	7.1	12.0	26.8	0.0	45.9	0.0	45.9
12.10	12.0	15.9	45.9	0.0	73.7	0.0	73.7
12.20	15.9	15.6	73.7	0.0	105.2	0.0	105.2
12.30	15.6	12.3	105.2	0.0	133.1	0.0	133.1
12.40	12.3	8.8	133.1	0.0	154.2	0.0	154.2
12.50	8.8	6.8	154.2	0.0	169.9	0.0	169.9
12.60	6.8	5.6	169.9	0.0	182.3	0.0	182.3
12.70	5.6	4.5	182.3	0.0	192.4	0.0	192.4
12.80	4.5	3.7	192.4	0.0	200.6	0.0	200.6
12.90	3.7	3.1	200.6	0.0	207.3	0.0	207.3
13.00	3.1	2.8	207.3	0.0	213.1	0.0	213.1
13.10	2.8	2.6	213.1	0.0	218.5	0.0	218.5
13.20	2.6	2.4	218.5	0.0	223.5	0.0	223.5
13.30	2.4	2.0	223.5	0.0	227.8	0.0	227.8
13.40	2.0	1.8	227.8	0.0	231.6	0.0	231.6
13.50	1.8	1.7	231.6	0.0	235.2	0.0	235.2
13.60	1.7	1.7	235.2	0.0	238.6	0.0	238.6
13.70	1.7	1.6	238.6	0.0	241.8	0.0	241.8
13.80	1.6	1.5	241.8	0.0	244.9	0.0	244.9
13.90	1.5	1.4	244.9	0.0	247.7	0.1	247.6
14.00	1.4	1.3	247.6	0.1	250.1	0.7	249.4
14.10	1.3	1.3	249.4	0.7	251.3	1.0	250.3
14.20	1.3	1.2	250.3	1.0	251.8	1.1	250.7
14.30	1.2	1.1	250.7	1.1	251.9	1.1	250.8
14.40	1.1	1.0	250.8	1.1	251.8	1.1	250.7
14.50	1.0	1.0	250.7	1.1	251.6	1.1	250.5
14.60	1.0	1.0	250.5	1.1	251.4	1.0	250.4

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Reconst. Sed. Pond "A"
 50 YEAR STORM FREQUENCY (CONT'D)

14.70	1.0	0.9	250.4	1.0	251.3	1.0	250.3
14.80	0.9	0.9	250.3	1.0	251.2	1.0	250.2
14.90	0.9	0.9	250.2	1.0	251.1	0.9	250.2
15.00	0.9	0.9	250.2	0.9	251.1	0.9	250.1
15.10	0.9	0.9	250.1	0.9	251.1	0.9	250.1
15.20	0.9	0.8	250.1	0.9	250.9	0.9	250.0
15.30	0.8	0.7	250.0	0.9	250.7	0.8	249.8
15.40	0.7	0.6	249.8	0.8	250.4	0.8	249.6
15.50	0.6	0.5	249.6	0.8	250.0	0.7	249.3
15.60	0.5	0.4	249.3	0.7	249.6	0.6	249.0
15.70	0.4	0.3	249.0	0.6	249.2	0.5	248.7

MAXIMUM OUTFLOW = 1.1 C.F.S.
 MAXIMUM STORAGE = 45,140.6 CU FT.
 MAXIMUM ELEVATION = 94.2 FEET

HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
S. C. S. HYDROGRAPH

BASIN IDENTIFICATION Sediment Pond "A"
 BASIN DISCHARGES INTO Spillway

BASIN AREA = 14.35 ACRES
 BASIN CURVE NUMBER = 82.00
 24-HOUR PRECIPITATION = 3.18 INCHES
 AVERAGE BASIN SLOPE = 14.0 %
 HYDRAULIC LENGTH = 640.0 FEET
 * BASIN LAG = 0.25 HOURS

HYDROGRAPH RUNOFF VALUES
 100 YEAR STORM FREQUENCY

TIME HOUR	RUNOFF C.F.S.						
8.00	0.0	8.10	0.0	8.20	0.0	8.30	0.0
8.40	0.0	8.50	0.0	8.60	0.0	8.70	0.0
8.80	0.0	8.90	0.0	9.00	0.0	9.10	0.0
9.20	0.0	9.30	0.0	9.40	0.0	9.50	0.1
9.60	0.1	9.70	0.1	9.80	0.1	9.90	0.1
10.00	0.1	10.10	0.2	10.20	0.2	10.30	0.2
10.40	0.2	10.50	0.3	10.60	0.3	10.70	0.4
10.80	0.4	10.90	0.5	11.00	0.5	11.10	0.6
11.20	0.7	11.30	0.8	11.40	1.0	11.50	1.1
11.60	1.5	11.70	2.7	11.80	4.8	11.90	8.6
12.00	14.2	12.10	18.8	12.20	18.3	12.30	14.4
12.40	10.3	12.50	7.9	12.60	6.5	12.70	5.2
12.80	4.2	12.90	3.5	13.00	3.2	13.10	3.0
13.20	2.7	13.30	2.2	13.40	2.1	13.50	2.0
13.60	1.9	13.70	1.8	13.80	1.7	13.90	1.6
14.00	1.5	14.10	1.5	14.20	1.4	14.30	1.3
14.40	1.2	14.50	1.1	14.60	1.1	14.70	1.1
14.80	1.1	14.90	1.1	15.00	1.1	15.10	1.1
15.20	1.0	15.30	0.9	15.40	0.8	15.50	0.7
15.60	0.6	15.70	0.5	15.80	0.4	15.90	0.3
16.00	0.2	16.10	0.1	16.20	0.0	16.30	0.0
16.40	0.0	16.50	0.0	16.60	0.0	16.70	0.0

HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Reconst. Sed. Pond "A"
 100 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	O1	2S2/T +O2	O2	2S2/T
11.00	0.0	0.5	0.0	0.0	0.5	0.0	0.5
11.10	0.5	0.6	0.5	0.0	1.6	0.0	1.6
11.20	0.6	0.7	1.6	0.0	2.9	0.0	2.9
11.30	0.7	0.8	2.9	0.0	4.5	0.0	4.5
11.40	0.8	1.0	4.5	0.0	6.3	0.0	6.3
11.50	1.0	1.1	6.3	0.0	8.4	0.0	8.4
11.60	1.1	1.5	8.4	0.0	11.0	0.0	11.0
11.70	1.5	2.7	11.0	0.0	15.1	0.0	15.1
11.80	2.7	4.8	15.1	0.0	22.6	0.0	22.6
11.90	4.8	8.6	22.6	0.0	35.9	0.0	35.9
12.00	8.6	14.2	35.9	0.0	58.7	0.0	58.7
12.10	14.2	18.8	58.7	0.0	91.7	0.0	91.7
12.20	18.8	18.3	91.7	0.0	128.8	0.0	128.8
12.30	18.3	14.4	128.8	0.0	161.4	0.0	161.4
12.40	14.4	10.3	161.4	0.0	186.1	0.0	186.1
12.50	10.3	7.9	186.1	0.0	204.3	0.0	204.3
12.60	7.9	6.5	204.3	0.0	218.6	0.0	218.6
12.70	6.5	5.2	218.6	0.0	230.3	0.0	230.3
12.80	5.2	4.2	230.3	0.0	239.8	0.0	239.8
12.90	4.2	3.5	239.8	0.0	247.5	0.1	247.4
13.00	3.5	3.2	247.4	0.1	254.1	1.6	252.4
13.10	3.2	3.0	252.4	1.6	256.9	2.3	254.6
13.20	3.0	2.7	254.6	2.3	258.0	2.6	255.4
13.30	2.7	2.2	255.4	2.6	257.8	2.5	255.3
13.40	2.2	2.1	255.3	2.5	257.1	2.4	254.7
13.50	2.1	2.0	254.7	2.4	256.4	2.2	254.2
13.60	2.0	1.9	254.2	2.2	255.9	2.1	253.8
13.70	1.9	1.8	253.8	2.1	255.4	2.0	253.5
13.80	1.8	1.7	253.5	2.0	255.0	1.9	253.1
13.90	1.7	1.6	253.1	1.9	254.5	1.7	252.7
14.00	1.6	1.5	252.7	1.7	254.1	1.7	252.4
14.10	1.5	1.5	252.4	1.7	253.8	1.6	252.2
14.20	1.5	1.4	252.2	1.6	253.5	1.5	252.0
14.30	1.4	1.3	252.0	1.5	253.1	1.4	251.7
14.40	1.3	1.2	251.7	1.4	252.7	1.3	251.4

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Reconst. Sed. Pond "A"
 100 YEAR STORM FREQUENCY (CONT'D)

14.50	1.2	1.1	251.4	1.3	252.3	1.2	251.1
14.60	1.1	1.1	251.1	1.2	252.1	1.2	250.9
14.70	1.1	1.1	250.9	1.2	251.9	1.1	250.8
14.80	1.1	1.1	250.8	1.1	251.8	1.1	250.7
14.90	1.1	1.1	250.7	1.1	251.7	1.1	250.6
15.00	1.1	1.1	250.6	1.1	251.6	1.1	250.6
15.10	1.1	1.1	250.6	1.1	251.6	1.1	250.5
15.20	1.1	1.0	250.5	1.1	251.5	1.0	250.5
15.30	1.0	0.9	250.5	1.0	251.2	1.0	250.3
15.40	0.9	0.8	250.3	1.0	250.9	0.9	250.0
15.50	0.8	0.7	250.0	0.9	250.5	0.8	249.7
15.60	0.7	0.6	249.7	0.8	250.1	0.7	249.4
15.70	0.6	0.5	249.4	0.7	249.7	0.6	249.1
15.80	0.5	0.4	249.1	0.6	249.3	0.5	248.8
15.90	0.4	0.3	248.8	0.5	248.9	0.4	248.5

MAXIMUM OUTFLOW = 2.6 C.F.S.
 MAXIMUM STORAGE = 45,975.2 CU FT.
 MAXIMUM ELEVATION = 94.3 FEET

HYDROLOGICAL STUDY FOR
CO-OP Mine Disturbed Area

Existing Sediment Pond "A"

Bear Canyon Mine Site

BY

HORROCKS & CAROLLO ENGINEERS

ONE WEST MAIN

AMERICAN FORK, UTAH 84003

February 28, 1984



ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(inches)

Station: Clear Creek Summit
Latitude: 39° 39'

Elevation: 9630
Longitude: 111° 12'

D U R A T I O N

RETURN PERIOD (years)	D U R A T I O N									
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.10	.16	.20	.28	.35	.46	.57	.84	1.08	1.33
2	.12	.19	.25	.34	.43	.57	.70	1.04	1.34	1.65
5	.16	.24	.31	.43	.54	.72	.90	1.34	1.73	2.14
10	.19	.29	.37	.51	.65	.86	1.06	1.55	1.99	2.45
25	.24	.38	.48	.66	.84	1.08	1.31	1.88	2.39	2.92
50	.25	.38	.48	.67	.85	1.13	1.40	2.07	2.67	3.29
100	.27	.42	.53	.73	.93	1.24	1.54	2.29	2.96	3.65

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION
(inches)

Station: Hiawatha
Latitude: 39° 29'

Elevation: 7230
Longitude: 111° 01'

D U R A T I O N

RETURN PERIOD (years)	D U R A T I O N									
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.03	.04	.05	.07	.09	.24	.39	.76	1.09	1.43
2	.07	.10	.13	.18	.23	.40	.55	.95	1.30	1.67
5	.13	.20	.25	.35	.44	.62	.79	1.22	1.60	2.00
10	.16	.25	.31	.43	.55	.75	.93	1.40	1.82	2.25
25	.23	.35	.44	.62	.78	.99	1.19	1.69	2.14	2.60
50	.26	.40	.50	.70	.88	1.11	1.33	1.89	2.38	2.90
100	.31	.48	.60	.84	1.06	1.39	1.54	2.12	2.64	3.18

Hiawatha RAINFALL DATA BASE
 RAINFALL INTENSITY (Inches/Hour)

TIME (Min)	STORM FREQUENCY (Years)					
	2	5	10	25	50	100
5.0	0.84	1.56	1.92	2.76	3.12	3.72
6.0	0.79	1.49	1.84	2.63	2.98	3.55
7.0	0.74	1.42	1.76	2.50	2.84	3.38
8.0	0.69	1.35	1.68	2.37	2.70	3.21
9.0	0.64	1.28	1.60	2.24	2.56	3.04
10.0	0.60	1.20	1.50	2.10	2.40	2.88
11.0	0.58	1.16	1.45	2.03	2.32	2.78
12.0	0.56	1.12	1.40	1.96	2.24	2.68
13.0	0.54	1.08	1.35	1.89	2.16	2.58
14.0	0.53	1.04	1.30	1.82	2.08	2.48
15.0	0.52	1.00	1.24	1.76	2.00	2.40
20.0	0.47	0.90	1.11	1.59	1.80	2.16
25.0	0.42	0.80	0.98	1.42	1.60	1.92
30.0	0.36	0.70	0.86	1.24	1.40	1.68
40.0	0.32	0.61	0.76	1.09	1.23	1.48
50.0	0.28	0.52	0.66	0.94	1.06	1.28
60.0	0.23	0.44	0.55	0.78	0.88	1.06
120.0	0.20	0.31	0.38	0.50	0.56	0.65
180.0	0.18	0.26	0.31	0.40	0.44	0.51
240.0	0.17	0.24	0.28	0.36	0.40	0.46
300.0	0.16	0.22	0.25	0.32	0.36	0.41
360.0	0.16	0.20	0.23	0.28	0.32	0.35
480.0	0.14	0.18	0.20	0.25	0.28	0.31
600.0	0.12	0.16	0.17	0.22	0.24	0.27
720.0	0.11	0.13	0.15	0.18	0.20	0.22
1080.0	0.09	0.11	0.12	0.15	0.16	0.18
1440.0	0.07	0.08	0.09	0.11	0.12	0.13

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HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
POND DEPTH VS STORAGE PROVIDED

POND IDENTIFIER Sed. Pond "A" - *Existing Pond*

ELEV feet	DEPTH feet	AREA sq.ft.	VOLUME cu.ft.	SUM VOL cu.ft.	OUTFLOW c.f.s.
89.8		7020.0		0.0	0.0
	4.1		32126.4		
93.9		8500.0		32126.4	0.0
	0.5		4447.0		
94.4		9288.0		36573.4	13.4
	0.4		4355.5		
94.8		10070.0		40928.9	35.2

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**HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
STAGE, STORAGE & DISCHARGE**

POND IDENTIFIER Sed. Pond "A" - *Existing Pond*

ELEV	STORAGE (CU.FT.)	OUTFLOW (CFS)	2S/T+0 (CFS)
89.8	0.0	0.0	0.0
93.9	32126.4	0.0	142.8
94.4	36573.4	13.4	176.0
94.8	40928.9	35.2	217.1

Existing Spillway

BROAD CRESTED WEIR

WIDTH = 10.00 FEET

ELEV. (FT.)	FLOW (CFS)
93.89	0.00
93.94	0.42
93.99	1.20
94.04	2.21
94.09	3.40
94.14	4.75
94.19	6.24
94.24	7.87
94.29	9.61
94.34	11.47
94.39	13.44
94.44	15.50
94.49	17.66
94.54	19.91
94.59	22.26
94.64	24.68
94.69	27.19
94.74	29.78
94.79	32.44
94.84	35.19

FORMULA USED: $Q = C * L * H^{1.5}$

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**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 UNIVERSAL RATIONAL HYDROGRAPH**

Q(Peak) = C*I*A
 10 YEAR STORM FREQUENCY

BASIN IDENTIFIER Sediment Pond "A"
 DISCHARGES INTO Spillway

BASIN AREA = 14.35 ACRES
 RUNOFF COEFF. = 0.40
 RAINFALL INT. = 1.24 IN/HR

TIME (MIN)	RUNOFF (C.F.S.)
0.0	0.0
7.5	0.6
15.0	1.3
22.5	1.6
30.0	1.9
37.5	4.5
45.0	7.1
52.5	4.9
60.0	2.8
67.5	2.6
75.0	2.4
82.5	1.9
90.0	1.4
97.5	1.2
105.0	1.0
112.5	0.7
120.0	0.5
127.5	0.4
135.0	0.4
142.5	0.2
150.0	0.0
157.5	0.0
165.0	0.0
172.5	0.0
180.0	0.0
187.5	0.0
195.0	0.0
202.5	0.0
210.0	0.0
217.5	0.0

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Sed. Pond "A"
 10 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	01	2S2/T +02	02	2S2/T
7.5	0.0	0.6	0.0	0.0	0.6	0.0	0.6
15.0	0.6	1.3	0.6	0.0	2.6	0.0	2.6
22.5	1.3	1.6	2.6	0.0	5.4	0.0	5.4
30.0	1.6	1.9	5.4	0.0	9.0	0.0	9.0
37.5	1.9	4.5	9.0	0.0	15.4	0.0	15.4
45.0	4.5	7.1	15.4	0.0	27.1	0.0	27.1
52.5	7.1	4.9	27.1	0.0	39.1	0.0	39.1
60.0	4.9	2.8	39.1	0.0	46.8	0.0	46.8
67.5	2.8	2.6	46.8	0.0	52.1	0.0	52.1
75.0	2.6	2.4	52.1	0.0	57.1	0.0	57.1
82.5	2.4	1.9	57.1	0.0	61.3	0.0	61.3
90.0	1.9	1.4	61.3	0.0	64.7	0.0	64.7
97.5	1.4	1.2	64.7	0.0	67.3	0.0	67.3
105.0	1.2	1.0	67.3	0.0	69.5	0.0	69.5
112.5	1.0	0.7	69.5	0.0	71.2	0.0	71.2
120.0	0.7	0.5	71.2	0.0	72.4	0.0	72.4
127.5	0.5	0.4	72.4	0.0	73.3	0.0	73.3
135.0	0.4	0.4	73.3	0.0	74.1	0.0	74.1
142.5	0.4	0.2	74.1	0.0	74.7	0.0	74.7
150.0	0.2	0.0	74.7	0.0	74.9	0.0	74.9
157.5	0.0	0.0	74.9	0.0	74.9	0.0	74.9
165.0	0.0	0.0	74.9	0.0	74.9	0.0	74.9
172.5	0.0	0.0	74.9	0.0	74.9	0.0	74.9
180.0	0.0	0.0	74.9	0.0	74.9	0.0	74.9
187.5	0.0	0.0	74.9	0.0	74.9	0.0	74.9
195.0	0.0	0.0	74.9	0.0	74.9	0.0	74.9
202.5	0.0	0.0	74.9	0.0	74.9	0.0	74.9
210.0	0.0	0.0	74.9	0.0	74.9	0.0	74.9
217.5	0.0	0.0	74.9	0.0	74.9	0.0	74.9

MAXIMUM ELEVATION = 93.9 FT
 MAXIMUM STORAGE = 32126.4 CU FT
 MAXIMUM DISCHARGE = 0.0 CFS

HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area
S. C. S. HYDROGRAPH

BASIN IDENTIFICATION		Sediment Pond "A"
BASIN DISCHARGES INTO		Spillway
BASIN AREA	=	14.35 ACRES
BASIN CURVE NUMBER	=	82.00
24-HOUR PRECIPITATION	=	2.25 INCHES
AVERAGE BASIN SLOPE	=	14.0 %
HYDRAULIC LENGTH	=	1,033.4 FEET
BASIN LAG	=	0.25 HOURS

HYDROGRAPH RUNOFF VALUES
10 YEAR STORM FREQUENCY

TIME HOUR	RUNOFF C.F.S.						
10.00	0.0	10.10	0.0	10.20	0.0	10.30	0.0
10.40	0.0	10.50	0.0	10.60	0.0	10.70	0.0
10.80	0.0	10.90	0.1	11.00	0.1	11.10	0.1
11.20	0.2	11.30	0.2	11.40	0.3	11.50	0.3
11.60	0.5	11.70	1.0	11.80	1.9	11.90	3.9
12.00	7.0	12.10	9.7	12.20	9.6	12.30	7.7
12.40	5.6	12.50	4.4	12.60	3.6	12.70	3.0
12.80	2.4	12.90	2.0	13.00	1.8	13.10	1.7
13.20	1.6	13.30	1.3	13.40	1.2	13.50	1.2
13.60	1.1	13.70	1.1	13.80	1.0	13.90	0.9
14.00	0.9	14.10	0.9	14.20	0.8	14.30	0.7
14.40	0.7	14.50	0.7	14.60	0.6	14.70	0.6
14.80	0.6	14.90	0.6	15.00	0.6	15.10	0.5
15.20	0.4	15.30	0.3	15.40	0.2	15.50	0.1
15.60	0.0	15.70	0.0	15.80	0.0	15.90	0.0
16.00	0.0	16.10	0.0	16.20	0.0	16.30	0.0

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POND IDENTIFIER Sed. Pond "A" *Existing Pond - more data points*

ELEV feet	DEPTH feet	AREA sq.ft.	VOLUME cu.ft.	SUM VOL cu.ft.	OUTFLOW c.f.s.
89.8		7020.0		0.0	0.00
	2.0		14780.0		
91.8		7760.0		14780.0	0.00
	2.1		17073.0		
93.9		8500.0		31853.0	0.00
	0.5		4447.0		
94.4		9288.0		36300.0	13.40
	0.4		3871.6		
94.8		10070.0		40171.6	35.20

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HYDROLOGIC REPORT FOR
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STAGE, STORAGE & DISCHARGE

POND IDENTIFIER Sed. Pond "A"

Existing Pond - More data points

ELEV	STORAGE (CU.FT.)	OUTFLOW (CFS)	25/T+0 (CFS)
89.8	0.0	0.0	0.0
91.8	14780.0	0.0	82.1
93.9	31853.0	0.0	177.0
94.4	36300.0	13.4	215.1
94.8	40171.6	35.2	258.4

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Sed. Pond "A"
 10 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	O1	2S2/T +O2	O2	2S2/T
11.70	0.0	1.0	0.0	0.0	1.0	0.0	1.0
11.80	1.0	1.9	1.0	0.0	3.9	0.0	3.9
11.90	1.9	3.9	3.9	0.0	9.7	0.0	9.7
12.00	3.9	7.0	9.7	0.0	20.6	0.0	20.6
12.10	7.0	9.7	20.6	0.0	37.2	0.0	37.2
12.20	9.7	9.6	37.2	0.0	56.5	0.0	56.5
12.30	9.6	7.7	56.5	0.0	73.9	0.0	73.9
12.40	7.7	5.6	73.9	0.0	87.2	0.0	87.2
12.50	5.6	4.4	87.2	0.0	97.1	0.0	97.1
12.60	4.4	3.6	97.1	0.0	105.1	0.0	105.1
12.70	3.6	3.0	105.1	0.0	111.7	0.0	111.7
12.80	3.0	2.4	111.7	0.0	117.0	0.0	117.0
12.90	2.4	2.0	117.0	0.0	121.4	0.0	121.4
13.00	2.0	1.8	121.4	0.0	125.3	0.0	125.3
13.10	1.8	1.7	125.3	0.0	128.8	0.0	128.8
13.20	1.7	1.6	128.8	0.0	132.1	0.0	132.1
13.30	1.6	1.3	132.1	0.0	135.1	0.0	135.1
13.40	1.3	1.2	135.1	0.0	137.6	0.0	137.6
13.50	1.2	1.2	137.6	0.0	140.0	0.0	140.0
13.60	1.2	1.1	140.0	0.0	142.3	0.0	142.3
13.70	1.1	1.1	142.3	0.0	144.5	0.0	144.5
13.80	1.1	1.0	144.5	0.0	146.5	0.0	146.5
13.90	1.0	0.9	146.5	0.0	148.4	0.0	148.4
14.00	0.9	0.9	148.4	0.0	150.3	0.0	150.3
14.10	0.9	0.9	150.3	0.0	152.0	0.0	152.0
14.20	0.9	0.8	152.0	0.0	153.7	0.0	153.7
14.30	0.8	0.7	153.7	0.0	155.3	0.0	155.3
14.40	0.7	0.7	155.3	0.0	156.8	0.0	156.8
14.50	0.7	0.7	156.8	0.0	158.1	0.0	158.1
14.60	0.7	0.6	158.1	0.0	159.4	0.0	159.4
14.70	0.6	0.6	159.4	0.0	160.7	0.0	160.7
14.80	0.6	0.6	160.7	0.0	162.0	0.0	162.0
14.90	0.6	0.6	162.0	0.0	163.3	0.0	163.3
15.00	0.6	0.6	163.3	0.0	164.5	0.0	164.5
15.10	0.6	0.5	164.5	0.0	165.7	0.0	165.7

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**HYDROLOGIC REPORT FOR
CO-OP Mine Disturbed Area**

BASIN IDENTIFIER Sediment Pond "A"
POND IDENTIFIER Sed. Pond "A"
10 YEAR STORM FREQUENCY (CONT'D)

MAXIMUM OUTFLOW = 0.0 C.F.S.
MAXIMUM STORAGE = 31,853.0 CU FT.
MAXIMUM ELEVATION = 93.9 FEET

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 S. C. S. HYDROGRAPH**

BASIN IDENTIFICATION Sediment Pond "A"
 BASIN DISCHARGES INTO Spillway

BASIN AREA = 14.35 ACRES
 BASIN CURVE NUMBER = 82.00
 24-HOUR PRECIPITATION = 3.18 INCHES
 AVERAGE BASIN SLOPE = 14.0 %
 HYDRAULIC LENGTH = 1,033.4 FEET
 BASIN LAG = 0.25 HOURS

**HYDROGRAPH RUNOFF VALUES
 100 YEAR STORM FREQUENCY**

TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.	TIME HOUR	RUNOFF C.F.S.
8.00	0.0	8.10	0.0	8.20	0.0	8.30	0.0
8.40	0.0	8.50	0.0	8.60	0.0	8.70	0.0
8.80	0.0	8.90	0.0	9.00	0.0	9.10	0.0
9.20	0.0	9.30	0.0	9.40	0.0	9.50	0.1
9.60	0.1	9.70	0.1	9.80	0.1	9.90	0.1
10.00	0.1	10.10	0.2	10.20	0.2	10.30	0.2
10.40	0.2	10.50	0.3	10.60	0.3	10.70	0.4
10.80	0.4	10.90	0.5	11.00	0.5	11.10	0.6
11.20	0.7	11.30	0.8	11.40	1.0	11.50	1.1
11.60	1.5	11.70	2.7	11.80	4.8	11.90	8.6
12.00	14.2	12.10	18.8	12.20	18.3	12.30	14.4
12.40	10.3	12.50	7.9	12.60	6.5	12.70	5.2
12.80	4.2	12.90	3.5	13.00	3.2	13.10	3.0
13.20	2.7	13.30	2.2	13.40	2.1	13.50	2.0
13.60	1.9	13.70	1.8	13.80	1.7	13.90	1.6
14.00	1.5	14.10	1.5	14.20	1.4	14.30	1.3
14.40	1.2	14.50	1.1	14.60	1.1	14.70	1.1
14.80	1.1	14.90	1.1	15.00	1.1	15.10	1.1
15.20	1.0	15.30	0.9	15.40	0.8	15.50	0.7
15.60	0.6	15.70	0.5	15.80	0.4	15.90	0.3
16.00	0.2	16.10	0.1	16.20	0.0	16.30	0.0
16.40	0.0	16.50	0.0	16.60	0.0	16.70	0.0

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 HORROCKS ENGINEERS
 AMERICAN FORK, UTAH
 February 27, 1984

**HYDROLOGIC REPORT FOR
 CO-OP Mine Disturbed Area
 HYDROGRAPH RESERVOIR ROUTING**

BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Sed. Pond "A"
 100 YEAR STORM FREQUENCY

T	I1	I2	2S1/T	O1	2S2/T +02	O2	2S2/T
11.00	0.0	0.5	0.0	0.0	0.5	0.0	0.5
11.10	0.5	0.6	0.5	0.0	1.6	0.0	1.6
11.20	0.6	0.7	1.6	0.0	2.9	0.0	2.9
11.30	0.7	0.8	2.9	0.0	4.5	0.0	4.5
11.40	0.8	1.0	4.5	0.0	6.3	0.0	6.3
11.50	1.0	1.1	6.3	0.0	8.4	0.0	8.4
11.60	1.1	1.5	8.4	0.0	11.0	0.0	11.0
11.70	1.5	2.7	11.0	0.0	15.1	0.0	15.1
11.80	2.7	4.8	15.1	0.0	22.6	0.0	22.6
11.90	4.8	8.6	22.6	0.0	35.9	0.0	35.9
12.00	8.6	14.2	35.9	0.0	58.7	0.0	58.7
12.10	14.2	18.8	58.7	0.0	91.7	0.0	91.7
12.20	18.8	18.3	91.7	0.0	128.8	0.0	128.8
12.30	18.3	14.4	128.8	0.0	161.4	0.0	161.4
12.40	14.4	10.3	161.4	0.0	186.1	3.2	182.9
12.50	10.3	7.9	182.9	3.2	197.9	7.4	190.5
12.60	7.9	6.5	190.5	7.4	197.5	7.2	190.3
12.70	6.5	5.2	190.3	7.2	194.7	6.3	188.5
12.80	5.2	4.2	188.5	6.3	191.7	5.2	186.5
12.90	4.2	3.5	186.5	5.2	189.1	4.3	184.8
13.00	3.5	3.2	184.8	4.3	187.3	3.6	183.6
13.10	3.2	3.0	183.6	3.6	186.2	3.2	182.9
13.20	3.0	2.7	182.9	3.2	185.4	3.0	182.4
13.30	2.7	2.2	182.4	3.0	184.5	2.6	181.8
13.40	2.2	2.1	181.8	2.6	183.5	2.3	181.2
13.50	2.1	2.0	181.2	2.3	183.0	2.1	180.9
13.60	2.0	1.9	180.9	2.1	182.6	2.0	180.6
13.70	1.9	1.8	180.6	2.0	182.4	1.9	180.5
13.80	1.8	1.7	180.5	1.9	182.0	1.8	180.2
13.90	1.7	1.6	180.2	1.8	181.7	1.7	180.0
14.00	1.6	1.5	180.0	1.7	181.5	1.6	179.9
14.10	1.5	1.5	179.9	1.6	181.3	1.5	179.8
14.20	1.5	1.4	179.8	1.5	181.1	1.5	179.6
14.30	1.4	1.3	179.6	1.5	180.8	1.4	179.5
14.40	1.3	1.2	179.5	1.4	180.5	1.3	179.3

**HYDROLOGIC REPORT FOR
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BASIN IDENTIFIER Sediment Pond "A"
 POND IDENTIFIER Sed. Pond "A"
 100 YEAR STORM FREQUENCY (CONT'D)

14.50	1.2	1.1	179.3	1.3	180.3	1.2	179.1
14.60	1.1	1.1	179.1	1.2	180.2	1.1	179.0
14.70	1.1	1.1	179.0	1.1	180.1	1.1	179.0
14.80	1.1	1.1	179.0	1.1	180.0	1.1	178.9
14.90	1.1	1.1	178.9	1.1	180.0	1.1	178.9
15.00	1.1	1.1	178.9	1.1	180.0	1.1	178.9
15.10	1.1	1.1	178.9	1.1	180.0	1.1	178.9
15.20	1.1	1.0	178.9	1.1	179.9	1.0	178.8
15.30	1.0	0.9	178.8	1.0	179.6	0.9	178.7
15.40	0.9	0.8	178.7	0.9	179.4	0.8	178.5
15.50	0.8	0.7	178.5	0.8	179.1	0.7	178.3
15.60	0.7	0.6	178.3	0.7	178.8	0.6	178.2
15.70	0.6	0.5	178.2	0.6	178.5	0.5	178.0
15.80	0.5	0.4	178.0	0.5	178.2	0.4	177.8

MAXIMUM OUTFLOW = 7.4 C.F.S.
 MAXIMUM STORAGE = 34,292.8 CU FT.
 MAXIMUM ELEVATION = 94.2 FEET