PART D
OPERATION AND RECLAMATION PLAN

APPENDICES

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APPENDIX A
E-10 FLOCCULENT
SPECIFICATION SHEET

Allied Colloids

Technical and Processing Data

TPD 1025

PERCOL E10

ANIONIC FLOCCULANT

DESCRIPTION

PERCOL E10 is a very high molecular weight slightly anionic polyacrylamide flocculant supplied as a free flowing granular powder.

PRINCIPAL USES

PERCOL E10 has found application in a wide variety of mineral processing operations including the following:

1. Acid leach CCD (Uranium)
2. Potash slimes clarification and dewatering
3. Acid leach CCD (Copper)
4. Acid leach (Zinc)
5. Iron ore tailings clarification
6. Base metal concentrate thickening and filtration.
7. Deep cone thickening of coal tailings

Dosage depends upon the application but normally lies in the range 2 gm to 200 gm per tonne of dry substrate flocculated.

TYPICAL PROPERTIES

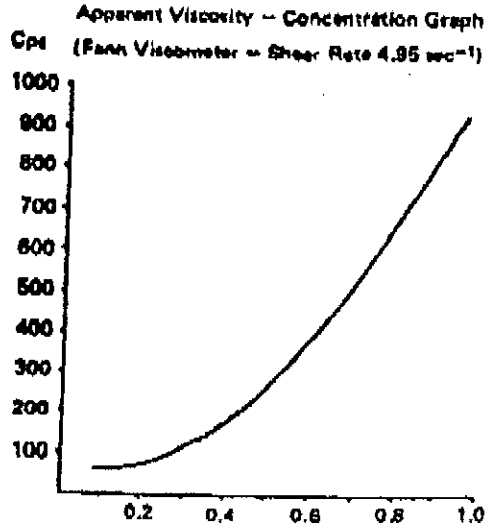
Physical form.....white granular powder
Particle size.....98%< 750 μ
Bulk density.....0.5-0.6
pH of 1% solution @ 25°C.....3.0-4.0
Viscosity at 25°C.....see graph and table overleaf

APPLICATION AND STORAGE

Recommended solution concentrations:
Stock solution.....0.25 to 0.5% max.
Feed solution .....0.025 to 0.05% max.
Recommended storage periods:
Solid.....up to two years
Stock solution.....3 to 6 days

Storage of polymer should be in a cool, dry place.

Details on preparation and feeding can be obtained from an Allied Colloids representative.



ALLIED COLLOIDS (CANADA) INC
11 AUTOMATIC ROAD
TEL (416) 793-9473
FAX (416) 793-9447

SOLUTION VISCOSITY DATA

(Fann Viscometer — 25°C – solvent — deionised water)

PERCOL E10 concentration (%)	Shear rate (sec^{-1}) / Viscosity (Cps)	4.96	9.90	165	330	495	989
1.0		800	620	117	85	69	62
0.5		250	175	39	33	34	32
0.25		80	50	18	14	12	12
0.10		50	50	9	7	6	5

SHIPPING AND HANDLING

PERCOL E10 is supplied in 25kg polyethylene-lined, multi-walled bags. PERCOL E10 has a low order of toxicity and no special precautions are necessary in handling.

Corrosivity towards most standard material of construction is low, but aluminum and galvanized equipment should be avoided.

TECHNICAL SERVICE

Advice and assistance in the running of laboratory and plant tests to select the correct flocculant and determine the best application is given by representatives of Allied Colloids, who are experienced in mineral processing applications.

PERCOL is the registered trade name of Allied Colloids.

HEALTH AND SAFETY INFORMATION

PERCOL E10 exhibits a very low order of oral toxicity and does not present any abnormal problems in its handling or general use.

Full details on Health and Safety aspects are available on request.

WARRANTY

The information contained in this leaflet is given in good faith, but no liability is assumed nor is freedom from any patent owned by Allied Colloids or others implied.

I. PRODUCT IDENTIFICATION

Manufacturer:
ALLIED COLLOIDS LTD.
P.O. Box 38,
Low Moor, West Yorkshire,
Bradford, BD12 0JZ
ENGLAND Tel.: 011-44-274-671267

Distributor:
ALLIED COLLOIDS (CANADA) INC.
11 Automatic Road,
Brampton, Ontario
L6S 4K6
Emergency Tel.: (416) 793-9473

Product Name: PERCOL E10
Product Type: Copolymer of sodium acrylate and acrylamide

II. HAZARDOUS INGREDIENTS

INGREDIENTS	CAS NUMBER	CONCENTRATION	LD50/LC50

No hazardous ingredients as per regulations

III. PHYSICAL PROPERTIES

Appearance and Odour: White free flowing powder

Density: 0.8 g/cm³
Specific Gravity: not available
Vapour Density: not available
Boiling Point: not available
pH Value: not available

Odour Threshold: not available
Vapour Pressure: not available
Evaporation Rate: not available
Freezing Point: not available
Coeff. of water/oil dist.: not available

IV. FIRE AND EXPLOSION HAZARD

Conditions of Flammability: Very low risk.
Flash Point (method of determination) - none exhibited
LEL, UEL - not applicable
Auto-ignition temperature: not available
Flammability Classification: not applicable
Hazardous Combustion Products: none
Explosion Data: not applicable

EXTINGUISHING MEDIA and SPECIAL FIRE FIGHTING PROCEDURES
Carbon dioxide, dry chemical, foam

V. REACTIVITY

Materials to Avoid:
Avoid contact with strong oxidants.

Stability:
This product is stable and will not react violently with water. Hazardous polymerization will not occur.

Hazardous Decomposition Products:
none

VI. TOXICOLOGICAL PROPERTIES OF PRODUCT

HAZARD STATEMENTS

Nature of Hazard:
This product has been determined to be non-hazardous in accordance with 29CFR 1910.1200; however, as with any chemical this product should be handled with good industrial hygiene and safety practices as set forth in the material safety data sheet.

Primary routes of entry:
Ingestion, inhalation

Effects of Acute Exposure: (Signs and symptoms of exposure)
Not applicable.

Effects of Chronic exposure:
None

Exposure Limit:
ACGIH: none OSHA PEL: none MFRS Recommended: none

Carcinogenicity Determination by NTP, IARC, OSHA: None

Sensitization of Product: not as sensitizer
Synergistic Materials: none reported
Reproductive Toxicity: not available
Teratogenicity: not available
Mutagenicity: not available

VII. PREVENTIVE MEASURES

1. PROTECTIVE EQUIPMENT

Eye Protection:
Use splash goggles or face shield when eye contact may occur.

Skin Protection:
Use gloves, if needed, to avoid prolonged or repeated skin contact.

Respiratory Protection:
Normally not needed, use dust mask if needed to prevent inhalation of airborne particles.

Ventilation:
Provide adequate ventilation to minimize dust inhalation.

2. PERSONAL HYGIENE

Minimize breathing dust. Avoid prolonged or repeated breathing of dust and contact with skin. Remove contaminated clothing; launder or dry-clean before reuse. Cleanse skin thoroughly after contact, before breaks and meals and at end of work period. Product is readily removed from skin by washing thoroughly with soap and water.

3. PRECAUTIONARY STATEMENTS

Dust generated in handling of this product can be explosive if sufficient quantities are mixed in air in which case ignition sources should be avoided.

4. SPILLS, LEAKS

Product may create a slip hazard when mixed with water. Spills should be dealt with immediately. Spills of dry product present a slip hazard when wet and should be cleaned up immediately. Do not wet spills of dry product. Sweep up dry and flush spill area with water. Spills of dilute solutions may be flushed with copious amounts of water, or alternatively, they may be absorbed with an inert material such as earth or speedi-dry and contained for disposal. The product or its solutions should not be allowed to enter waterways without treatment. Product should be disposed of in accordance with applicable federal, provincial and local regulations.

VIII. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT

If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

INGESTION

If ingested, give emetic and seek medical advice.

IX. PREPARATION INFORMATION

Person to contact: Trixie Schultz, Occupational Health and Safety Department

Prepared By: [illegible] Date Revised: 11-03-88

The information and recommendations contained herein are, to the best of Allied Colloids' knowledge and belief, accurate and reliable as of the date issued. Allied Colloids does not warrant or guarantee their accuracy or reliability, and Allied Colloids shall not be liable for any loss or damage arising out of their use thereof.

The information and recommendations are offered for the users' consideration and examination, and it is the users' responsibility to satisfy itself that they are suitable and complete for its particular use.

APPENDIX B
CLIMATOLOGICAL DATA

APPENDIX B - CLIMATOLOGICAL DATA

This appendix contains the climatologic data derived for the site and used in assessing project water balance and hydrologic design of facilities.

Mean annual precipitation was derived using data for Palmer, Alaska obtained via computer modem through the Soil Conservation Service (SCS) in Portland, Oregon and applying an elevation correction to extrapolate to the site.

Mean annual evaporation was derived using data from Matanuska Agriculture Experimental Station and Palmer and regional information obtained from the National Weather Service (Technical Publications NWS 33 and NWS 34).

Site runoff was derived using data obtained from the SCS database for the Little Susitna River and regional atlases of Alaska and Canada for developing precipitation/runoff relationship.

Recurrence interval storm events, including the 100-yr storm, were derived using daily precipitation data for Palmer obtained from the SCS database. These data were analyzed using a Pearson Type 1 Extremal Distribution technique (Chow, 1964) to produce a storm precipitation depth versus recurrence interval curve.

TABLE B-1

PRECIPITATION AT PALMER

TAPS Station : PALMER IAS, 6870
start yr. - 1949 end yr. - 1988

Month	Temperature						Precipitation			
				2 years in 10 will have				2 yrs in 10 will have		
	avg daily max	avg daily min	avg	max temp. >than	min temp. <than	avg no. of grow'n degree days*	avg (in.)	less than (in.)	more than (in.)	average number of days with 0.10 inch or more
January	20.0	3.9	11.9	47	-29	1	0.91	0.25	1.49	2
February	26.4	8.9	17.7	47	-21	1	0.68	0.21	1.10	2
March	34.0	15.1	24.6	53	-15	2	0.53	0.25	0.87	2
April	45.1	27.1	36.1	60	8	21	0.61	0.16	1.03	2
May	56.9	36.5	46.7	74	24	210	0.67	0.24	1.06	2
June	64.2	44.6	54.4	80	35	419	1.37	0.75	1.92	4
July	66.4	48.1	57.2	81	39	537	2.20	1.26	3.04	6
August	64.3	46.7	55.5	78	32	463	2.37	1.10	3.46	6
September	56.4	38.9	47.6	68	22	228	2.34	1.10	3.41	6
October	41.7	26.2	34.0	59	1	35	1.48	0.72	2.14	4
November	28.2	13.1	20.7	51	-13	4	1.01	0.32	1.68	3
December	21.1	6.2	13.7	47	-26	1	1.01	0.46	1.49	3
Yearly :										
Average	43.7	26.3	35.0	----	----	----	---	---	---	---
Extreme	87	-38	---	84	-32	----	---	---	---	---
Total	---	---	---	----	----	1922	15.20	7.94	18.28	42

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold : 40.0 deg. F)

TABLE B-2

ESTIMATED MONTHLY PRECIPITATION FOR THE MINE SITE, BUFFALO CREEK, AND THE LITTLE SUSITNA RIVER BASED ON DATA FOR PALMER AND ELEVATION CORRELATIONS

MONTH	% MEAN ANNUAL PRECIPITATION	PRECIP* MONTHLY BUFFALO CREEK (28")	PRECIP* MONTHLY SITE (24")	LITTLE SUSITNA
Jan	.06	1.68	1.44	3.00
Feb	.045	1.26	1.08	2.25
Mar	.035	0.98	0.84	1.75
Apr	.04	1.12	0.96	2.00
May	.044	1.23	1.06	2.20
Jun	.09	2.52	2.16	4.50
Jul	.145	4.06	3.48	7.25
Aug	.156	4.37	3.74	7.80
Sep	.154	4.31	3.70	7.70
Oct	.097	2.72	2.33	4.85
Nov	.066	1.85	1.58	3.30
Dec	.066	1.85	1.58	3.30

*Elevation correlations from Palmer Site.

B.C. Area = 446 acres = 19.4×10^6 ft^2

		Mean Annual Precipitation (in inches)
Palmer Elevation	225 ft	15.2
Site Elevation	1000 ft	24
Buffalo Creek Elevation	1400 ft	28
Little Susitna Elevation	3700 ft	50

TABLE B-3

PAN EVAPORATION DATA FROM PALMER AND THE MATANUSKA AGRICULTURAL EXPERIMENT STATION

MONTH	PAN EVAPORATION (INCHES) MATANUSKA	PALMER
May	4.62 (.232)	5.05 (.259)
Jun	4.38 (.220)	4.77 (.245)
Jul	4.16 (.209)	4.66 (.239)
Aug	3.16 (.159)	3 (.154)
Sep	1.95 (.098)	2 (.103)
Oct	1.61 (.081)	-
	19.88 (1.000)	19.48 (1.000)

For the site, say May through October, pan evaporation = 20 inches.

Typical ratio of May through October evaporation to annual is approximately 80% (based on rough regional evaporation mapping in some of the colder U.S. states National Weather Service Technical Reports 33 and 34, 1982).

Mean annual pan evaporation is approximately 25 inches.

Assuming a pan coefficient of 80% ---> mean annual FWS evaporation = 20 inches.

TABLE B-4

WISHBONE HILL SITE EVAPORATION

MONTH	PAN EVAPORATION (INCHES)	LAKE EVAPORATION (INCHES)
Jan	0.8	0.6
Feb	0.8	0.6
Mar	0.8	0.6
Apr	0.9	0.7
May	4.6	3.8
Jun	4.4	3.5
Jul	4.2	3.4
Aug	3.2	2.6
Sep	2.0	1.6
Oct	1.6	1.3
Nov	0.9	0.7
Dec	0.8	0.6
TOTAL	25.0	20.0

May through October based on Matanuska Dist. and 20-inch pan evaporation. November through April evaporation assumed relatively uniform.

TABLE B-5

STORM CALCULATION SPREADSHEET

DAILY PRECIP DEPTHS(INCHES)
PALMER IAS RECORDING GAUGE
P.O.R.=1949-1988

EST.NO.DAYS NO DATA	1,072	P.O.R.		31-Aug-49
EST.NO.DAYS 0 PREC	9,990			31-Dec-88
ABBREVIATED SPREADSHEET VER.		NO. DAYS		14,367.000

R.I.(yr)	T	K	(FOR PLOTTING ONLY)	
100	36525	7.7	0	1
50	18263	7.2	0	1
25	9131	6.7	0	1
10	3653	5.9	0	1
		4		

SORT.PREC.	RANK	T	LOG PREC	K
2.67	1	13,296	0.43	7.0
2.50	2	6,648	0.40	6.4
2.21	3	4,432	0.34	6.1
1.60	4	3,324	0.20	5.9
1.57	5	2,659	0.20	5.7
1.45	6	2,216	0.16	5.6
1.42	7	1,899	0.15	5.4
1.40	8	1,662	0.15	5.3
1.37	9	1,477	0.14	5.2
1.35	10	1,330	0.13	5.2
1.35	11	1,209	0.13	5.1
1.30	12	1,108	0.11	5.0
1.26	13	1,023	0.10	5.0
1.25	14	950	0.10	4.9
1.22	15	886	0.09	4.8
1.22	16	831	0.09	4.8
1.20	17	782	0.08	4.7
1.14	18	739	0.06	4.7
1.13	19	700	0.05	4.7
1.12	20	665	0.05	4.6
1.10	21	633	0.04	4.6
1.10	22	604	0.04	4.5
1.08	23	578	0.03	4.5
1.08	24	554	0.03	4.5
1.07	25	532	0.03	4.4
1.06	26	511	0.03	4.4
1.02	27	492	0.01	4.4
1.01	28	475	0.00	4.4
1.00	29	458	0.00	4.3
1.00	30	443	0.00	4.3
1.00	31	429	0.00	4.3

LIN REG

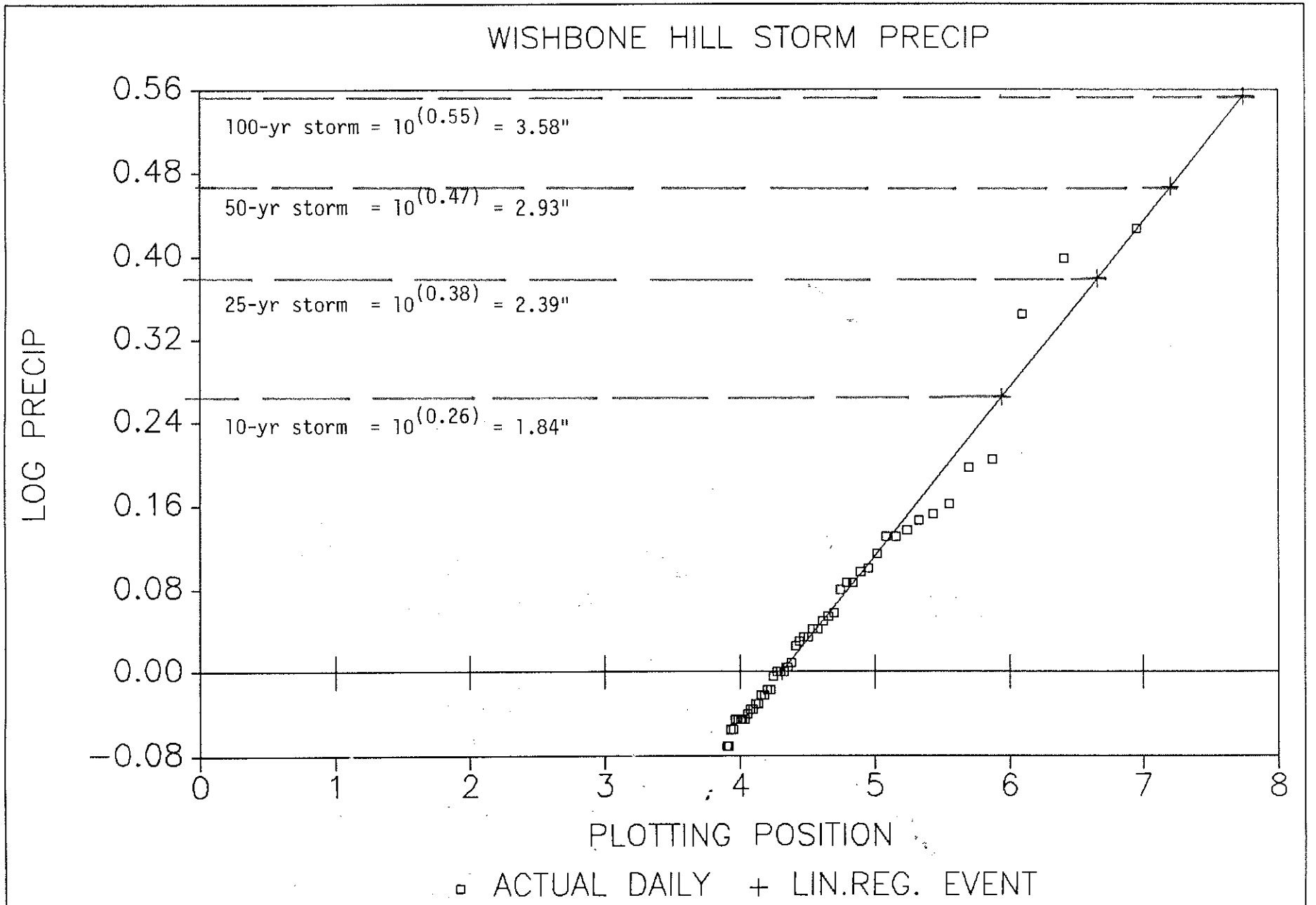
-0.696	b
0.161	m

SUMMARY

****

EVENT	PRECIP	LOG PREC
100	3.58	0.55
50	2.93	0.47
25	2.39	0.38
10	1.84	0.26
	1	0.00

Based on daily data for Palmer obtained from the Soil Conservation Service computer database via computer modem. Attached graph shows plot of storm events.



BASED ON DATA RECORDED AT PALMER IAS

APPENDIX C
PROJECT WATER BALANCE CALCULATIONS

APPENDIX C - PROJECT WATER BALANCE CALCULATIONS

This appendix contains the facilities water balance spreadsheets, slurry pond sizing calculations, and sediment pond gross annual mass balance spreadsheets for all sediment control ponds.

The water balance was evaluated for normal, wet, and dry years to assess pond sizing and water supply needs for the facilities area ponds. The water balance was derived using a SMART spreadsheet with calculations developed by SRK.

The sediment pond mass balance was evaluated to assess pond sizing and maintenance (sediment removal) needs utilizing normal climate, the SECAD results of Appendix D, and the infiltration results of Appendix I.

The slurry pond sizing calculations were based on plant operating criteria provided by McKinley Mining Consultants Inc. (MMCI) and laboratory column settling tests and consolidation testing (Appendix K).

APPENDIX C.1
SUPPORT FACILITIES WATER BALANCE

CALCULATIONS FOR SLURRY POND CAPACITY

1. Total hours plant operation - 70,365 (from McKinley Mining Consultants, Inc. (MMCI)).

2. Fines production: 210 TPD (from MMCI - based on 20-hr day)
   = 10.5 ton/hr

3. Total fines production (1) x (2) = 738,832.5 tons.

4. Assume 63 pcf for average deposited density based on lab test results ranging from 58 to approximately 70 pcf (see Appendix K for column settling and consolidation testing).

5. Volume of fines = (3)/(4) x C; C = 2,000
   = 23,455,000 cu ft

6. Storage elevation for estimated fines production: from height-capacity curve ---> 855.5 ft.

7. Maximum storage elevation for surplus water is approximately 863 ft.

8. Total storage at elevation 863 ft is approximately 30,551,134 cu ft.

9. Net available water storage is approximately (8) - (5) = 7,096,134 cu ft.

10. Slurry pond catchment area is approximately 72 ac ±.

EXPLANATION OF SPREADSHEET COLUMNS

Slurry Pond Water Balance

1. DATE - The month and year under consideration.
2. SOLIDS/cum. - Cumulative tally of the fine coal waste deposited into the slurry pond. Rates are based on a production rate of 210 tons/day and a deposited density of 63 pounds/ft^3.
3. FREEWATER - Slurry water minus the moisture retained in the voids of the fine coal waste.
4. PRECIP - Direct precipitation for the month on the slurry impoundment area.
5. RUNOFF - Runoff from the catchment area tributary to the pond from precipitation for the month (assuming 50% runoff rate).
6. INITIAL STORAGE - Calculation of monthly water inflow for determination of water pool area for loss calculation. Determined by adding columns 3, 4 and 5.
7. INITIAL POND AREA - Area of water pool based on column 6 (initial storage) and slurry pond height-capacity data for use in seepage and evaporation loss calculations.
8. SEEPAGE - Potential seepage loss from the slurry pond based on subsoil and coal slurry infiltration rates (subsoil rates were used for the first year and slurry rates were used for following years).
9. EVAPORATION - Evaporation from the slurry pond water pool based on initial pond area and monthly evaporation data.
10. POND RECLAIM - Water available from the slurry pond for recycling.
11. RECOVER AND RECYCLE - Not applicable since column 10 always is zero.
12. NET STORAGE - End of month water storage.

Fresh Water Pond Balance

1. DATE - The month and year under consideration.
2. WATER FRM BUFF CR - Estimated Buffalo Creek flow at the diversion intake (see CK RO under Climate/Hydrology parameters.
3. PRECIP - Direct precipitation for the month on the lined pond area of both ponds.
4. RUNOFF - Runoff from the catchment area tributary to the ponds from precipitation for the month (assuming 50% runoff rate).
5. EVAP - Evaporation over the lined pond areas. Based on monthly evaporation data.
6. WASH CIRC - Make-up water to be pumped to the coal wash circuit.
7. BUFF CR MAKEUP - Additional makeup water required to maintain storage in the ponds.
8. STORAGE - Total end of month storage at both ponds.
9. WASH PLANT DEFICIT - Calculated shortage at the wash plant (if any).

Wash Down Water Pond

1. PRECIP - Monthly precipitation over the lined pond area.
2. RUNOFF - Runoff from the catchment area tributary to the pond from precipitation for the month (assuming 50% runoff rate).
3. EVAP - Monthly evaporation over the lined pond area.
4. SEEPAGE - Pond seepage (since pond is lined seepage is always equal to zero).
5. BALANCE - Sum of inflows and losses.
6. DUST SUPP'N - Water taken from the wash down water pond as needed for dust control and to maintain pond level below freeboard level (estimated at 14 gpm).
7. POND STORAGE - Wash down water pond storage volume after summing all inflows and losses.

REVISED TABLE C.1
WISHBONE HILL PROJECT WATER BALANCE 05/23/90
1991-2001 PERIOD OF OPERATION
NORMAL OPERATING/NORMAL CLIMATE

OPERATING PARAMETERS

FRESH WATER POND NO. 1(FWP1)

ELEV	AREA	CAPACITY
ft	acres	acre ft
840	0	
850	1	2
865	2	24

CATCHMENT AREA	4	ACRES		
INFILTRATION RATE	1.0E-07	CM/SEC OR	0	FT/MO
INITIAL STORAGE	0	ACRE FT		
POTABLE REQUIREMENT	0.0	GPM		
DUST SUPPRESSION	42	GPM		
WASHDOWN RECYCLE	1	GPM		

FRESH WATER POND NO. 2(FWP2)

CAPACITY	51	AC FT
CATCHMENT	10	ACRES
SURFACE	6	ACRES

SLURRY POND(SP)

ELEV	AREA	CAPACITY
ft	acres	acre ft
825	10	72
850	21	427
865	27	785

CATCHMENT AREA	51	ACRES		
INFILTRATION RATE	1.0E-02	CM/SEC OR	850	FT/MO
(" " AFTER YR1):	1.0E-03	CM/SEC OR	85	FT/MO

TAILINGS PARAMETERS				
SLURRY DENSITY	23%			
SPECIFIC GRAVITY	2.6			
DEGREE SATURATION	75%			
DEPOSITED DENSITY	63	PCF		
VOIDS WATER RETAINED	45%	OR IN GPM:	16	
MINIMUM POND VOLUME	10	ACRE FT		
MILL/PROCESS PARAMETERS				
TAILINGS PRODUCTION	210	TPD		
INITIAL ORE MOISTURE	4%			
SLURRY WATER	120	GPM:	55.7	GPM
MINIMUM FRESHWATER	4	GPM	COARSE WASH FLOW	
SP RECOVER & RECYCLE	0	GPM	0%	
			OF FREEWATER	

CLIMATE/HYDROLOGY PARAMETERS

MONTH	MEAN PPT	MEAN EVAP	MEAN ROV	CK RO DIST	CK RO**
	in	in	in	%	in
JAN	1.4	0.6	0.7	1%	0.1

SLURRY POND BALANCE

DATE	INFLOWS				INITIAL	INITIAL	LOSSES		POND	RECOVER&	NET
YR/MO	SOLIDS/cum	FREEWATER	PRECIP	RUNOFF	STORAGE	POND AREA	SEEPAGE	EVAP	RECLAIM	RECYCLE	STORAGE
	acre ft	gpm	gpm	gpm	acre ft	acre	gpm	gpm	gpm	gpm	acre ft
1990/SEP					0	0					
OCT	0	0	0	37	5	1	-4,179	-1	0	0	0
NOV	0	0	1	25	3	0	-2,944	0	0	0	0
DEC	0	0	0	25	3	0	-2,933	0	0	0	0
1991/JAN	0	0	0	22	3	0	-2,566	0	0	0	0
FEB	0	0	0	17	2	0	-2,014	0	0	0	0
MAR	0	0	0	13	2	0	-1,462	0	0	0	0
APR	0	0	0	16	2	0	-1,825	0	0	0	0
MAY	0	0	0	18	2	0	-2,010	-1	0	0	0
JUN	0	0	0	35	5	1	-4,022	-1	0	0	0
JUL	0	0	1	55	8	1	-6,437	-2	0	0	0
AUG	0	0	2	58	8	1	-6,855	-2	0	0	0
SEP	0	0	2	58	8	1	-6,863	-1	0	0	0
OCT	5	104	2	36	19	3	-16,094	-2	0	0	0
NOV	9	104	3	24	17	2	-14,878	-1	0	0	0
DEC	14	104	2	24	17	2	-14,867	-1	0	0	0
1992/JAN	18	104	2	21	17	2	-1,449	-1	0	0	0
FEB	23	104	2	17	16	2	-1,392	-1	0	0	0
MAR	27	104	1	12	16	2	-1,334	-1	0	0	0
APR	32	104	1	15	16	2	-1,372	-1	0	0	0
MAY	37	104	1	17	16	2	-1,391	-5	0	0	0
JUN	41	104	3	34	19	2	-1,600	-5	0	0	0
JUL	46	104	5	53	22	3	-1,850	-6	0	0	0
AUG	50	104	7	56	22	3	-1,893	-5	0	0	0
SEP	55	104	7	56	22	3	-1,894	-3	0	0	0
OCT	60	104	4	35	19	3	-1,625	-2	0	0	0
NOV	64	104	3	24	17	2	-1,488	-1	0	0	0
DEC	69	104	2	24	17	2	-1,487	-1	0	0	0
1993/JAN	73	104	2	21	17	2	-1,449	-1	0	0	0
FEB	78	104	2	17	16	2	-1,392	-1	0	0	0
MAR	82	104	1	12	16	2	-1,334	-1	0	0	0
APR	87	104	1	15	16	2	-1,372	-1	0	0	0
MAY	92	104	1	17	16	2	-1,391	-5	0	0	0
JUN	96	104	3	34	19	2	-1,600	-5	0	0	0
JUL	101	104	5	53	22	3	-1,850	-6	0	0	0
AUG	105	104	7	56	22	3	-1,893	-5	0	0	0
SEP	110	104	7	56	22	3	-1,894	-3	0	0	0
OCT	115	104	4	35	19	3	-1,625	-2	0	0	0
NOV	119	104	3	24	17	2	-1,488	-1	0	0	0
DEC	124	104	2	24	17	2	-1,487	-1	0	0	0
1994/JAN	128	104	2	21	17	2	-1,449	-1	0	0	0
FEB	133	104	2	17	16	2	-1,392	-1	0	0	0
MAR	137	104	1	12	16	2	-1,334	-1	0	0	0
APR	142	104	1	15	16	2	-1,372	-1	0	0	0
MAY	147	104	1	17	16	2	-1,391	-5	0	0	0
JUN	151	104	3	34	19	2	-1,600	-5	0	0	0
JUL	156	104	5	53	22	3	-1,850	-6	0	0	0
AUG	160	104	7	56	22	3	-1,893	-5	0	0	0
SEP	165	104	7	56	22	3	-1,894	-3	0	0	0

FEB	1.1	0.6	0.6	1%	0.1
MAR	0.8	0.6	0.4	1%	0.1
APR	1.0	0.7	0.5	1%	0.1
MAY	1.1	3.8	0.6	8%	1.0
JUN	2.2	3.5	1.1	27%	3.2
JUL	3.5	3.4	1.6	22%	2.6
AUG	3.7	2.6	1.9	18%	2.2
SEP	3.7	1.6	1.9	12%	1.4
OCT	2.3	1.3	1.2	5%	0.6
NOV	1.6	0.7	0.6	2%	0.2
DEC	1.6	0.6	0.8	2%	0.2
ANNUAL	24.0	20.0	12.0		12.0

*MEAN RO=BASIN RUNOFF=PRECIPx 50%
*CK RO=CREEK FLOW-CK RO DISTx H.A.R.

BUFFALO CREEK DIVERSION
CATCHMENT AREA 446 ACRES

WET YR PPT 157%
DRY YR PPT 56%
DRY YR RO 0

OCT	170	104	4	35	19	3	-1,625	-2	0	0	0
NOV	174	104	3	24	17	2	-1,488	-1	0	0	0
DEC	179	104	2	24	17	2	-1,487	-1	0	0	0
1995/JAN	183	104	2	21	17	2	-1,449	-1	0	0	0
FEB	188	104	2	17	16	2	-1,392	-1	0	0	0
MAR	192	104	1	12	16	2	-1,334	-1	0	0	0
APR	197	104	1	15	16	2	-1,372	-1	0	0	0
MAY	202	104	1	17	16	2	-1,391	-5	0	0	0
JUN	206	104	3	34	19	2	-1,600	-5	0	0	0
JUL	211	104	5	53	22	3	-1,850	-6	0	0	0
AUG	215	104	7	56	22	3	-1,893	-5	0	0	0
SEP	220	104	7	56	22	3	-1,894	-3	0	0	0
OCT	225	104	4	35	19	3	-1,625	-2	0	0	0
NOV	229	104	3	24	17	2	-1,488	-1	0	0	0
DEC	234	104	2	24	17	2	-1,487	-1	0	0	0
1996/JAN	238	104	2	21	17	2	-1,449	-1	0	0	0
FEB	243	104	2	17	16	2	-1,392	-1	0	0	0
MAR	247	104	1	12	16	2	-1,334	-1	0	0	0
APR	252	104	1	15	16	2	-1,372	-1	0	0	0
MAY	257	104	1	17	16	2	-1,391	-5	0	0	0
JUN	261	104	3	34	19	2	-1,600	-5	0	0	0
JUL	266	104	5	53	22	3	-1,850	-6	0	0	0
AUG	270	104	7	56	22	3	-1,893	-5	0	0	0
SEP	275	104	7	56	22	3	-1,894	-3	0	0	0
OCT	280	104	4	35	19	3	-1,625	-2	0	0	0
NOV	284	104	3	24	17	2	-1,488	-1	0	0	0
DEC	289	104	2	24	17	2	-1,487	-1	0	0	0
1997/JAN	293	104	2	21	17	2	-1,449	-1	0	0	0
FEB	298	104	2	17	16	2	-1,392	-1	0	0	0
MAR	302	104	1	12	16	2	-1,334	-1	0	0	0
APR	307	104	1	15	16	2	-1,372	-1	0	0	0
MAY	312	104	1	17	16	2	-1,391	-5	0	0	0
JUN	316	104	3	34	19	2	-1,600	-5	0	0	0
JUL	321	104	5	53	22	3	-1,850	-6	0	0	0
AUG	325	104	7	56	22	3	-1,893	-5	0	0	0
SEP	330	104	7	56	22	3	-1,894	-3	0	0	0
OCT	335	104	4	35	19	3	-1,625	-2	0	0	0
NOV	339	104	3	24	17	2	-1,488	-1	0	0	0
DEC	344	104	2	24	17	2	-1,487	-1	0	0	0
1998/JAN	348	104	2	21	17	2	-1,449	-1	0	0	0
FEB	353	104	2	17	16	2	-1,392	-1	0	0	0
MAR	357	104	1	12	16	2	-1,334	-1	0	0	0
APR	362	104	1	15	16	2	-1,372	-1	0	0	0
MAY	367	104	1	17	16	2	-1,391	-5	0	0	0
JUN	371	104	3	34	19	2	-1,600	-5	0	0	0
JUL	376	104	5	53	22	3	-1,850	-6	0	0	0
AUG	380	104	7	56	22	3	-1,893	-5	0	0	0
SEP	385	104	7	56	22	3	-1,894	-3	0	0	0
OCT	390	104	4	35	19	3	-1,625	-2	0	0	0
NOV	394	104	3	24	17	2	-1,488	-1	0	0	0
DEC	399	104	2	24	17	2	-1,487	-1	0	0	0
1999/JAN	403	104	2	21	17	2	-1,449	-1	0	0	0

FEB	408	104	2	17	16	2	-1,392	-1	0	0	0
MAR	412	104	1	12	16	2	-1,334	-1	0	0	0
APR	417	104	1	15	16	2	-1,372	-1	0	0	0
MAY	422	104	1	17	16	2	-1,391	-5	0	0	0
JUN	426	104	3	34	19	2	-1,600	-5	0	0	0
JUL	431	104	5	53	22	3	-1,850	-6	0	0	0
AUG	435	104	7	56	22	3	-1,893	-5	0	0	0
SEP	440	104	7	56	22	3	-1,894	-3	0	0	0
OCT	445	104	4	35	19	3	-1,625	-2	0	0	0
NOV	449	104	3	24	17	2	-1,488	-1	0	0	0
DEC	454	104	2	24	17	2	-1,487	-1	0	0	0
2000/JAN	458	104	2	21	17	2	-1,449	-1	0	0	0
FEB	463	104	2	17	16	2	-1,392	-1	0	0	0
MAR	467	104	1	12	16	2	-1,334	-1	0	0	0
APR	472	104	1	15	16	2	-1,372	-1	0	0	0
MAY	477	104	1	17	16	2	-1,391	-5	0	0	0
JUN	481	104	3	34	19	2	-1,600	-5	0	0	0
JUL	486	104	5	53	22	3	-1,850	-6	0	0	0
AUG	490	104	7	56	22	3	-1,893	-5	0	0	0
SEP	495	104	7	56	22	3	-1,894	-3	0	0	0
OCT	500	104	4	35	19	3	-1,625	-2	0	0	0
NOV	504	104	3	24	17	2	-1,488	-1	0	0	0
DEC	509	104	2	24	17	2	-1,487	-1	0	0	0
2001/JAN	513	104	2	21	17	2	-1,449	-1	0	0	0
FEB	518	104	2	17	16	2	-1,392	-1	0	0	0
MAR	522	104	1	12	16	2	-1,334	-1	0	0	0
APR	527	104	1	15	16	2	-1,372	-1	0	0	0
MAY	532	104	1	17	16	2	-1,391	-5	0	0	0
JUN	536	104	3	34	19	2	-1,600	-5	0	0	0

AVAIL. FRESH WATER POND BALANCE

DATE YR/MO	WATER FRM BUFF CR gpm	******INFLOWS****** PRECIP gpm	RUNOFF gpm	EVAP gpm	********** POTABLE gpm	LOSSES********** WASH CIRC gpm	DUST SUPN gpm	WASHDOWN gpm	BUFF CR MAKEUP gpm	STORAGE acre ft	WASH PLANT DEFICIT gpm
1990/SEP											
OCT	168	11	2	-6	0	0	0	0	168	23	0
NOV	67	8	1	-3	0	0	0	0	67	33	0
DEC	67	8	1	-3	0	0	0	0	67	43	0
1991/JAN	34	7	3	-3	0	0	0	0	34	48	0
FEB	34	5	2	-3	0	0	0	0	34	53	0
MAR	34	4	2	-3	0	0	0	0	34	58	0
APR	34	5	2	-3	0	0	0	0	34	63	0
MAY	269	5	2	-19	0	0	0	0	269	97	0
JUN	908	11	4	-17	0	0	-42	0	105	105	0
JUL	740	17	7	-17	0	0	-42	0	34	105	0
AUG	605	18	8	-13	0	0	-42	0	29	105	0
SEP	404	18	8	-8	0	0	-42	0	24	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1992/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1993/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1994/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0

OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1995/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	19	8	-13	0	-176	-42	-1	206	105	0
SEP	401	18	5	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1996/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	165	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1997/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	710	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1998/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	19	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	165	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1999/JAN	34	7	3	-3	0	-176	0	-1	34	57	0

FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2000/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2001/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0

REVISED TABLE C.2

WISHBONE HILL PROJECT WATER BALANCE 06/06/90

1991-2001 PERIOD OF OPERATION

NORMAL OPERATING/DRY YEAR IN 1995

OPERATING PARAMETERS

FRESH WATER POND NO. 1(FWP1)

ELEV	AREA	CAPACITY
ft	acres	acre ft
840	0	
850	1	2
865	2	24

CATCHMENT AREA	4	ACRES		
INFILTRATION RATE	1.0E-07	CM/SEC OR	0	FT/MO
INITIAL STORAGE	0	ACRE FT		
POTABLE REQUIREMENT	0.0	GPM		
DUST SUPPRESSION	42	GPM		
WASHDOWN RECYCLE	1	GPM		

FRESH WATER POND NO. 2(FWP2)

CAPACITY	81	AC FT
CATCHMENT	10	ACRES
SURFACE	6	ACRES

SLURRY POND(SP)

ELEV	AREA	CAPACITY
ft	acres	acre ft
825	10	72
850	21	127
865	27	785

CATCHMENT AREA	51	ACRES		
INFILTRATION RATE	1.0E-02	CM/SEC OR	850	FT/MO
(" " AFTER YR1):	1.0E-03	CM/SEC OR	85	FT/MO

TAILINGS PARAMETERS

SLURRY DENSITY	23%			
SPECIFIC GRAVITY	2.6			
DEGREE SATURATION	75%			
DEPOSITED DENSITY	63	PCF		
VOIDS WATER RETAINED	45%	OR IN GPM=	16	
MINIMUM POND VOLUME	10	ACRE FT		

MILL/PROCESS PARAMETERS

TAILINGS PRODUCTION	210	TPD		
INITIAL ORE MOISTURE	4%			
SLURRY WATER	120	GPM+	55.7	GPM
MINIMUM FRESHWATER	4	GPM	COARSE WASH FLOW	
SP RECOVER & RECYCLE	0	GPM	0%	
			OF FREEWATER	

CLIMATE/HYDROLOGY PARAMETERS

MONTH	MEAN PPT	MEAN EVAP	MEAN RO*	CK RO DIST	CK RO**
	in	in	in	%	in
JAN	1.4	0.6	0.7	1%	0.1

SLURRY POND BALANCE

DATE YR/MO	INFLOWS SOLIDS/cum acre ft	INFLOWS FREEWATER gpm	INFLOWS PRECIP gpm	INFLOWS RUNOFF gpm	INITIAL STORAGE acre ft	INITIAL POND AREA acre	LOSSES SEEPAGE gpm	LOSSES EVAP gpm	POND RECLAIM gpm	RECOVERY RECYCLE gpm	NET STORAGE acre ft
1990/SEP					0	0					
OCT	0	0	0	37	5	1	-4,179	-1	0	0	0
NOV	0	0	1	25	3	0	-2,944	0	0	0	0
DEC	0	0	0	25	3	0	-2,933	0	0	0	0
1991/JAN	0	0	0	22	3	0	-2,566	0	0	0	0
FEB	0	0	0	17	2	0	-2,014	0	0	0	0
MAR	0	0	0	13	2	0	-1,462	0	0	0	0
APR	0	0	0	16	2	0	-1,825	0	0	0	0
MAY	0	0	0	18	2	0	-2,010	-1	0	0	0
JUN	0	0	0	35	5	1	-4,022	-1	0	0	0
JUL	0	0	1	55	8	1	-6,437	-2	0	0	0
AUG	0	0	2	58	8	1	-6,855	-2	0	0	0
SEP	0	0	2	58	8	1	-6,863	-1	0	0	0
OCT	5	104	2	36	19	3	-16,094	-2	0	0	0
NOV	9	104	3	24	17	2	-14,878	-1	0	0	0
DEC	14	104	2	24	17	2	-14,867	-1	0	0	0
1992/JAN	18	104	2	21	17	2	-1,449	-1	0	0	0
FEB	23	104	2	17	16	2	-1,392	-1	0	0	0
MAR	27	104	1	12	16	2	-1,334	-1	0	0	0
APR	32	104	1	15	16	2	-1,372	-1	0	0	0
MAY	37	104	1	17	16	2	-1,391	-5	0	0	0
JUN	41	104	3	34	19	2	-1,600	-5	0	0	0
JUL	46	104	5	53	22	3	-1,850	-6	0	0	0
AUG	50	104	7	56	22	3	-1,893	-5	0	0	0
SEP	55	104	7	56	22	3	-1,894	-3	0	0	0
OCT	60	104	4	35	19	3	-1,625	-2	0	0	0
NOV	64	104	3	24	17	2	-1,488	-1	0	0	0
DEC	69	104	2	24	17	2	-1,487	-1	0	0	0
1993/JAN	73	104	2	21	17	2	-1,449	-1	0	0	0
FEB	78	104	2	17	16	2	-1,392	-1	0	0	0
MAR	82	104	1	12	16	2	-1,334	-1	0	0	0
APR	87	104	1	15	16	2	-1,372	-1	0	0	0
MAY	92	104	1	17	16	2	-1,391	-5	0	0	0
JUN	96	104	3	34	19	2	-1,600	-5	0	0	0
JUL	101	104	5	53	22	3	-1,850	-6	0	0	0
AUG	105	104	7	56	22	3	-1,893	-5	0	0	0
SEP	110	104	7	56	22	3	-1,894	-3	0	0	0
OCT	115	104	4	35	19	3	-1,625	-2	0	0	0
NOV	119	104	3	24	17	2	-1,488	-1	0	0	0
DEC	124	104	2	24	17	2	-1,487	-1	0	0	0
1994/JAN	128	104	2	21	17	2	-1,449	-1	0	0	0
FEB	133	104	2	17	16	2	-1,392	-1	0	0	0
MAR	137	104	1	12	16	2	-1,334	-1	0	0	0
APR	142	104	1	15	16	2	-1,372	-1	0	0	0
MAY	147	104	1	17	16	2	-1,391	-5	0	0	0
JUN	151	104	3	34	19	2	-1,600	-5	0	0	0
JUL	156	104	5	53	22	3	-1,850	-6	0	0	0
AUG	160	104	7	56	22	3	-1,893	-5	0	0	0
SEP	165	104	7	56	22	3	-1,894	-3	0	0	0

FEB	1.1	0.6	0.6	1%	0.1
MAR	0.8	0.6	0.4	1%	0.1
APR	1.0	0.7	0.5	1%	0.1
MAY	1.1	3.8	0.6	8%	1.0
JUN	2.2	3.5	1.1	27%	3.2
JUL	3.5	3.4	1.8	22%	2.6
AUG	3.7	2.6	1.9	18%	2.2
SEP	3.7	1.6	1.9	12%	1.4
OCT	2.3	1.3	1.2	5%	0.6
NOV	1.6	0.7	0.8	2%	0.2
DEC	1.6	0.6	0.8	2%	0.2
ANNUAL	24.0	20.0	12.0		12.0

*MEAN RO=BASIN RUNOFF-PRECIPx 50%
**CK RO=CREEK FLOW-CK RO DISTx M.A.R.

BUFFALO CREEK DIVERSION
CATCHMENT AREA 446 ACRES

WET YR PPT 157%
DRY YR PPT 56%
DRY YR RO 0

OCT	170	104	4	35	19	3	-1,625	-2	0	0	0
NOV	174	104	3	24	17	2	-1,488	-1	0	0	0
DEC	179	104	2	24	17	2	-1,487	-1	0	0	0
1995/JAN	183	104	1	0	14	2	-1,196	-1	0	0	0
FEB	188	104	1	0	14	2	-1,191	-1	0	0	0
MAR	192	104	1	0	14	2	-1,189	-1	0	0	0
APR	197	104	1	0	14	2	-1,190	-1	0	0	0
MAY	202	104	1	0	14	2	-1,191	-4	0	0	0
JUN	206	104	1	0	14	2	-1,199	-4	0	0	0
JUL	211	104	2	0	14	2	-1,209	-4	0	0	0
AUG	215	104	2	0	14	2	-1,210	-3	0	0	0
SEP	220	104	2	0	14	2	-1,210	-2	0	0	0
OCT	225	104	2	0	14	2	-1,200	-2	0	0	0
NOV	229	104	1	0	14	2	-1,195	-1	0	0	0
DEC	234	104	1	0	14	2	-1,195	-1	0	0	0
1996/JAN	238	104	2	22	17	2	-1,446	-1	0	0	0
FEB	243	104	2	17	16	2	-1,391	-1	0	0	0
MAR	247	104	1	12	16	2	-1,334	-1	0	0	0
APR	252	104	1	15	16	2	-1,372	-1	0	0	0
MAY	257	104	1	17	16	2	-1,391	-5	0	0	0
JUN	261	104	3	34	19	2	-1,600	-5	0	0	0
JUL	266	104	5	53	22	3	-1,850	-6	0	0	0
AUG	270	104	7	56	22	3	-1,893	-5	0	0	0
SEP	275	104	7	56	22	3	-1,894	-3	0	0	0
OCT	280	104	4	35	19	3	-1,625	-2	0	0	0
NOV	284	104	3	24	17	2	-1,488	-1	0	0	0
DEC	289	104	2	24	17	2	-1,487	-1	0	0	0
1997/JAN	293	104	2	21	17	2	-1,449	-1	0	0	0
FEB	298	104	2	17	16	2	-1,392	-1	0	0	0
MAR	302	104	1	12	16	2	-1,334	-1	0	0	0
APR	307	104	1	15	16	2	-1,372	-1	0	0	0
MAY	312	104	1	17	16	2	-1,391	-5	0	0	0
JUN	316	104	3	34	19	2	-1,600	-5	0	0	0
JUL	321	104	5	53	22	3	-1,850	-6	0	0	0
AUG	325	104	7	56	22	3	-1,893	-5	0	0	0
SEP	330	104	7	56	22	3	-1,894	-3	0	0	0
OCT	335	104	4	35	19	3	-1,625	-2	0	0	0
NOV	339	104	3	24	17	2	-1,488	-1	0	0	0
DEC	344	104	2	24	17	2	-1,487	-1	0	0	0
1998/JAN	348	104	2	21	17	2	-1,449	-1	0	0	0
FEB	353	104	2	17	16	2	-1,392	-1	0	0	0
MAR	357	104	1	12	16	2	-1,334	-1	0	0	0
APR	362	104	1	15	16	2	-1,372	-1	0	0	0
MAY	367	104	1	17	16	2	-1,391	-5	0	0	0
JUN	371	104	3	34	19	2	-1,600	-5	0	0	0
JUL	376	104	5	53	22	3	-1,850	-6	0	0	0
AUG	380	104	7	56	22	3	-1,893	-5	0	0	0
SEP	385	104	7	56	22	3	-1,894	-3	0	0	0
OCT	390	104	4	35	19	3	-1,625	-2	0	0	0
NOV	394	104	3	24	17	2	-1,488	-1	0	0	0
DEC	399	104	2	24	17	2	-1,487	-1	0	0	0
1999/JAN	403	104	2	21	17	2	-1,449	-1	0	0	0

FEB	408	104	2	17	16	2	-1,392	-1	0	0	0
MAR	412	104	1	12	16	2	-1,334	-1	0	0	0
APR	417	104	1	15	16	2	-1,372	-1	0	0	0
MAY	422	104	1	17	16	2	-1,391	-5	0	0	0
JUN	426	104	3	34	19	2	-1,600	-5	0	0	0
JUL	431	104	5	53	22	3	-1,850	-6	0	0	0
AUG	435	104	7	56	22	3	-1,893	-5	0	0	0
SEP	440	104	7	56	22	3	-1,894	-3	0	0	0
OCT	445	104	4	35	19	3	-1,625	-2	0	0	0
NOV	449	104	3	24	17	2	-1,488	-1	0	0	0
DEC	454	104	2	24	17	2	-1,487	-1	0	0	0
2000/JAN	458	104	2	21	17	2	-1,449	-1	0	0	0
FEB	463	104	2	17	16	2	-1,392	-1	0	0	0
MAR	467	104	1	12	16	2	-1,334	-1	0	0	0
APR	472	104	1	15	16	2	-1,372	-1	0	0	0
MAY	477	104	1	17	16	2	-1,391	-5	0	0	0
JUN	481	104	3	34	19	2	-1,600	-5	0	0	0
JUL	486	104	5	53	22	3	-1,850	-6	0	0	0
AUG	490	104	7	56	22	3	-1,893	-5	0	0	0
SEP	495	104	7	56	22	3	-1,894	-3	0	0	0
OCT	500	104	4	35	19	3	-1,625	-2	0	0	0
NOV	504	104	3	24	17	2	-1,488	-1	0	0	0
DEC	509	104	2	24	17	2	-1,487	-1	0	0	0
2001/JAN	513	104	2	21	17	2	-1,449	-1	0	0	0
FEB	518	104	2	17	16	2	-1,392	-1	0	0	0
MAR	522	104	1	12	16	2	-1,334	-1	0	0	0
APR	527	104	1	15	16	2	-1,372	-1	0	0	0
MAY	532	104	1	17	16	2	-1,391	-5	0	0	0
JUN	536	104	3	34	19	2	-1,600	-5	0	0	0

AVAIL. FRESH WATER POND BALANCE

DATE	WATER FRM	******INFLOWS******			**********	**********	LOSSES	**********	**********	BUFF CR		WASH PLANT
YR/MO	BUFF CR	PRECIP	RUNOFF	EVAP	POTABLE	WASH CIRC	DUST SUPN	WASHDOWN		MAKEUP	STORAGE	DEFICIT
	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm		gpm	acre ft	gpm
1990/SEP												
OCT	168	11	2	-6	0	0	0	0		168	23	0
NOV	67	8	1	-3	0	0	0	0		67	33	0
DEC	67	9	1	-3	0	0	0	0		67	43	0
1991/JAN	34	7	3	-3	0	0	0	0		34	48	0
FEB	34	5	2	-3	0	0	0	0		34	53	0
MAR	34	4	2	-3	0	0	0	0		34	58	0
APR	34	5	2	-3	0	0	0	0		34	63	0
MAY	269	5	2	-19	0	0	0	0		269	97	0
JUN	908	11	4	-17	0	0	-42	0		105	105	0
JUL	740	17	7	-17	0	0	-42	0		34	105	0
AUG	605	18	8	-13	0	0	-42	0		29	105	0
SEP	404	18	8	-8	0	0	-42	0		24	105	0
OCT	168	11	5	-6	0	-176	-28	-1		168	102	0
NOV	67	8	3	-3	0	-176	0	-1		67	88	0
DEC	67	8	3	-3	0	-176	0	-1		67	75	0
1992/JAN	34	7	3	-3	0	-176	0	-1		34	57	0
FEB	34	5	2	-3	0	-176	0	-1		34	38	0
MAR	34	4	2	-3	0	-176	0	-1		34	20	0
APR	34	5	2	-3	0	-176	0	-1		34	1	0
MAY	269	5	2	-19	0	-176	0	-1		269	12	0
JUN	908	11	4	-17	0	-176	-42	-1		908	103	0
JUL	740	17	7	-17	0	-176	-42	-1		228	105	0
AUG	605	18	8	-13	0	-176	-42	-1		206	105	0
SEP	404	18	8	-8	0	-176	-42	-1		201	105	0
OCT	168	11	5	-6	0	-176	-28	-1		168	102	0
NOV	67	8	3	-3	0	-176	0	-1		67	88	0
DEC	67	8	3	-3	0	-176	0	-1		67	75	0
1993/JAN	34	7	3	-3	0	-176	0	-1		34	57	0
FEB	34	5	2	-3	0	-176	0	-1		34	38	0
MAR	34	4	2	-3	0	-176	0	-1		34	20	0
APR	34	5	2	-3	0	-176	0	-1		34	1	0
MAY	269	5	2	-19	0	-176	0	-1		269	12	0
JUN	908	11	4	-17	0	-176	-42	-1		908	103	0
JUL	740	17	7	-17	0	-176	-42	-1		228	105	0
AUG	605	18	8	-13	0	-176	-42	-1		206	105	0
SEP	404	18	8	-8	0	-176	-42	-1		201	105	0
OCT	168	11	5	-6	0	-176	-28	-1		168	102	0
NOV	67	8	3	-3	0	-176	0	-1		67	88	0
DEC	67	8	3	-3	0	-176	0	-1		67	75	0
1994/JAN	34	7	3	-3	0	-176	0	-1		34	57	0
FEB	34	5	2	-3	0	-176	0	-1		34	38	0
MAR	34	4	2	-3	0	-176	0	-1		34	20	0
APR	34	5	2	-3	0	-176	0	-1		34	1	0
MAY	269	5	2	-19	0	-176	0	-1		269	12	0
JUN	908	11	4	-17	0	-176	-42	-1		908	103	0
JUL	740	17	7	-17	0	-176	-42	-1		228	105	0
AUG	605	18	8	-13	0	-176	-42	-1		206	105	0
SEP	404	18	8	-8	0	-176	-42	-1		201	105	0

OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1995/JAN	19	4	0	-3	0	-176	0	-1	19	54	0
FEB	19	3	0	-3	0	-176	0	-1	19	33	0
MAR	19	2	0	-3	0	-176	0	-1	19	12	0
APR	19	3	0	-3	0	-176	0	-1	19	0	-62
MAY	150	3	0	-19	0	-176	0	-1	150	0	-4
JUN	505	6	0	-17	0	-176	-42	-1	505	36	0
JUL	411	10	0	-17	0	-176	-42	-1	411	61	0
AUG	337	10	0	-13	0	-176	-42	-1	337	76	0
SEP	224	10	0	-8	0	-176	-42	-1	224	77	0
OCT	94	6	0	-6	0	-176	-28	-1	94	63	0
NOV	37	4	0	-3	0	-176	0	-1	37	44	0
DEC	37	4	0	-3	0	-176	0	-1	37	26	0
1996/JAN	34	7	3	-3	0	-176	0	-1	34	8	0
FEB	34	5	2	-3	0	-176	0	-1	34	0	-73
MAR	34	4	2	-3	0	-176	0	-1	34	0	-134
APR	34	5	2	-3	0	-176	0	-1	34	0	-132
MAY	269	5	2	-19	0	-176	0	-1	269	11	0
JUN	908	11	4	-17	0	-176	-42	-1	908	102	0
JUL	740	17	7	-17	0	-176	-42	-1	236	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	401	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	5	3	-3	0	-176	0	-1	67	75	0
1997/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1998/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1999/JAN	34	7	3	-3	0	-176	0	-1	34	57	0

FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	905	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	5	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2000/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	5	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2001/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0

REVISED TABLE C.3
WISHBONE HILL PROJECT WATER BALANCE 06/06/90
1991-2001 PERIOD OF OPERATION
NORMAL OPERATING/WET YEAR IN 1995

OPERATING PARAMETERS

FRESH WATER POND NO. 1(FWP1)

ELEV	AREA	CAPACITY
ft	acres	acre ft
840	0	
850	1	2
868	2	24

CATCHMENT AREA	4	ACRES		
INFILTRATION RATE	1.0E-07	CM/SEC OR	0	FT/MO
INITIAL STORAGE	0	ACRE FT		
POTABLE REQUIREMENT	0.0	GPM		
DUST SUPPRESSION	42	GPM		
WASHDOWN RECYCLE	1	GPM		

FRESH WATER POND NO. 2(FWP2)

CAPACITY	81	AC FT
CATCHMENT	10	ACRES
SURFACE	6	ACRES

SLURRY POND(SP)

ELEV	AREA	CAPACITY
ft	acres	acre ft
825	10	72
850	21	427
865	27	785

CATCHMENT AREA	51	ACRES		
INFILTRATION RATE	1.0E-02	CM/SEC OR	850	FT/MO
(" " AFTER YR1)=	1.0E-03	CM/SEC OR	85	FT/MO

TAILINGS PARAMETERS				
SLURRY DENSITY	23%			
SPECIFIC GRAVITY	2.6			
DEGREE SATURATION	75%			
DEPOSITED DENSITY	63	PCF		
VOIDS WATER RETAINED	45%	OR IN GPM	16	
MINIMUM POND VOLUME	10	ACRE FT		
MILL/PROCESS PARAMETERS				
TAILINGS PRODUCTION	210	TPD		
INITIAL ORE MOISTURE	4%			
SLURRY WATER	120	GPM	55.7	GPM
MINIMUM FRESHWATER	4	GPM	COARSE WASH FLOW	
SP RECOVER & RECYCLE	0	GPM	0%	
			OF FREEWATER	

CLIMATE/HYDROLOGY PARAMETERS

MONTH	MEAN PPT	MEAN EVAP	MEAN RO*	CK RO DIST	CK RO**
	in	in	in	%	in
JAN	1.4	0.6	0.7	1%	0.1

SLURRY POND BALANCE

DATE YR/MO	INFLOWS SOLIDS/cum	INFLOWS FREEWATER	INFLOWS PRECIP	INFLOWS RUNOFF	INITIAL STORAGE	INITIAL POND AREA	LOSSES SEEPAGE	LOSSES EVAP	POND RECLAIM	RECOVER& RECYCLE	NET STORAGE
	acre ft	gpm	gpm	gpm	acre ft	acre	gpm	gpm	gpm	gpm	acre ft
1990/SEP					0	0					
OCT	0	0	0	37	5	1	-4,179	-1	0	0	0
NOV	0	0	1	25	3	0	-2,944	0	0	0	0
DEC	0	0	0	25	3	0	-2,933	0	0	0	0
1991/JAN	0	0	0	22	3	0	-2,566	0	0	0	0
FEB	0	0	0	17	2	0	-2,014	0	0	0	0
MAR	0	0	0	13	2	0	-1,462	0	0	0	0
APR	0	0	0	16	2	0	-1,825	0	0	0	0
MAY	0	0	0	18	2	0	-2,010	-1	0	0	0
JUN	0	0	0	35	5	1	-4,022	-1	0	0	0
JUL	0	0	1	55	8	1	-6,437	-2	0	0	0
AUG	0	0	2	58	8	1	-6,855	-2	0	0	0
SEP	0	0	2	58	8	1	-6,863	-1	0	0	0
OCT	5	104	2	36	19	3	-16,094	-2	0	0	0
NOV	9	104	3	24	17	2	-14,878	-1	0	0	0
DEC	14	104	2	24	17	2	-14,867	-1	0	0	0
1992/JAN	18	104	2	21	17	2	-1,449	-1	0	0	0
FEB	23	104	2	17	16	2	-1,392	-1	0	0	0
MAR	27	104	1	12	16	2	-1,334	-1	0	0	0
APR	32	104	1	15	16	2	-1,372	-1	0	0	0
MAY	37	104	1	17	16	2	-1,391	-5	0	0	0
JUN	41	104	3	34	19	2	-1,600	-5	0	0	0
JUL	46	104	5	53	22	3	-1,850	-6	0	0	0
AUG	50	104	7	56	22	3	-1,893	-5	0	0	0
SEP	55	104	7	56	22	3	-1,894	-3	0	0	0
OCT	60	104	4	35	19	3	-1,625	-2	0	0	0
NOV	64	104	3	24	17	2	-1,488	-1	0	0	0
DEC	69	104	2	24	17	2	-1,487	-1	0	0	0
1993/JAN	73	104	2	21	17	2	-1,449	-1	0	0	0
FEB	78	104	2	17	16	2	-1,392	-1	0	0	0
MAR	82	104	1	12	16	2	-1,334	-1	0	0	0
APR	87	104	1	15	16	2	-1,372	-1	0	0	0
MAY	92	104	1	17	16	2	-1,391	-5	0	0	0
JUN	96	104	3	34	19	2	-1,600	-5	0	0	0
JUL	101	104	5	53	22	3	-1,850	-6	0	0	0
AUG	105	104	7	56	22	3	-1,893	-5	0	0	0
SEP	110	104	7	56	22	3	-1,894	-3	0	0	0
OCT	115	104	4	35	19	3	-1,625	-2	0	0	0
NOV	119	104	3	24	17	2	-1,488	-1	0	0	0
DEC	124	104	2	24	17	2	-1,487	-1	0	0	0
1994/JAN	128	104	2	21	17	2	-1,449	-1	0	0	0
FEB	133	104	2	17	16	2	-1,392	-1	0	0	0
MAR	137	104	1	12	16	2	-1,334	-1	0	0	0
APR	142	104	1	15	16	2	-1,372	-1	0	0	0
MAY	147	104	1	17	16	2	-1,391	-5	0	0	0
JUN	151	104	3	34	19	2	-1,600	-5	0	0	0
JUL	156	104	5	53	22	3	-1,850	-6	0	0	0
AUG	160	104	7	56	22	3	-1,893	-5	0	0	0
SEP	165	104	7	56	22	3	-1,894	-3	0	0	0

FEB	1.1	0.6	0.6	1%	0.1
MAR	0.8	0.6	0.4	1%	0.1
APR	1.0	0.7	0.5	1%	0.1
MAY	1.1	3.8	0.6	8%	1.0
JUN	2.2	3.5	1.1	27%	3.2
JUL	3.5	3.4	1.8	22%	2.6
AUG	3.7	2.6	1.9	18%	2.2
SEP	3.7	1.6	1.9	12%	1.4
OCT	2.3	1.3	1.2	5%	0.6
NOV	1.6	0.7	0.8	2%	0.2
DEC	1.6	0.6	0.8	2%	0.2
ANNUAL	21.0	20.0	12.0		12.0

*MEAN RO=BASIN RUNOFF=PRECIPx 50%
**CK RO=CREEK FLOW-CK RO DISTx M.A.R.

BUFFALO CREEK DIVERSION
CATCHMENT AREA 446 ACRES

WET YR PPT 157%
DRY YR PPT 56%
DRY YR RO 0

OCT	170	104	4	35	19	3	-1,625	-2	0	0	0
NOV	174	104	3	24	17	2	-1,488	-1	0	0	0
DEC	179	104	2	24	17	2	-1,487	-1	0	0	0
1995/JAN	183	104	3	34	19	2	-1,600	-1	0	0	0
FEB	188	104	3	28	18	2	-1,527	-1	0	0	0
MAR	192	104	2	19	17	2	-1,421	-1	0	0	0
APR	197	104	2	24	17	2	-1,479	-1	0	0	0
MAY	202	104	3	26	18	2	-1,511	-6	0	0	0
JUN	206	104	5	53	22	3	-1,840	-6	0	0	0
JUL	211	104	10	84	26	4	-2,247	-7	0	0	0
AUG	215	104	13	88	27	4	-2,323	-6	0	0	0
SEP	220	104	13	87	27	4	-2,315	-4	0	0	0
OCT	225	104	8	54	22	3	-1,885	-2	0	0	0
NOV	229	104	5	37	19	3	-1,659	-1	0	0	0
DEC	234	104	4	38	19	3	-1,659	-1	0	0	0
1996/JAN	238	104	2	21	17	2	-1,450	-1	0	0	0
FEB	243	104	2	17	16	2	-1,392	-1	0	0	0
MAR	247	104	1	12	16	2	-1,334	-1	0	0	0
APR	252	104	1	15	16	2	-1,372	-1	0	0	0
MAY	257	104	1	17	16	2	-1,391	-5	0	0	0
JUN	261	104	3	34	19	2	-1,600	-5	0	0	0
JUL	266	104	5	53	22	3	-1,850	-6	0	0	0
AUG	270	104	7	56	22	3	-1,893	-5	0	0	0
SEP	275	104	7	56	22	3	-1,894	-3	0	0	0
OCT	280	104	4	35	19	3	-1,625	-2	0	0	0
NOV	284	104	3	24	17	2	-1,488	-1	0	0	0
DEC	289	104	2	24	17	2	-1,487	-1	0	0	0
1997/JAN	293	104	2	21	17	2	-1,449	-1	0	0	0
FEB	298	104	2	17	16	2	-1,392	-1	0	0	0
MAR	302	104	1	12	16	2	-1,334	-1	0	0	0
APR	307	104	1	15	16	2	-1,372	-1	0	0	0
MAY	312	104	1	17	16	2	-1,391	-5	0	0	0
JUN	316	104	3	34	19	2	-1,600	-5	0	0	0
JUL	321	104	5	53	22	3	-1,850	-6	0	0	0
AUG	325	104	7	56	22	3	-1,893	-5	0	0	0
SEP	330	104	7	56	22	3	-1,894	-3	0	0	0
OCT	335	104	4	35	19	3	-1,625	-2	0	0	0
NOV	339	104	3	24	17	2	-1,488	-1	0	0	0
DEC	344	104	2	24	17	2	-1,487	-1	0	0	0
1998/JAN	348	104	2	21	17	2	-1,449	-1	0	0	0
FEB	353	104	2	17	16	2	-1,392	-1	0	0	0
MAR	357	104	1	12	16	2	-1,334	-1	0	0	0
APR	362	104	1	15	16	2	-1,372	-1	0	0	0
MAY	367	104	1	17	16	2	-1,391	-5	0	0	0
JUN	371	104	3	34	19	2	-1,600	-5	0	0	0
JUL	376	104	5	53	22	3	-1,850	-6	0	0	0
AUG	380	104	7	56	22	3	-1,893	-5	0	0	0
SEP	385	104	7	56	22	3	-1,894	-3	0	0	0
OCT	390	104	4	35	19	3	-1,625	-2	0	0	0
NOV	394	104	3	24	17	2	-1,488	-1	0	0	0
DEC	399	104	2	24	17	2	-1,487	-1	0	0	0
1999/JAN	403	104	2	21	17	2	-1,449	-1	0	0	0

FEB	408	104	2	17	16	2	-1,392	-1	0	0	0
MAR	412	104	1	12	16	2	-1,334	-1	0	0	0
APR	417	104	1	15	16	2	-1,372	-1	0	0	0
MAY	422	104	1	17	16	2	-1,391	-5	0	0	0
JUN	426	104	3	34	19	2	-1,600	-5	0	0	0
JUL	431	104	5	53	22	3	-1,850	-6	0	0	0
AUG	435	104	7	56	22	3	-1,893	-5	0	0	0
SEP	440	104	7	56	22	3	-1,894	-3	0	0	0
OCT	445	104	4	35	19	3	-1,625	-2	0	0	0
NOV	449	104	3	24	17	2	-1,488	-1	0	0	0
DEC	454	104	2	24	17	2	-1,487	-1	0	0	0
2000/JAN	458	104	2	21	17	2	-1,449	-1	0	0	0
FEB	463	104	2	17	16	2	-1,392	-1	0	0	0
MAR	467	104	1	12	16	2	-1,334	-1	0	0	0
APR	472	104	1	15	16	2	-1,372	-1	0	0	0
MAY	477	104	1	17	16	2	-1,391	-5	0	0	0
JUN	481	104	3	34	19	2	-1,600	-5	0	0	0
JUL	486	104	5	53	22	3	-1,850	-6	0	0	0
AUG	490	104	7	56	22	3	-1,893	-5	0	0	0
SEP	495	104	7	56	22	3	-1,894	-3	0	0	0
OCT	500	104	4	35	19	3	-1,625	-2	0	0	0
NOV	504	104	3	24	17	2	-1,488	-1	0	0	0
DEC	509	104	2	24	17	2	-1,487	-1	0	0	0
2001/JAN	513	104	2	21	17	2	-1,449	-1	0	0	0
FEB	518	104	2	17	16	2	-1,392	-1	0	0	0
MAR	522	104	1	12	16	2	-1,334	-1	0	0	0
APR	527	104	1	15	16	2	-1,372	-1	0	0	0
MAY	532	104	1	17	16	2	-1,391	-5	0	0	0
JUN	536	104	3	34	19	2	-1,600	-5	0	0	0

AVAIL. FRESH WATER POND BALANCE

DATE YR/MO	AVAIL. WATER FRM BUFF CR	INFLOWS PRECIP	INFLOWS RUNOFF	LOSSES EVAP	LOSSES POTABLE	LOSSES WASH CIRC	LOSSES DUST SUPN	LOSSES WASHDOWN	BUFF CR MAKEUP	STORAGE	WASH PLANT DEFICIT
	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	acre ft	gpm
1990/SEP											
OCT	168	11	2	-6	0	0	0	0	168	23	0
NOV	67	8	1	-3	0	0	0	0	67	33	0
DEC	67	5	1	-3	0	0	0	0	67	43	0
1991/JAN	34	7	3	-3	0	0	0	0	34	48	0
FEB	34	5	2	-3	0	0	0	0	34	53	0
MAR	34	4	2	-3	0	0	0	0	34	58	0
APR	34	5	2	-3	0	0	0	0	34	63	0
MAY	269	5	2	-19	0	0	0	0	269	97	0
JUN	909	11	4	-17	0	0	-42	0	105	105	0
JUL	740	17	7	-17	0	0	-42	0	34	105	0
AUG	605	18	5	-13	0	0	-42	0	29	105	0
SEP	404	18	8	-8	0	0	-42	0	24	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1992/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	86	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1993/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1994/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	5	-8	0	-176	-42	-1	201	105	0

OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1995/JAN	53	11	4	-3	0	-176	0	-1	53	60	0
FEB	53	9	4	-3	0	-176	0	-1	53	45	0
MAR	53	6	3	-3	0	-176	0	-1	53	29	0
APR	53	8	3	-3	0	-176	0	-1	53	13	0
MAY	422	9	4	-19	0	-176	0	-1	422	45	0
JUN	1,425	17	7	-17	0	-176	-42	-1	665	105	0
JUL	1,161	27	11	-17	0	-176	-42	-1	197	105	0
AUG	950	29	12	-13	0	-176	-42	-1	191	105	0
SEP	633	29	12	-8	0	-176	-42	-1	186	105	0
OCT	264	18	7	-6	0	-176	-28	-1	186	105	0
NOV	106	12	5	-3	0	-176	0	-1	106	98	0
DEC	106	12	5	-3	0	-176	0	-1	106	90	0
1996/JAN	34	7	3	-3	0	-176	0	-1	34	72	0
FEB	34	5	2	-3	0	-176	0	-1	34	54	0
MAR	34	4	2	-3	0	-176	0	-1	34	35	0
APR	34	5	2	-3	0	-176	0	-1	34	16	0
MAY	269	5	2	-19	0	-176	0	-1	269	27	0
JUN	908	11	4	-17	0	-176	-42	-1	509	105	0
JUL	740	17	7	-17	0	-176	-42	-1	211	105	0
AUG	605	15	5	-13	0	-176	-42	-1	206	105	0
SEP	404	15	5	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1997/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	15	8	-13	0	-176	-42	-1	206	105	0
SEP	404	15	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1998/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	19	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
1999/JAN	34	7	3	-3	0	-176	0	-1	34	57	0

FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2000/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0
JUL	740	17	7	-17	0	-176	-42	-1	228	105	0
AUG	605	18	8	-13	0	-176	-42	-1	206	105	0
SEP	404	18	8	-8	0	-176	-42	-1	201	105	0
OCT	168	11	5	-6	0	-176	-28	-1	168	102	0
NOV	67	8	3	-3	0	-176	0	-1	67	88	0
DEC	67	8	3	-3	0	-176	0	-1	67	75	0
2001/JAN	34	7	3	-3	0	-176	0	-1	34	57	0
FEB	34	5	2	-3	0	-176	0	-1	34	38	0
MAR	34	4	2	-3	0	-176	0	-1	34	20	0
APR	34	5	2	-3	0	-176	0	-1	34	1	0
MAY	269	5	2	-19	0	-176	0	-1	269	12	0
JUN	908	11	4	-17	0	-176	-42	-1	908	103	0

APPENDIX C.2

SEDIMENT POND MASS BALANCE SUMMARY

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 1

CATCHMENT AREA	114	ACRES
POND SURFACE AREA	8	ACRES
POND STORAGE CAPACITY	46	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	15	ACRE FT
100YR STORM SEDIMENT	22	ACRE FT
100YR STORM RUNOFF	10	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	15	12	816	0	15	46	15
1992	15	12	816	0	15	46	15
1993	15	12	816	0	15	46	15
1994	15	12	816	0	15	46	15
1995	15	12	816	0	15	46	15
1996	15	12	816	0	15	46	15
1997	15	12	816	0	15	46	15
1998	15	12	816	0	15	46	15
1999	15	12	816	0	15	46	15
2000	15	12	816	0	15	46	15
2001	15	12	816	0	15	46	15

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 2

CATCHMENT AREA	175	ACRES
POND SURFACE AREA	7	ACRES
POND STORAGE CAPACITY	31	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	10	ACRE FT
100YR STORM SEDIMENT	5	ACRE FT
100YR STORM RUNOFF	16	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	10	12	679	0	10	31	10
1992	10	12	679	0	10	31	10
1993	10	12	679	0	10	31	10
1994	10	12	679	0	10	31	10
1995	10	12	679	0	10	31	10
1996	10	12	679	0	10	31	10
1997	10	12	679	0	10	31	10
1998	10	12	679	0	10	31	10
1999	10	12	679	0	10	31	10
2000	10	12	679	0	10	31	10
2001	10	12	679	0	10	31	10

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 3

CATCHMENT AREA	13	ACRES
POND SURFACE AREA	1	ACRES
POND STORAGE CAPACITY	4	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	2	ACRE FT
100YR STORM SEDIMENT	2	ACRE FT
100YR STORM RUNOFF	1	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGE1 ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	2	12	62	0	2	4	2
1992	2	12	62	0	2	4	2
1993	2	12	62	0	2	4	2
1994	2	12	62	0	2	4	2
1995	2	12	62	0	2	4	2
1996	2	12	62	0	2	4	2
1997	2	12	62	0	2	4	2
1998	2	12	62	0	2	4	2
1999	2	12	62	0	2	4	2
2000	2	12	62	0	2	4	2
2001	2	12	62	0	2	4	2

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 4

CATCHMENT AREA	5	ACRES
POND SURFACE AREA	0.2	ACRES
POND STORAGE CAPACITY	0.42	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	0.02	ACRE FT
100YR STORM SEDIMENT	0.00	ACRE FT
100YR STORM RUNOFF	0.4	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	0.02	12	19	0	0.02	0.42	0.02
1992	0.02	12	19	0	0.02	0.42	0.02
1993	0.02	12	19	0	0.02	0.42	0.02
1994	0.02	12	19	0	0.02	0.42	0.02
1995	0.02	12	19	0	0.02	0.42	0.02
1996	0.02	12	19	0	0.02	0.42	0.02
1997	0.02	12	19	0	0.02	0.42	0.02
1998	0.02	12	19	0	0.02	0.42	0.02
1999	0.02	12	19	0	0.02	0.42	0.02
2000	0.02	12	19	0	0.02	0.42	0.02
2001	0.02	12	19	0	0.02	0.42	0.02

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 5

CATCHMENT AREA	105	ACRES
POND SURFACE AREA	1.6	ACRES
POND STORAGE CAPACITY	12.7	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	1.6	ACRE FT
100YR STORM SEDIMENT	1.8	ACRE FT
100YR STORM RUNOFF	9.3	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	1.6	12	165	0	1.6	12.7	1.6
1992	1.6	12	165	0	1.6	12.7	1.6
1993	1.6	12	165	0	1.6	12.7	1.6
1994	1.6	12	165	0	1.6	12.7	1.6
1995	1.6	12	165	0	1.6	12.7	1.6
1996	1.6	12	165	0	1.6	12.7	1.6
1997	1.6	12	165	0	1.6	12.7	1.6
1998	1.6	12	165	0	1.6	12.7	1.6
1999	1.6	12	165	0	1.6	12.7	1.6
2000	1.6	12	165	0	1.6	12.7	1.6
2001	1.6	12	165	0	1.6	12.7	1.6

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 6

CATCHMENT AREA	6	ACRES
POND SURFACE AREA	1.1	ACRES
POND STORAGE CAPACITY	4.6	ACRE FT
MEAN ANNUAL PRECIP	24	IN
MEAN ANNUAL RUNOFF	12	IN
MEAN ANNUAL SEDIMENT	0.8	ACRE FT
100YR STORM SEDIMENT	3.3	ACRE FT
100YR STORM RUNOFF	0.5	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	0.8	12	119	0	0.8	4.6	0.8
1992	0.8	12	119	0	0.8	4.6	0.8
1993	0.8	12	119	0	0.8	4.6	0.8
1994	0.8	12	119	0	0.8	4.6	0.8
1995	0.8	12	119	0	0.8	4.6	0.8
1996	0.8	12	119	0	0.8	4.6	0.8
1997	0.8	12	119	0	0.8	4.6	0.8
1998	0.8	12	119	0	0.8	4.6	0.8
1999	0.8	12	119	0	0.8	4.6	0.8
2000	0.8	12	119	0	0.8	4.6	0.8
2001	0.8	12	119	0	0.8	4.6	0.8

WISHBONE HILL MINE PROJECT 07/31/89
SEDIMENT POND MASS BALANCE SUMMARY 17202

SEDIMENT POND 7

CATCHMENT AREA	0.75	ACRES
POND SURFACE AREA	0.47	ACRES
POND STORAGE CAPACITY	0.57	ACRE FT
MEAN ANNUAL PRECIP	24.00	IN
MEAN ANNUAL RUNOFF	12.00	IN
MEAN ANNUAL SEDIMENT	0.10	ACRE FT
100YR STORM SEDIMENT	0.40	ACRE FT
100YR STORM RUNOFF	0.07	ACRE FT
POND INFILTRATION	1.E-04	CM/SEC
	103	FT/YR

YR	POND SED STORAGE ACRE FT	POND WATER STORAGEi ACRE FT	SEEPAGE ACRE FT	POND WATER STORAGEf ACRE FT	WATER+SED STORAGEf ACRE FT	STORAGEf+ 100YR STORM ACRE FT	SEDIMENT REMOVAL ACRE FT
1991	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1992	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1993	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1994	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1995	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1996	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1997	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1998	0.10	12.00	48.60	0.00	0.10	0.57	0.10
1999	0.10	12.00	48.60	0.00	0.10	0.57	0.10
2000	0.10	12.00	48.60	0.00	0.10	0.57	0.10
2001	0.10	12.00	48.60	0.00	0.10	0.57	0.10

APPENDIX D
SEDIMENT POND DESIGN CALCULATIONS

APPENDIX D - SEDIMENT POND DESIGN CALCULATIONS

This Appendix contains the calculations used for designing the proposed sediment ponds for the life of the project. Materials included in this Appendix are:

- SEDCAD summary printouts;
- Average annual sediment generation calculations;
- Watershed data including areas, slopes, distances, etc.;
- Pond emergency overflow channel sizing calculations; and
- Sediment control ditch sizing calculations.

Table D-1 provides a summary of the 100-yr storm runoff and sediment load and average annual sediment yield for each proposed sediment pond.

SEDCAD, which was largely developed at the Agricultural Engineering Department of the University of Kentucky, is a widely accepted standard for sediment pond design for coal mines. The very conservative SLOSS subroutine was used for calculating sediment yield (detachment and transport theory based on CREAMS model). SEDCAD is a licensed product of Civil Software Design of Lexington, Kentucky.

Input parameters for SEDCAD include catchment areas, lengths and slopes, SCS curve number, storm type and storm precipitation, soil characteristics including grain size distribution, specific gravity, soil erodibility factor and control practice factor, and Muskingum routing parameters. The program calculates various runoff and sediment load information including runoff volume, peak discharge and sediment yield.

Average annual sediment calculations were done using the Universal Soil Loss Equation (Barfield et al, 1981).

Emergency overflow channel design calculations are based on the broad-crested weir formula.

Sediment control ditch sizing utilizes a calculation spreadsheet setup by SRK on the computer which employs Manning's equation.

All flood runoff calculations are based on hydrologic condition AMC II (USBR Design of Small Dams).

The predominant soil types throughout the project area are alluvial sands and gravels, and glacial tills. Based on field observation and laboratory testing, a USCS classification of SP to GW is common for the in-situ materials which are anticipated to be exposed in the disturbed (stripped) project areas. As such, the general classification for the site soils would be Group A - high infiltration/ low runoff potential. These soils would be classified as poor in terms of hydrologic condition for infiltration, and thus merit a runoff curve number of 68 for pasture or rangeland use. For simplicity, a conservative curve number of 70 has been assumed throughout the disturbed project area.

Attached is a working map which delineates the catchment areas for each of the sediment ponds for the sediment and runoff calculations contained in this Appendix.

SUBJECT REVISIONS			
REV.	DATE	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:

DRAWN BY:

CHECK BY:

DWG FILE:

DATE DRAWN:

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

MINE AREA 1 & 2 WORKING DRAINAGE MAP

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No.

SHEET No. 1 OF 1

REV. 1

APPENDIX D.1
SEDCAD PRINTOUTS

TABLE D.1-1

SEDIMENT POND DESIGN SUMMARY

SEDIMENT POND NO.	VOLUMES IN ACRE-FT: 100-YR STORM SEDIMENT LOAD	100-YR STORM WATER	AVERAGE ANNUAL SEDIMENT YIELD	TOTAL
1	21.5	10.2	14.5	46.2
2	4.9	15.6	10.0	30.5
3	1.6	1.1	1.6	4.3
4	.002	0.4	.02	0.4
5	1.8	9.3	1.6	12.7
6	3.3	0.5	0.8	4.6
7	0.4	0.04	0.1	0.6

* Assumed density of settled solids = 65 PCF

** Sediment Ponds 6 and 7 sediment loads based on area ratio method. SEDCAD calculation is for combined drainage area.

TABLE D.1-2

100-YR FLOOD PEAKS FOR SEDIMENT AND FRESH WATER PONDS

POND NO.	100-YR PEAK FLOW* CFS
1	21
2	33**
3	5
4	2
5	32
6	3
7	3
Fresh Water Pond No. 1	43
Fresh Water Pond No. 2	8

* Assumes No attenuation at pond.

** Estimated. Channel routing not used in SEDCAD calculations.

```
*****************************************************************************
*                                                                           *
*                              SEDCAD+(TM)                                  *
*          Sediment, Erosion, Discharge by Computer Aided Design            *
*                        Version No. 2.15b  (11/11/88)                      *
*                                                                           *
*                                  by                                       *
*                                                                           *
*                            Pamela J. Schwab                               *
*                          Civil Software Design                            *
*                             P.O. Box 11092                                *
*                       Lexington, Kentucky  40512                          *
*                                                                           *
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*                                                                           *
*                  Steffen Robertson & Kirsten                              *
*                  3232 S. Vance St., Suite 210                             *
*                  Lakewood, CO  80227                                      *
*                  (303) 985-1333                                           *
*                                                                           *
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*****************************************************************************
*                                                                           *
*    Current Date and Time:            07-11-1989   07:28:41               *
*    Computed Date and Time:           01-01-1980   08:17:17               *
*    File Created By:                  RJF                                 *
*    File Currently Being Printed:     A:SEDPOND1                          *
*                                                                           *
*****************************************************************************

************************** WATERSHED IDENTIFICATION **************************
*                                                                           *
* SED POND 1                                                                *
*                                                                           *
*****************************************************************************

********************************** STORM INPUT ***********************************
*                                                                           *
*                  Storm Type          SCS TYPE 1                           *
*                  Rainfall Depth       3.6 inches                          *
*                  Storm Duration      24.0 hours                           *
*                                                                           *
*****************************************************************************
```

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WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2
	2	1
2	1	1
	2	1
3	1	1
	2	1
4	1	1
		2
	2	1
5	1	1

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5
Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.078	0.078	0.333
1	2	Prior J or S to Structure 1	0.000	0.000	0.000
2	1	Prior J or S to Structure 1	0.089	0.089	0.333
2	2	Prior J or S to Structure 1	0.000	0.000	0.000
3	1	Prior J or S to Structure 1	0.080	0.080	0.333
3	2	Prior J or S to Structure 1	0.000	0.000	0.000
4	1	Prior J or S to Structure 1	0.008	0.008	0.333
4	1	Prior J or S to Structure 2	0.372	0.372	0.185
4	2	Prior J or S to Structure 1	0.000	0.000	0.000
5	1	Prior J or S to Structure 1	0.000	0.000	0.000

<<< SEDCAD+ >>>

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```
**********************************************
**********************************************
**                                          **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                    E                     **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	8.90	70.00	0.389	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	980.0	0.5	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	2.522	1.070	1.62	0.009

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RESULTS TO E

Total Drainage Area to This Point = 8.900 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.794	2.522	2610.69	0.974	1.62

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.60	0.56	0.56	0.44	0.30

```
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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  1 , BRANCH  1 , STRUCTURE  2  **
          **           NULL STRUCTURE               **
          **                  E1                    **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1     0.00    70.00  0.000   0.000    0.000   0.000   INSTANT    *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*              1      1      0.00   960.0    10.0    0.000    0   (MUSLE)   *
*                                                                           *
*                                                                           *
*              COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                    *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*              1       0.000    1.070       0.00    0.001                   *
*                                                                           *
*****************************************************************************
```

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RESULTS TO E1

Total Drainage Area to This Point = 8.900 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.794	2.437	2569.08	0.958	1.61

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.60	0.55	0.55	0.43	0.30

<<< SEDCAD+ >>>

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  2 , STRUCTURE  1  **
**            NULL STRUCTURE               **
**                    D                    **
**                                         **
*********************************************
*********************************************
```

```
*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1    19.60    70.00  0.922   0.000    0.000   0.000   FAST      *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*              1      1      0.24   248.0    44.0    1.200    1   (SLOSS)   *
*                                                                           *
*                                                                           *
*                COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                  *
*                                                                           *
*                     PEAK FLOW   RUNOFF   SEDIMENT    D50                  *
*           WATERSHED   (cfs)    (inches)   (tons)     (mm)                 *
*---------------------------------------------------------------------------*
*              1        4.652    1.070    7076.19    0.250                 *
*                                                                           *
*****************************************************************************
```

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RESULTS TO D

Total Drainage Area to This Point = 19.600 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.748	4.652	1648753.00	1167.461	7076.19

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	17.20	938.96	938.96	812.03	581.95

```
                    <<< SEDCAD+ >>>
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        ********************************************
        ********************************************
        **                                        **
        **  JUNCTION  2 , BRANCH  1 , STRUCTURE  1  **
        **           NULL STRUCTURE               **
        **                  D+E                   **
        **                                        **
        ********************************************
        ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1     0.00    70.00  0.000   0.000    0.000   0.000   INSTANT    *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*              1      1      0.00  1080.0    10.0    1.200    1   (SLOSS)   *
*                                                                           *
*                                                                           *
*              COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                    *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*              1        0.000    1.070       0.00    0.001                  *
*                                                                           *
*****************************************************************************
```

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RESULTS TO D+E

Total Drainage Area to This Point = 28.500 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	2.542	6.641	1437900.00	1017.982	7074.65

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	17.30	777.68	777.68	661.86	477.09

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*********************************************
*********************************************
**                                         **
**  JUNCTION  2 , BRANCH  2 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                    C                    **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	42.50	70.00	1.440	0.000	0.000	0.000	FAST

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	275.0	39.0	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	8.054	1.070	12527.20	0.250

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RESULTS TO C

Total Drainage Area to This Point = 42.500 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	3.791	8.054	1486272.00	1052.410	12527.20

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	18.50	855.45	855.45	716.22	552.09

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**********************************************
**********************************************
**                                          **
**  JUNCTION  3 , BRANCH  1 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                  C+D+E                   **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	980.0	10.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO C+D+E

Total Drainage Area to This Point = 71.000 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	6.333	13.842	1452767.00	1028.568	19594.01

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	18.50	826.09	826.09	688.63	530.82

<<< SEDCAD+ >>>
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```
**********************************************
**********************************************
**                                          **
**  JUNCTION  3 , BRANCH  2 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                    B                     **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	33.20	70.00	1.472	0.000	0.000	0.000	FAST

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	288.0	37.0	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	6.217	1.070	9178.11	0.250

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RESULTS TO B

Total Drainage Area to This Point = 33.200 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	2.961	6.217	1445145.00	1023.289	9178.11

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	18.60	827.96	827.96	689.38	534.27

```
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        ********************************************
        ********************************************
        **                                        **
        **  JUNCTION  4 , BRANCH  1 , STRUCTURE  1 **
        **            NULL STRUCTURE              **
        **                 B+C+D+E                **
        **                                        **
        ********************************************
        ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1     0.00    70.00  0.000   0.000    0.000   0.000   INSTANT   *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*              1      1      0.00   100.0    10.0    0.000    0   (SLOSS)   *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                     PEAK FLOW   RUNOFF   SEDIMENT    D50                  *
*           WATERSHED   (cfs)    (inches)   (tons)     (mm)                 *
*---------------------------------------------------------------------------*
*              1        0.000    1.070       0.00    0.001                 *
*                                                                           *
*****************************************************************************
```

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RESULTS TO B+C+D+E

Total Drainage Area to This Point = 104.200 acres

Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	9.294	20.059	1447983.00	1024.691	28657.32

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	18.40	824.64	824.64	691.61	530.23

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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  4 , BRANCH  1 , STRUCTURE  2  **
          **           NULL STRUCTURE               **
          **               SED POND 1               **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1     0.00    70.00  0.000   0.000    0.000   0.000   INSTANT    *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*              1      1      0.00  1340.0     1.0    0.000    0   (MUSLE)   *
*                                                                           *
*                                                                           *
*              COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                    *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*              1        0.000    1.070       0.00    0.001                  *
*                                                                           *
*****************************************************************************
```

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RESULTS TO SED POND 1

Total Drainage Area to This Point = 104.200 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	9.294	19.425	1445794.00	1022.897	28604.30

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	18.50	823.76	823.76	691.47	533.01

```
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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  4 , BRANCH  2 , STRUCTURE  1  **
          **           NULL STRUCTURE               **
          **                   A                    **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                       SUBWATERSHED INFORMATION                            *
*                                                                           *
*****************************************************************************
*                                                                           *
*                       HYDRAULIC INPUT VALUES                              *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO    *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE     *
*---------------------------------------------------------------------------*
*          1     9.80    70.00  0.551   0.000    0.000   0.000   FAST        *
*                                                                           *
*                         SEDIMENT INPUT VALUES                             *
*                                                                           *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART            *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT             *
*---------------------------------------------------------------------------*
*              1      1      0.24   158.0    33.0    1.200    1   (SLOSS)   *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*              1       2.900    1.070    1750.64    0.239                   *
*                                                                           *
*****************************************************************************
```

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RESULTS TO A

Total Drainage Area to This Point = 9.800 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.874	2.900	1273442.00	899.117	1750.64

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.20	636.34	636.34	543.04	366.55

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```
**********************************************
**********************************************
**                                          **
**  JUNCTION  5 , BRANCH  1 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                   END                    **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1960.0	1.0	0.000	0	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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```
*******************************************************************************
*                                                                             *
*                              RESULTS TO END                                 *
*                                                                             *
*******************************************************************************
*                                                                             *
*  Total Drainage Area to This Point =                        114.000 acres  *
*  Drainage Area Between Previous Structure and This One =      0.000 acres  *
*                                                                             *
*         RUNOFF    PEAK     PEAK SEDIMENT  PEAK SETTLEABLE  SEDIMENT        *
*         VOLUME  DISCHARGE  CONCENTRATION   CONCENTRATION    YIELD         *
*         (ac-ft)   (cfs)       (mg/l)          (ml/l)        (tons)         *
*-----------------------------------------------------------------------------*
* IN/OUT  10.169   20.761     1426386.00       1009.047     30354.94         *
*                                                                             *
*                                                                             *
*                              AVERAGE SETTLEABLE CONCENTRATION:              *
*            TIME OF      VOLUME WEIGHTED DURING     ARITHMETIC DURING       *
*          SIGNIFICANT      TIME OF     PEAK          TIME OF     PEAK       *
*         CONCENTRATION   SIGN. CONC.  24 HOUR     SIGN. CONC.  24 HOUR      *
*            (hrs)          (ml/l)     (ml/l)        (ml/l)     (ml/l)       *
*-----------------------------------------------------------------------------*
* IN/OUT       18.60         811.35     811.35        689.83     534.62       *
*                                                                             *
*******************************************************************************
```

*** RUN COMPLETED ***

```
*************************************************************************
*                                                                       *
*                              SEDCAD+(TM)                              *
*          Sediment, Erosion, Discharge by Computer Aided Design        *
*                       Version No. 2.15b  (11/11/88)                   *
*                                                                       *
*                                  by                                   *
*                                                                       *
*                            Pamela J. Schwab                           *
*                          Civil Software Design                        *
*                             P.O. Box 11092                            *
*                        Lexington, Kentucky  40512                     *
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*************************************************************************
*                                                                       *
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*                                                                       *
*                  Steffen Robertson & Kirsten                          *
*                  3232 S. Vance St., Suite 210                         *
*                  Lakewood, CO  80227                                  *
*                  (303) 985-1333                                       *
*                                                                       *
*************************************************************************
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*                                                                       *
*************************************************************************

*************************************************************************
*                                                                       *
*    Current Date and Time:            07-19-1989   10:17:30           *
*    Computed Date and Time:           07-19-1989   09:39:28           *
*    File Created By:                  RJF                             *
*    File Currently Being Printed:     A:SEDPOND2                      *
*                                                                       *
*************************************************************************

************************** WATERSHED IDENTIFICATION **************************
*                                                                       *
* SED POND 2                                                            *
*                                                                       *
*************************************************************************

********************************** STORM INPUT ***********************************
*                                                                       *
*                  Storm Type          SCS TYPE 1                       *
*                  Rainfall Depth       3.6 inches                      *
*                  Storm Duration      24.0 hours                       *
*                                                                       *
*************************************************************************
```

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********** WATERSHED NETWORK **********

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
	2	1
2	1	1
	2	1
	3	1
3	1	1
	2	1
	3	1
4	1	1
	2	1
5	1	1

********** SEDIMENTOLOGY INPUTS **********

Specific Gravity = 2.5
Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

********** BETWEEN STRUCTURE ROUTING PARAMETERS **********

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	2	Prior J or S to Structure 1	0.000	0.000	0.000
2	1	Prior J or S to Structure 1	0.000	0.000	0.000
2	2	Prior J or S to Structure 1	0.000	0.000	0.000
2	3	Prior J or S to Structure 1	0.000	0.000	0.000
3	1	Prior J or S to Structure 1	0.000	0.000	0.000
3	2	Prior J or S to Structure 1	0.000	0.000	0.000
3	3	Prior J or S to Structure 1	0.000	0.000	0.000
4	1	Prior J or S to Structure 1	0.000	0.000	0.000
4	2	Prior J or S to Structure 1	0.000	0.000	0.000
5	1	Prior J or S to Structure 1	0.000	0.000	0.000

```
                    <<< SEDCAD+ >>>
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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  1 , BRANCH  1 , STRUCTURE  1  **
          **           NULL STRUCTURE                **
          **                TS SLOPES                **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1    12.00    70.00  0.004   0.000    0.000   0.000   INSTANT    *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*             WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART          *
*             SHED    NUM      K     (feet)   (%)     VALUE   OPT           *
*---------------------------------------------------------------------------*
*               1      1      0.24   100.0    33.0    1.200    1   (SLOSS)  *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                     PEAK FLOW   RUNOFF   SEDIMENT    D50                  *
*           WATERSHED   (cfs)    (inches)   (tons)     (mm)                 *
*---------------------------------------------------------------------------*
*               1        5.951    1.070    1677.87    0.239                 *
*                                                                           *
*****************************************************************************
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RESULTS TO TS SLOPES

Total Drainage Area to This Point = 12.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.070	5.951	1247561.00	880.784	1677.87

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	538.11	538.11	459.86	285.49

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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  1 , BRANCH  2 , STRUCTURE  1  **
          **           NULL STRUCTURE               **
          **               TS BENCH/RD              **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                       SUBWATERSHED INFORMATION                            *
*                                                                           *
*****************************************************************************
*                                                                           *
*                       HYDRAULIC INPUT VALUES                              *
*                                                                           *
*        WATER(  AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO    *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1    15.50    70.00  0.077   0.000    0.000   0.000   INSTANT     *
*                                                                           *
*                         SEDIMENT INPUT VALUES                             *
*                                                                           *
*             WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART           *
*             SHED    NUM      K     (feet)   (%)     VALUE   OPT            *
*---------------------------------------------------------------------------*
*               1      1      0.24   500.0     3.0    1.200    1   (SLOSS)   *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*               1       7.686    1.070      23.74    0.016                  *
*                                                                           *
*****************************************************************************
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RESULTS TO TS BENCH/RD

Total Drainage Area to This Point = 15.500 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.383	7.686	27002.63	12.559	23.74

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	5.87	5.87	4.58	2.84

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**********************************************
**********************************************
**                                          **
**  JUNCTION  2 , BRANCH  1 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                   PITS                   **
**                                          **
**********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1.0	1.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO PITS

Total Drainage Area to This Point = 27.500 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	2.453	13.637	765105.88	537.405	1701.61

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	291.22	291.22	239.03	148.40

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        ********************************************
        ********************************************
        **                                        **
        **  JUNCTION  2 , BRANCH  2 , STRUCTURE  1  **
        **           NULL STRUCTURE               **
        **               OB 2 SLOPES              **
        **                                        **
        ********************************************
        ********************************************


*************************************************************************
*                                                                       *
*                      SUBWATERSHED INFORMATION                         *
*                                                                       *
*************************************************************************
*                                                                       *
*                      HYDRAULIC INPUT VALUES                           *
*                                                                       *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE  *
*-----------------------------------------------------------------------*
*          1    18.80    70.00  0.003   0.000    0.000   0.000   INSTANT  *
*                                                                       *
*                        SEDIMENT INPUT VALUES                          *
*                                                                       *
*            WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART        *
*            SHED    NUM      K     (feet)   (%)     VALUE   OPT         *
*-----------------------------------------------------------------------*
*              1      1      0.24    75.0    33.0    1.200    1   (SLOSS) *
*                                                                       *
*                                                                       *
*              COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                *
*                                                                       *
*                   PEAK FLOW   RUNOFF   SEDIMENT    D50                *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)               *
*-----------------------------------------------------------------------*
*              1        9.322    1.070    2093.94    0.250               *
*                                                                       *
*************************************************************************
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RESULTS TO OB 2 SLOPES

Total Drainage Area to This Point = 18.800 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.677	9.322	1106160.00	783.258	2093.94

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	460.87	460.87	388.95	241.47

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**********************************************
**********************************************
**                                          **
**  JUNCTION  2 , BRANCH  3 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**               OB 2 BENCH/RD              **
**                                          **
**********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	18.90	70.00	0.077	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT
1	1	0.24	500.0	3.0	1.200	1 (SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	9.372	1.070	28.94	0.016

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RESULTS TO OB 2 BENCH/RD

Total Drainage Area to This Point = 18.900 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.686	9.372	27001.53	12.558	28.94

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	5.87	5.87	4.58	2.84

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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  3 , BRANCH  1 , STRUCTURE  1  **
          **           NULL STRUCTURE               **
          **                 INT I                  **
          **                                        **
          ********************************************
          ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1     0.00    70.00  0.000   0.000    0.000   0.000   INSTANT    *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*             WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART          *
*             SHED    NUM      K     (feet)   (%)     VALUE   OPT           *
*---------------------------------------------------------------------------*
*               1      1      0.00     1.0     1.0    0.000    0   (SLOSS)  *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*               1       0.000    1.070       0.00    0.001                  *
*                                                                           *
*****************************************************************************
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RESULTS TO INT I

Total Drainage Area to This Point = 65.200 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	5.816	32.331	737048.81	518.570	3824.49

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	279.24	279.24	228.70	141.99

<<< SEDCAD+ >>>

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*********************************************
*********************************************
**                                         **
**  JUNCTION  3 , BRANCH  2 , STRUCTURE  1 **
**           NULL STRUCTURE                **
**               OB 3 SLOPES               **
**                                         **
*********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	16.30	70.00	0.003	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	75.0	33.0	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	8.083	1.070	1815.49	0.250

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RESULTS TO OB 3 SLOPES

Total Drainage Area to This Point = 16.300 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.454	8.083	1106161.00	783.258	1815.49

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	460.87	460.87	388.95	241.47

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**********************************************
**********************************************
**                                          **
**  JUNCTION  3 , BRANCH  3 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**               OB 3 BENCH/RD              **
**                                          **
**********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	16.30	70.00	0.077	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	500.0	3.0	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	8.083	1.070	24.96	0.016

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RESULTS TO OB 3 BENCH/RD

Total Drainage Area to This Point = 16.300 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.454	8.083	27000.88	12.558	24.96

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	5.87	5.87	4.58	2.84

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*********************************************
*********************************************
**                                         **
**  JUNCTION  4 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                  INT 2                  **
**                                         **
*********************************************
*********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1.0	1.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO INT 2

Total Drainage Area to This Point = 97.800 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	8.724	48.497	730522.31	514.207	5664.94

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	276.49	276.49	226.34	140.52

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              ********************************************
              ********************************************
              **                                        **
              **  JUNCTION  4 , BRANCH  2 , STRUCTURE  1  **
              **           NULL STRUCTURE               **
              **                MISC PITS               **
              **                                        **
              ********************************************
              ********************************************


*****************************************************************************
*                                                                           *
*                        SUBWATERSHED INFORMATION                           *
*                                                                           *
*****************************************************************************
*                                                                           *
*                        HYDRAULIC INPUT VALUES                             *
*                                                                           *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO   *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE    *
*---------------------------------------------------------------------------*
*          1    77.60    70.00  0.335   0.000    0.000   0.000   MED        *
*                                                                           *
*                          SEDIMENT INPUT VALUES                            *
*                                                                           *
*             WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART          *
*             SHED    NUM      K     (feet)   (%)     VALUE   OPT           *
*---------------------------------------------------------------------------*
*               1      1      0.24  1320.0     8.9    1.200    1   (SLOSS)  *
*                                                                           *
*                                                                           *
*               COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS                   *
*                                                                           *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                   *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)                  *
*---------------------------------------------------------------------------*
*               1      23.364    1.070    1076.42    0.026                  *
*                                                                           *
*****************************************************************************
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RESULTS TO MISC PITS

Total Drainage Area to This Point = 77.600 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	6.922	23.364	187538.80	95.819	1076.42

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.40	55.31	55.31	43.67	29.84

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*********************************************
*********************************************
**                                         **
**  JUNCTION  5 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                SED POND 2               **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1.0	1.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO SED POND 2

Total Drainage Area to This Point = 175.400 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	15.645	65.917	609306.19	409.092	6741.36

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.50	184.08	184.08	140.10	96.32

*** RUN COMPLETED ***

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*                                                                       *
*                              SEDCAD+(TM)                              *
*          Sediment, Erosion, Discharge by Computer Aided Design        *
*                       Version No. 2.15b  (11/11/88)                   *
*                                                                       *
*                                  by                                   *
*                                                                       *
*                            Pamela J. Schwab                           *
*                          Civil Software Design                        *
*                             P.O. Box 11092                            *
*                        Lexington, Kentucky  40512                     *
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*************************************************************************
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*                                                                       *
*                  Steffen Robertson & Kirsten                          *
*                  3232 S. Vance St., Suite 210                         *
*                  Lakewood, CO  80227                                  *
*                  (303) 985-1333                                       *
*                                                                       *
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*                                                                       *
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*                                                                       *
*    Current Date and Time:            07-19-1989   10:19:11           *
*    Computed Date and Time:           01-01-1980   00:11:48           *
*    File Created By:                                                  *
*    File Currently Being Printed:     A:SEDPOND 3                     *
*                                                                       *
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************************** WATERSHED IDENTIFICATION **************************
*                                                                       *
* SED POND 4                                                            *
*                                                                       *
*************************************************************************

******************************** STORM INPUT *****************************
*                                                                       *
*                  Storm Type          SCS TYPE 1                       *
*                  Rainfall Depth       3.6 inches                      *
*                  Storm Duration      24.0 hours                       *
*                                                                       *
*************************************************************************
```

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****

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1

****

****

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5

Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

****

****

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000

****

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```
**********************************************
**********************************************
**                                          **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  1  **
**            NULL STRUCTURE                **
**                SED POND 3                **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	12.70	70.00	0.260	0.000	0.000	0.000	FAST

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT
1	1	0.24	150.0	33.0	1.200	1 (SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	4.919	1.070	2322.31	0.229

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RESULTS TO SED POND 3

Total Drainage Area to This Point = 12.700 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.133	4.919	1343572.00	945.727	2322.31

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	15.50	635.46	635.46	549.95	355.18

*** RUN COMPLETED ***

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*                                                                       *
*                                  by                                   *
*                                                                       *
*                            Pamela J. Schwab                           *
*                          Civil Software Design                        *
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*                                                                       *
*    Current Date and Time:            07-19-1989   10:21:07           *
*    Computed Date and Time:           01-01-1980   00:24:11           *
*    File Created By:                  RJF                             *
*    File Currently Being Printed:     A:SED POND 4                    *
*                                                                       *
*************************************************************************

************************* WATERSHED IDENTIFICATION *************************
*                                                                       *
* TEMP POND (4)                                                         *
*                                                                       *
*************************************************************************

******************************** STORM INPUT ********************************
*                                                                       *
*                  Storm Type          SCS TYPE 1                       *
*                  Rainfall Depth       3.6 inches                      *
*                  Storm Duration      24.0 hours                       *
*                                                                       *
*************************************************************************
```

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****

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
2	1	1
	2	1

****

****

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5

Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

****

****

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
2	1	Prior J or S to Structure 1	0.057	0.057	0.270
2	2	Prior J or S to Structure 1	0.000	0.000	0.000

****

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                    A                    **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	3.93	70.00	0.050	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	380.0	4.0	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	1.949	1.070	9.37	0.021

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RESULTS TO A

Total Drainage Area to This Point = 3.930 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.351	1.949	41770.46	20.552	9.37

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.80	9.63	9.63	7.56	4.66

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  2 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                   A'                    **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	410.0	4.0	1.200	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO A'

Total Drainage Area to This Point = 3.930 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.351	1.805	39991.46	19.580	9.29

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.80	9.52	9.52	7.49	4.62

```
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          ********************************************
          ********************************************
          **                                        **
          **  JUNCTION  2 , BRANCH  2 , STRUCTURE  1  **
          **           NULL STRUCTURE               **
          **                  B                     **
          **                                        **
          ********************************************
          ********************************************


*************************************************************************
*                                                                       *
*                      SUBWATERSHED INFORMATION                         *
*                                                                       *
*************************************************************************
*                                                                       *
*                      HYDRAULIC INPUT VALUES                           *
*                                                                       *
*        WATER   AREA    CURVE    TC     TT    ROUTING COEF'S  UNIT HYDRO  *
*        SHED   (acre)   NUMBER  (hr)   (hr)   K-(hr)    X      RESPONSE   *
*-----------------------------------------------------------------------*
*          1     4.66    70.00  0.200   0.000    0.000   0.000   MED      *
*                                                                       *
*                        SEDIMENT INPUT VALUES                          *
*                                                                       *
*             WATER   SEG     SOIL   LENGTH  SLOPE     CP     PART       *
*             SHED    NUM      K     (feet)   (%)     VALUE   OPT        *
*-----------------------------------------------------------------------*
*               1      1      0.24   720.0     1.5    1.200    1   (SLOSS) *
*                                                                       *
*                                                                       *
*               COMPUTED VALUES FOR INDIVIDUAL WATERShEDS               *
*                                                                       *
*                    PEAK FLOW   RUNOFF   SEDIMENT    D50                *
*          WATERSHED   (cfs)    (inches)   (tons)     (mm)               *
*-----------------------------------------------------------------------*
*               1       1.686    1.070       2.33    0.009               *
*                                                                       *
*************************************************************************
```

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RESULTS TO B

Total Drainage Area to This Point = 4.660 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.416	1.686	7825.29	2.956	2.33

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	15.80	1.55	1.55	1.22	0.80

*** RUN COMPLETED ***

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*    Computed Date and Time:           07-19-1989   07:33:07          *
*    File Created By:                  RJF                            *
*    File Currently Being Printed:     A:SEDPOND5                     *
*                                                                       *
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************************** WATERSHED IDENTIFICATION **************************
*                                                                       *
* SED POND 5                                                            *
*                                                                       *
*************************************************************************

******************************** STORM INPUT *****************************
*                                                                       *
*                  Storm Type          SCS TYPE 1                       *
*                  Rainfall Depth       3.6 inches                      *
*                  Storm Duration      24.0 hours                       *
*                                                                       *
*************************************************************************
```

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****

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2
	2	1
		2
	3	1
		2
2	1	1
	2	1
		2
3	1	1

****

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5
Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

****

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.142	0.142	0.320
1	2	Prior J or S to Structure 1	0.000	0.000	0.000
1	2	Prior J or S to Structure 2	0.330	0.330	0.230
1	3	Prior J or S to Structure 1	0.000	0.000	0.000
1	3	Prior J or S to Structure 2	0.125	0.125	0.270
2	1	Prior J or S to Structure 1	0.000	0.000	0.000
2	2	Prior J or S to Structure 1	0.000	0.000	0.000
2	2	Prior J or S to Structure 2	0.194	0.194	0.234
3	1	Prior J or S to Structure 1	0.000	0.000	0.000

****

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                   PIT 8                 **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	6.26	70.00	0.094	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	680.0	4.3	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	3.104	1.070	19.42	0.018

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RESULTS TO PIT 8

Total Drainage Area to This Point = 6.260 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.558	3.104	54091.54	25.733	19.42

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	12.09	12.09	9.44	5.86

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```
**********************************************
**********************************************
**                                          **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  2  **
**            NULL STRUCTURE                **
**                   PIT 8                  **
**                                          **
**********************************************
**********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1533.0	7.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO PIT 8

Total Drainage Area to This Point = 6.260 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.558	2.852	52811.79	25.121	19.41

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.80	12.11	12.11	9.51	5.87

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  2 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                  PIT 9                  **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	18.51	70.00	0.107	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	1160.0	8.8	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	9.179	1.070	268.18	0.023

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RESULTS TO PIT 9

Total Drainage Area to This Point = 18.510 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.651	9.179	234047.50	116.878	268.18

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	56.75	56.75	44.84	27.84

<<< SEDCAD+ >>>
--- Steffen Robertson & Kirsten ---

```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  2 , STRUCTURE  2 **
**            NULL STRUCTURE               **
**                  PIT 9                  **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1780.0	2.3	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

<<< SEDCAD+ >>>
--- Steffen Robertson & Kirsten ---

RESULTS TO PIT 9

Total Drainage Area to This Point = 18.510 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	1.651	7.007	230083.59	114.866	268.04

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.80	56.97	56.97	45.21	27.88

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```
*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  3 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                  PIT 10                 **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	8.20	70.00	0.052	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	750.0	22.5	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	4.066	1.070	1580.50	0.161

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RESULTS TO PIT 10

Total Drainage Area to This Point = 8.200 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.731	4.066	1446351.00	987.767	1580.50

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	638.82	638.82	556.29	345.36

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**                                          **
**  JUNCTION  1 , BRANCH  3 , STRUCTURE  2  **
**            NULL STRUCTURE                **
**                  PIT 10                  **
**                                          **
**********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	900.0	2.9	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO PIT 10

Total Drainage Area to This Point = 8.200 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.731	3.561	1437606.00	981.713	1579.71

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	639.84	639.84	556.28	345.35

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**                                         **
**  JUNCTION  2 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                 PITS 8-10               **
**                                         **
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1.0	1.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO PITS 8-10

Total Drainage Area to This Point = 32.970 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	2.941	12.499	769907.13	502.787	1867.16

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	251.31	251.31	209.25	129.91

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**                                         **
**  JUNCTION  2 , BRANCH  2 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                 MISC PITS               **
**                                         **
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	71.81	70.00	0.211	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.24	1543.0	6.8	1.200	1	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	25.555	1.070	610.73	0.020

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RESULTS TO MISC PITS

Total Drainage Area to This Point = 71.810 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	6.405	25.555	126231.60	61.261	610.73

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	15.90	32.86	32.86	25.93	17.18

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**                                         **
**  JUNCTION  2 , BRANCH  2 , STRUCTURE  2 **
**            NULL STRUCTURE               **
**                 MISC PITS               **
**                                         **
*********************************************
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SUBWATERShED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1050.0	2.4	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO MISC PITS

Total Drainage Area to This Point = 71.810 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	6.405	21.675	125680.70	60.983	610.57

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	15.90	32.86	32.86	26.14	17.32

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**                                         **
**  JUNCTION  3 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                SED POND 5               **
**                                         **
*********************************************
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SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	0.00	70.00	0.000	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.00	1.0	1.0	0.000	0	(SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	0.000	1.070	0.00	0.001

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RESULTS TO SED POND 5

Total Drainage Area to This Point = 104.780 acres
Drainage Area Between Previous Structure and This One = 0.000 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	9.346	32.365	505049.31	308.389	2477.73

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	16.00	108.15	108.15	87.58	58.39

*** RUN COMPLETED ***

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*                                                                       *
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*                          Civil Software Design                        *
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*                        Lexington, Kentucky  40512                     *
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*    Current Date and Time:            07-19-1989   10:22:33           *
*    Computed Date and Time:           01-01-1980   00:08:06           *
*    File Created By:                  RJF                             *
*    File Currently Being Printed:     A:SEDPOND6 & 7                  *
*                                                                       *
*************************************************************************

************************** WATERSHED IDENTIFICATION **************************
*                                                                       *
* SED POND 6                                                            *
*                                                                       *
*************************************************************************

********************************* STORM INPUT ********************************
*                                                                       *
*                  Storm Type          SCS TYPE 1                       *
*                  Rainfall Depth       3.6 inches                      *
*                  Storm Duration      24.0 hours                       *
*                                                                       *
*************************************************************************
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WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1

****

SEDIMENTOLOGY INPUTS

Specific Gravity =	2.5
Submerged Bulk Specific Gravity =	1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	25.0000	90.00
2	4.7500	75.00
3	2.0000	65.00
4	0.2500	50.00
5	0.0750	20.00
6	0.0010	0.00

****

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000

****

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*********************************************
*********************************************
**                                         **
**  JUNCTION  1 , BRANCH  1 , STRUCTURE  1 **
**            NULL STRUCTURE               **
**                SED POND 6 & 7           **
**                                         **
*********************************************
*********************************************
```

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	6.80	70.00	0.009	0.000	0.000	0.000	INSTANT

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT
1	1	0.24	290.0	59.0	1.200	1 (SLOSS)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	3.372	1.070	5197.92	0.250

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RESULTS TO SED POND 6 & 7

Total Drainage Area to This Point = 6.800 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	0.607	3.372	2110973.00	1494.753	5197.92

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	14.90	1227.78	1227.78	1155.44	717.34

*** RUN COMPLETED ***

APPENDIX D.2
USLE CALCULATIONS

TABLE D.2-1

APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS
Barfield et al, 1981

USLE A = RK LS CP
R = rainfall erosivity factor

- 6 hr storm is typically 2/3 of the 24-hr event for a given event (based on a cursory review of U.S. Department of Commerce publication, Technical Paper No. 40, 1961).

  2-yr, 24-hr event 1.15" (from Buffalo Creek analysis spreadsheet)

  2-yr, 6-hr event 0.76" say (1.0")

  Average annual R (Type I storm) = 16.55 $P_{2,6}^{2.2}$ = 16.6 say 20

K - Soil Erodibility factor

See nomograph (attached)
use K 0.15 to 0.27
gravelly sand - silt, use 0.21 as an average

LS - Length Slope factor

Dependent upon location, i.e., to be determined separately for each pond:

<u>Sed Pond 1</u> - Main purpose is to control sed from overburden Area 1

assume 3:1 slope ---> 33%
maximum height = say 300 ft
slope length = 950 ft

from nomograph ---> LS $\geq$ 20
using equation ---> LS = 28.5

<u>Sed Pond 2</u> - Overburden Area 2 Sed

assume 3:1 slope
maximum height = say 150 ft
slope length - 475 ft

from nomograph ---> LS = 20

<u>Sed Pond 3</u> - Portion of overburden Area 1

LS = 28.5 (see Sed Pond 1)

CP - Control Practice factor

From Table 5.8 ---> C = say, 1.5

A - Soil Loss (tons/acre) - Annual

Sed Pond 1

A = RK LS CP
= (20) (0.21) (28.5) (1.5)
= 180 tons/acre

Sed Pond 2

A = (20) (0.21) (20) (1.5)
= 126 tons/acre

Sed Pond 3

A = 180 tons/acre (see Sed Pond 1 calculation)

Annual Sediment Yield

Sed Pond 1

Dump area 114 acres ---> 20,520 tons @ 65 pcf ---> 14.5 acre ft

Sed Pond 2

Stockpiles: Use LS = 20

A_1 = (20) (.21) (20) (1.5)
= 126 tons/acre
Total Acre = 27.5 + 37.7 + 32.6 = 97.8
Sed_1 = 12,323 tons

Pit Areas: L = 1,320
S = 8.9, LS = 4

A_2 = (20) (.21) (4) (1.5)
= 25.2 tons/acre
Sed_2 = 1,956 tons

Total Sed (average annual) = 14,279 tons @ 65 pcf ---> 10.0 ac ft

Sed Pond 3

Catchment = 127 acres
180 tons/acre x 127 acres = 2,286 tons
2,286tons at 65 pcf = 1.6 acre-feet

Sed Pond 4

Areas:

A) 3.93 ac @ 4% LS = 380 ft
4% ditch = 410 ft
B) 4.66 ac @ 1.5% LS = 720 ft

Annual yield ---> take 4% for slope and 500 ft for length
yields .75 for LS

A = RK LS CP
= (20) (.21) (.75) (1.5)
= 4.7 tons/acre
Annual Sed = 4.7 x 4.66 = 22 tons ---> 0.016 ac ft

Sed Pond 5

Area = 104.8 acres

Component Area:

Pit 8	6.26 ac	4.26% 680 ft
		6.98% 1,553 ft
Pit 9 (partial)	18.51 ac	8.8% 1,160 ft
		2.3% 1,780 ft
Pit 10 (partial)	8.2 ac	14.1% 750 ft
		2.9% 600 ft

Pits 6, 7, 11, 12, 13, and 16 = 71.81
slope (average by area) 6.8%

Annual (average) Sed

A = RK LS CP
as before
R = 20
K = .21
CP = 1.5

LS: say, representative slope 7.6% (area weighted average)
length 1,361 ft (area weighted average)
LS (Figure 5.15) = 3.5

A = (20) (.21) (3.5) (1.5) = 22 tons/acre/year
* for 104.8 acres ---> A = 2,311 tons or 1.6 acre-feet

Sed Pond 6 - Use area ratio method to factor Sed Pond 1 yield

$$\left(\frac{\text{6.0 acres catchment}}{\text{114 acres catchment (for Sed Pond 1)}}\right) \times \text{14.5 acre ft sediment yield for Sed Pond 1}$$

0.8 acre-ft sediment

Sed Pond 7 - Use area ratio method to factor Sed Pond 1 yield

$$\left(\frac{1.0 \text{ acres catchment}}{114 \text{ acres catchment}}\right) \times 14.5 \text{ acre-ft sediment}$$
(for Sed Pond 1)

0.1 acre-ft sediment

Slurry Pond Sediment Loading

1. Total catchment area = 72 acres
2. Pond basin area = 27 acres
3. Net external catchment = 45 acres
   (1)-(2)

Catchment geometry includes part of topsoil Stockpile No. 1 and is similar to mine Area 2/Sediment Pond 2 catchment. Use area ratio method for sediment yield:

	Sed Pond 2	Slurry Pond
Catchment area	175 (acres)	45 (acres)
Area ratio	---	0.26
100-yr sediment yield	4.9 (acre-ft)	1.3 (acre-ft)
Average annual sediment yield	10.0 (acre-ft)	2.6 (acre-ft)

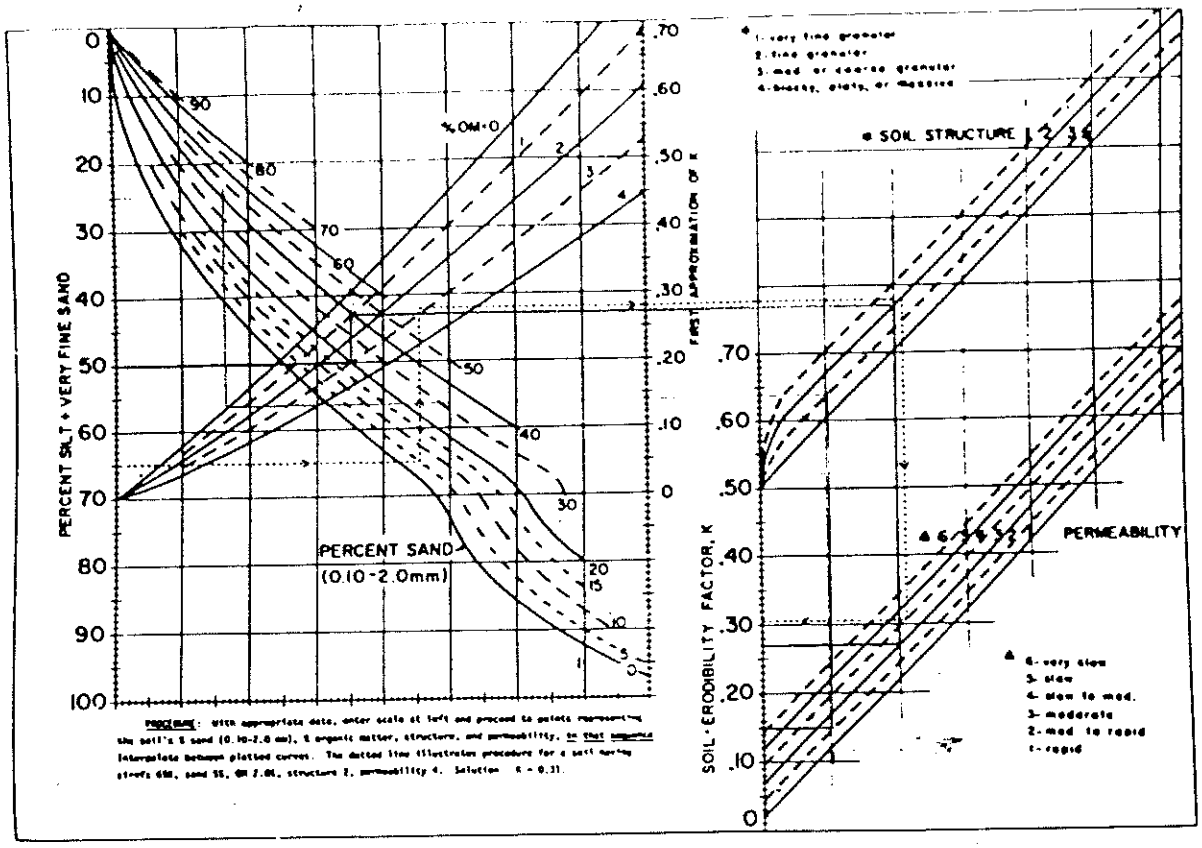


Figure 5.13. Nomograph for erodibility factor for surface and low clay subsoils. (Wischmeier *et al.*, 1971)

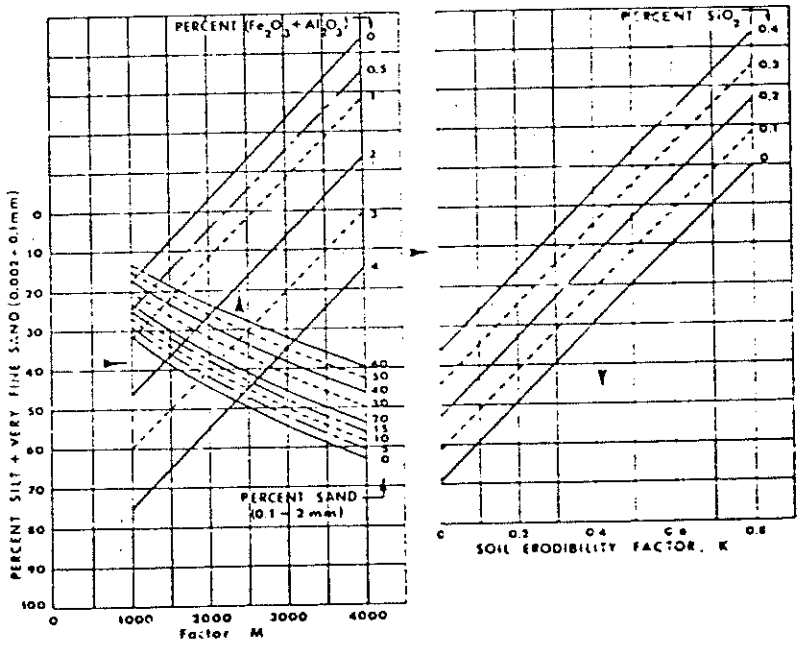
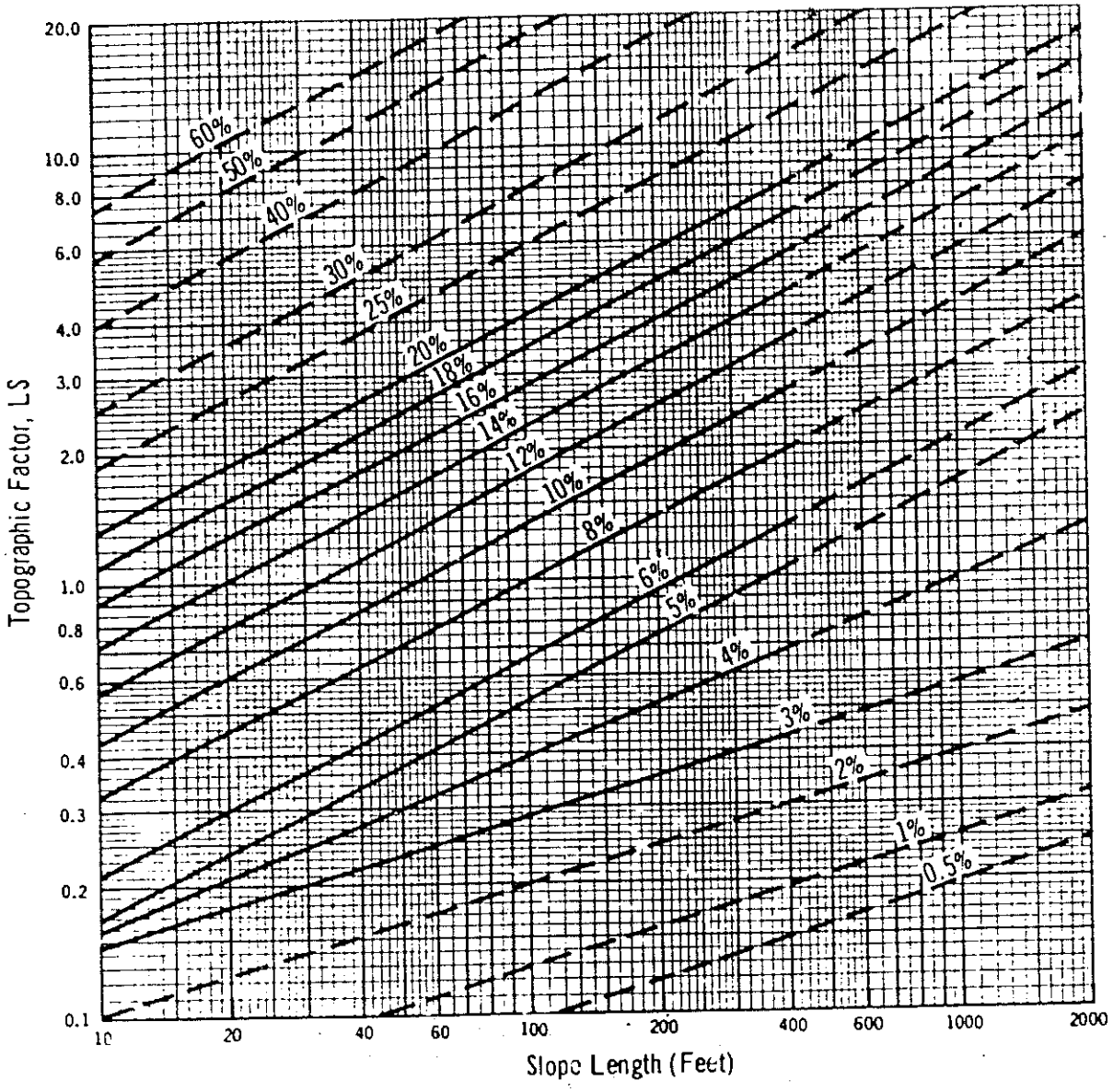


Figure 5.14. Nomograph for estimating the erodibility factor, K, of high clay subsoils. (Roth *et al.*, 1974)



*The dashed lines represent estimates for slope dimensions beyond the range of lengths and steepnesses for which data are available. The curves were derived by the formula:

$$LS = \left(\frac{\lambda}{72.6}\right)^m \left(\frac{430x^2 + 30x + 0.43}{6.613}\right)$$

where λ = field slope length in feet and $m = 0.5$ if $s = 5\%$ or greater, 0.4 if $s = 4\%$, and 0.3 if $s = 3\%$ or less; and $x = \sin\theta$. θ is the angle of slope in degrees.

Figure 5.15. Slope-effect chart (topographic factor, LS). (SCS, 1977)

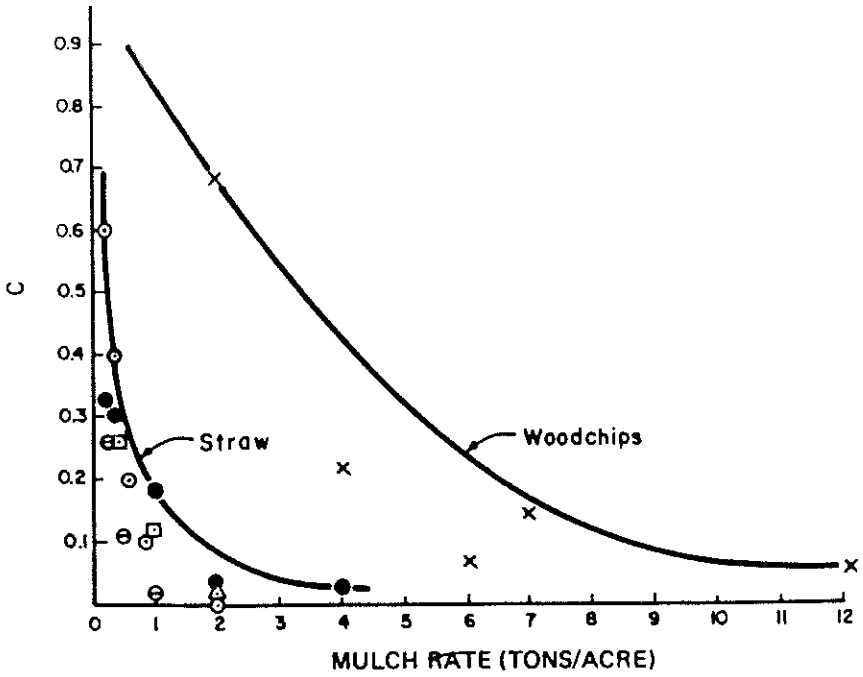


Figure 5.16b. Control factor, C, of surface mulching. (Chen, 1974)

Chemicals are also available for stabilizing the soil surface. C values for selected chemicals are tabulated in Table 5.8. A more complete listing can be found in Table 5.A.1.

Table 5.8 Selected C Values reported in the literature. A comprehensive list is given in Appendix 5A.

Condition	C factor
1. Bare soil conditions	
compacted bulldozer scraped up and down	1.30
compacted fill	1.24 – 1.71
2. Asphalt emulsion	
1250 gallons/acre	0.02
151 gallons/acre	0.65 – 0.70
3. Other chemicals	
Petroset SB	0.40 – 0.66
wood fiber slurry, 1000 lb/acre fresh	0.05
4. Seedings[1]	
permanent, 0 to 60 days[2]	0.40
permanent, after 12 months	0.01
5. Excelsior blanket with plastic net	0.04 – 0.10

1. If plantings are used with mulches, use the minimum C values.
2. If dry weather occurs at planting and emergence is a problem, extend the 0-60 days to a period when rainfall normally occurs.

APPENDIX D.3

DITCH DESIGNS

APPENDIX D.3 - DITCH DESIGNS

The various diversion ditches which are required to control site runoff are shown on Plates 11-8 and 11-11 for Mine Areas 1 and 2, respectively. Peak flood flows for these ditches have been taken from the SEDCAD runs for the appropriate sediment ponds (Appendix D.1). Design information and parameters for the flood peak determinations are discussed in the introductory text of Appendix D. AMC II and a runoff curve number of 70 were assumed for the hydrograph calculations.

Manning's equation was set up in a ditch sizing spreadsheet to design the ditch cross sections for the required diversion structures. Table D.3-1 presents the results of the ditch sizing. The general categorized ditch types on Table D.3-1 have been established based on the minimum calculated cross sections and are detailed on Plate 11-4. The ditch sizing spreadsheets are included also for reference.

TABLE D.3-1

SEDIMENT CONTROL DITCH DESIGNATION	DITCH TYPE
No. 1-EAST	TYPE 6
No. 1-WEST	TYPE 4
No. 2-NORTH	TYPE 6
No. 2A-NORTH	TYPE 4
No. 2B-NORTH	TYPE 4
No. 2C-NORTH	TYPE 4
No. 2-WEST	TYPE 6
No. 3-NORTH	TYPE 4 & 5
No. 3-SOUTH	TYPE 5
No. 4	TYPE 4
No. 5-NORTH	TYPE 5
No. 5-SOUTH	TYPE 6
No. 6	TYPE 4
No. 7	TYPE 4
No. S-WEST	TYPE 4
BENCH DITCHES	TYPE 6
RAMP DITCHES	TYPE 7

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: JULY 29,1989

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL SRK #17202	
FEATURE	DITCH 1-EAST	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	24.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.5	AREA	5.86 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	12.37 FT
CHANNEL LONGITUDINAL SLOPE (%)	3.3	HYD RADIUS	0.47 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	24.1	OK
MEAN FLOW VELOCITY (FPS)	4.1	
FREE SURFACE WIDTH (TOP WIDTH, FT)	12.1	
TOTAL DEPTH OF CHANNEL (FT)	1.5	
FROUDE NUMBER	1.0	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) **SUPERCRITICAL FLOW!**

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.6 ft
Velocity = 5.4

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 1 - E (UPPER REACH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.23 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.54 FT
CHANNEL LONGITUDINAL SLOPE (%)	7.7	HYD RADIUS	0.12 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.0	OK
MEAN FLOW VELOCITY (FPS)	2.5	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.5	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.3	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth - 0.6 ft
Velocity = 5.4 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: JULY 29,1989

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL SRK #17202	
FEATURE	DITCH 1-WEST	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	2.41 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	11.03 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.0	HYD RADIUS	0.22 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.2	OK
MEAN FLOW VELOCITY (FPS)	1.3	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.9	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	0.5	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.9 ft
Velocity = 2.0 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-ShAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WIShBONE HILL PROJECT 17202	
FEATURE	DITCH 3-SOUTH	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	1.0	INTERIM CALCS		
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0			
TRIAL FLOW DEPTH (FT)	0.1	AREA	0.56	SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.25	FT
CHANNEL LONGITUDINAL SLOPE (%)	12.0	HYD RADIUS	0.05	FT
MANNINGS "n" VALUE	0.040			

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	1.0	OK
MEAN FLOW VELOCITY (FPS)	1.8	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.2	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.4	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = .04 ft
Velocity = 4.1 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: JULY 29,1989

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL SRK #17202
FEATURE	DITCH 3-NORTH : LOWER REACH
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	5.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.33 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.58 FT
CHANNEL LONGITUDINAL SLOPE (%)	16.0	HYD RADIUS	0.13 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	5.7	OK
MEAN FLOW VELOCITY (FPS)	4.3	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.5	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	2.1	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) **SUPERCRITICAL FLOW!**

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.6 ft
Velocity = 7.1 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: JULY 29,1989

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL SRK #17202
FEATURE	DITCH 3-NORTH : UPPER REACH
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	5.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	2.08 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.89 FT
CHANNEL LONGITUDINAL SLOPE (%)	5.2	HYD RADIUS	0.19 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	6.7	OK
MEAN FLOW VELOCITY (FPS)	3.2	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.8	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	1.3	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.75 ft
Velocity - 4.7 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH S-WEST (LOWER REACH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	1.86 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.80 FT
CHANNEL LONGITUDINAL SLOPE (%)	2.0	HYD RADIUS	0.17 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.0	OK
MEAN FLOW VELOCITY (FPS)	1.6	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.7	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	0.7	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.8 ft
Velocity = 2.7 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	DITCH 2-WEST	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.44 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.63 FT
CHANNEL LONGITUDINAL SLOPE (%)	5.2	HYD RADIUS	0.14 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.2	OK
MEAN FLOW VELOCITY (FPS)	2.2	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.6	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.1	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.65 ft
Velocity = 3.7 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 2-NORTH (FROM JCT OF DITCHES A,B,C TO SEDIMENT POND No. 2)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	26.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.7	AREA	7.35 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	12.91 FT
CHANNEL LONGITUDINAL SLOPE (%)	2.0	HYD RADIUS	0.57 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	26.6	OK
MEAN FLOW VELOCITY (FPS)	3.6	
FREE SURFACE WIDTH (TOP WIDTH, FT)	12.6	
TOTAL DEPTH OF CHANNEL (FT)	1.7	
FROUDE NUMBER	0.8	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.75 ft
Velocity = 4.5 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT	17202
FEATURE	DITCH 2-NORTH - A	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	16.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.4	AREA	4.32 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	11.79 FT
CHANNEL LONGITUDINAL SLOPE (%)	4.3	HYD RADIUS	0.37 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	17.1	OK
MEAN FLOW VELOCITY (FPS)	4.0	
FREE SURFACE WIDTH (TOP WIDTH, FT)	11.6	
TOTAL DEPTH OF CHANNEL (FT)	1.4	
FROUDE NUMBER	1.1	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.25 ft
Velocity = 5.2 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT	17202
FEATURE	DITCH 2-NORTH - B	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	4.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	1.76 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.76 FT
CHANNEL LONGITUDINAL SLOPE (%)	4.2	HYD RADIUS	0.16 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	4.0	OK
MEAN FLOW VELOCITY (FPS)	2.3	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.7	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	1.0	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately is a 'V' ditch is used:

Flow Depth = 0.75 ft
Velocity = 3.7 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 2-NORTH - C (LOWER(REACH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.3	AREA	2.85 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	11.21 FT
CHANNEL LONGITUDINAL SLOPE (%)	0.5	HYD RADIUS	0.25 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.0	OK
MEAN FLOW VELOCITY (FPS)	1.1	
FREE SURFACE WIDTH (TOP WIDTH, FT)	11.1	
TOTAL DEPTH OF CHANNEL (FT)	1.3	
FROUDE NUMBER	0.4	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.0 ft
Velocity = 1.5 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 2-NORTH - C (UPPER REACH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.33 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.58 FT
CHANNEL LONGITUDINAL SLOPE (%)	7.2	HYD RADIUS	0.13 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.4	OK
MEAN FLOW VELOCITY (FPS)	2.5	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.5	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.2	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.6 ft
Velocity = 4.2 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	DITCH 4	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	2.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	1.65 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.72 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.5	HYD RADIUS	0.15 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	2.2	OK
MEAN FLOW VELOCITY (FPS)	1.3	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.6	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	0.6	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.7 ft
Velocity = 2.1 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	DITCH 5-NORTH	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	16.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.5	AREA	5.14 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	12.10 FT
CHANNEL LONGITUDINAL SLOPE (%)	2.2	HYD RADIUS	0.42 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	16.1	OK
MEAN FLOW VELOCITY (FPS)	3.1	
FREE SURFACE WIDTH (TOP WIDTH, FT)	11.9	
TOTAL DEPTH OF CHANNEL (FT)	1.5	
FROUDE NUMBER	0.8	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.45 ft
Velocity = 4.1 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 5-SOUTH (UPPER REACH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	5.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.45 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.63 FT
CHANNEL LONGITUDINAL SLOPE (%)	12.5	HYD RADIUS	0.14 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	5.1	OK
MEAN FLOW VELOCITY (FPS)	3.5	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.6	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.7	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.7 ft
Velocity = 5.9 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 5-SOUTH (DIVERSION)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	20.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.6	AREA	6.23 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	12.50 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.9	HYD RADIUS	0.50 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	20.1	OK
MEAN FLOW VELOCITY (FPS)	3.2	
FREE SURFACE WIDTH (TOP WIDTH, FT)	12.2	
TOTAL DEPTH OF CHANNEL (FT)	1.6	
FROUDE NUMBER	0.8	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.6 ft
Velocity = 4.1 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT	17202
FEATURE	DITCH 6	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.2	AREA	1.55 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.67 FT
CHANNEL LONGITUDINAL SLOPE (%)	4.2	HYD RADIUS	0.14 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.3	OK
MEAN FLOW VELOCITY (FPS)	2.1	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.6	
TOTAL DEPTH OF CHANNEL (FT)	1.2	
FROUDE NUMBER	1.0	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.7 ft
Velocity = 3.5 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH 7 (NORTH & SOUTH)
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	1.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.12 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.49 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.3	HYD RADIUS	0.11 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	1.1	OK
MEAN FLOW VELOCITY (FPS)	0.9	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.4	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	0.5	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 0.55 ft
Velocity = 1.7 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	BENCH DITCHES	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	24.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.9	AREA	11.17 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	14.20 FT
CHANNEL LONGITUDINAL SLOPE (%)	0.5	HYD RADIUS	0.79 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	25.1	OK
MEAN FLOW VELOCITY (FPS)	2.2	
FREE SURFACE WIDTH (TOP WIDTH, FT)	13.8	
TOTAL DEPTH OF CHANNEL (FT)	1.9	
FROUDE NUMBER	0.4	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 2.2 ft
Velocity = 2.6 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR(TRAPEZOIDAL OR(V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR(BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	RAMP DITCHES
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR(24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	24.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.4	AREA	4.20 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	11.74 FT
CHANNEL LONGITUDINAL SLOPE (%)	10.0	HYD RADIUS	0.36 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	25.0	OK
MEAN FLOW VELOCITY (FPS)	5.9	
FREE SURFACE WIDTH (TOP WIDTH, FT)	11.6	
TOTAL DEPTH OF CHANNEL (FT)	1.4	
FROUDE NUMBER	1.7	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) **SUPERCRITICAL FLOW!**

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = 1.25 ft
Velocity = 8.0 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	DITCH 2-SOUTH	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	2.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.03 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.45 FT
CHANNEL LONGITUDINAL SLOPE (%)	6.0	HYD RADIUS	0.10 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	2.0	OK
MEAN FLOW VELOCITY (FPS)	1.9	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.4	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.1	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

Alternately if a 'V' ditch is used:

Flow Depth = .55 ft
Velocity = 3.6 fps

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Aug-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202	
FEATURE	DITCH S-WEST AND S-EAST	
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	3.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.1	AREA	1.23 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	10.54 FT
CHANNEL LONGITUDINAL SLOPE (%)	7.7	HYD RADIUS	0.12 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	3.0	OK
MEAN FLOW VELOCITY (FPS)	2.5	
FREE SURFACE WIDTH (TOP WIDTH, FT)	10.5	
TOTAL DEPTH OF CHANNEL (FT)	1.1	
FROUDE NUMBER	1.3	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Aug-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	DITCH S-WEST AND S-EAST COMBINED BELOW CULVERT
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	6.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	5.0		
TRIAL FLOW DEPTH (FT)	0.5	AREA	3.00 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	7.24 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.0	HYD RADIUS	0.41 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	7.1	OK
MEAN FLOW VELOCITY (FPS)	2.4	
FREE SURFACE WIDTH (TOP WIDTH, FT)	7.0	
TOTAL DEPTH OF CHANNEL (FT)	1.5	
FROUDE NUMBER	0.6	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

APPENDIX D.4

CULVERT SIZING

APPENDIX D.4 - CULVERT SIZING

Mine Area Culverts

Based on the completed 100-yr storm flows (see SEDCAD printouts, Appendix D.1), and the attached nomograph, (American Iron and Steel Institute, 1971) 24 inch diameter cmp should suffice at all culvert installation locations. Design parameters are discussed in Appendix D.1. Road swales can be constructed to provide additional flow capacity if desired.

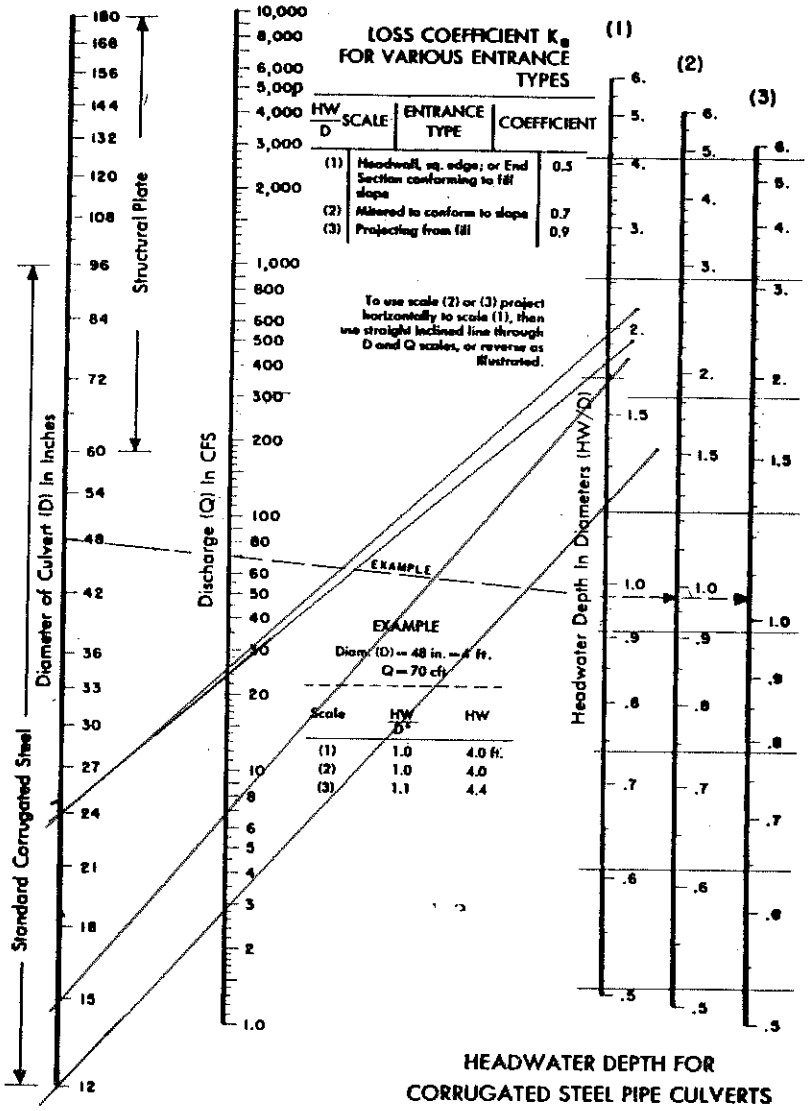
Ditch Designation	Peak Flows	Min - Culvert Size	# of Culvert
Ditch 1 - East	24 cfs	24 inch	1
Ditch S - West	3 cfs	12 inch	1
Ditch 2C - North	7 cfs	15 inch	1
Ditch 2 - North	26 cfs	24 inch	1
Culvert under Coal stockpile to Slurry Pond	6 cfs	24 inch	1*

Culvert must be installed at a minimum 1% grade to ensure self-cleaning.

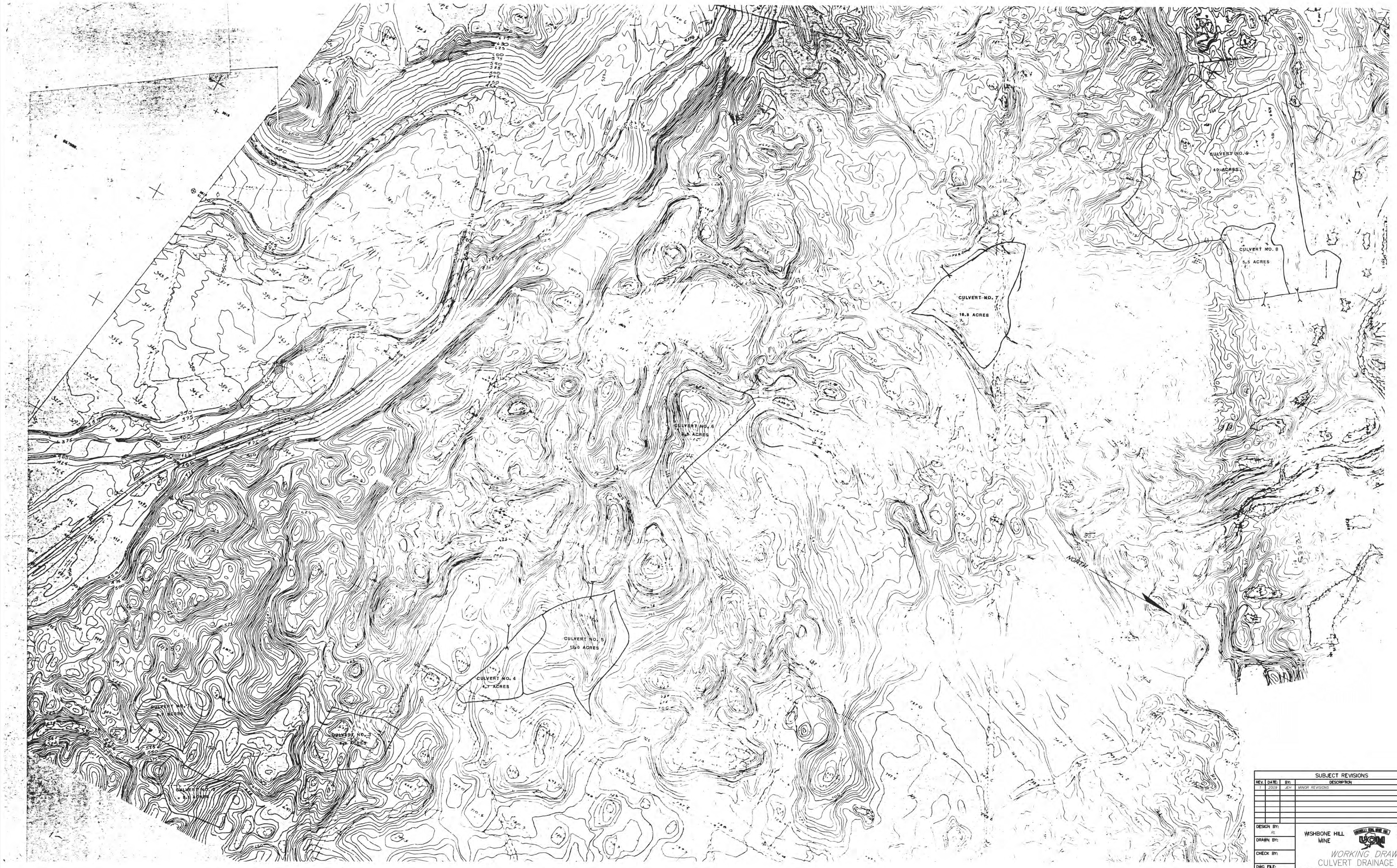
Access Road Culverts

For design purposes, it is assumed that the predominant soil types throughout the access road alignment are equivalent to those located in the mine area. Accordingly, a conservative runoff curve number of 70 has been used in the flood routing to size the haul road culverts. The condition modeled represents antecedent moisture condition (AMC) II. It is further pointed out that haul road culvert catchment areas are generally undisturbed, thus an additional conservatism exists in the curve number selection. Additional descriptive soil information is contained in Appendix D.1.

Culvert sizes have been based on 100 yr storm flood routing using the computer program WASHED. WASHED is discussed in some detail in Appendix E. Culvert locations are shown on Plate 9-2. A revised figure based on Plate 9-2 is attached, which enumerates the culverts and delineates their respective catchment areas.



From: Handbook of Steel Drainage and Highway Construction Products, American Iron and Steel Institute, 1971, Figure 4-18.



SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY: RL
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 7/90

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.

PERMIT NUMBER 01-89-796

WORKING DRAWING

CULVERT DRAINAGE AREAS
WISHBONE HILL MINE ACCESS ROAD

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No.
SHEET No. 1 OF 1
REV. 1

From this revised figure, culvert Nos. 5 and 9 were selected as the critical design cases as No. 9 has the largest catchment area (39.5 acres) and No. 5 the steepest overall catchment (30% slopes). Based on the attached WASHED rus for these culverts, peak design flood flows of 9.5 and 13.4 cfs have been calculated for culvert No. 5 and No. 9, respectively. An attached nomograph (AISI, 1974) indicates that 24" diameter CMP is adequate to convey these flows. Accordingly, all culverts along the access road have been designated 24" diameter CMP installations.

```
*****************************************************
*                                                   *
*     H Y D R O L O G I C A L   S Y S T E M S       *
*                                                   *
*****************************************************
*                                                   *
*            PROGRAM   -   WASHED                   *
*                                                   *
*            WATERSHED MODELLING                    *
*                                                   *
*       PROGRAM TO DETERMINE RUNOFF HYDROGRAPHS     *
*       AND SEDIMENTGRAPHS FOR SMALL CATCHMENTS     *
*                                                   *
*****************************************************
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```
COMPANY DOING ANALYSIS :   SRK
ENGINEER               :   RJF
DATE                   :   21-JUN-89
CLIENT                 :   MMCI
PROJECT DESCRIPTION    :   WISHBONE HILL HAUL R
MAJOR WATERSHED NAME   :   CULVERT NO 5

THE INPUT DATA FILE IS                    :C5.IN
THE FLOOD HYDROGRAPH AND SEDIMENTGRAPH IS NOT STORED
```

```
*****************************************************************
WATERSHED CONDITIONS AT  CULVERT NO 5
*****************************************************************

GLOBAL PARAMETERS
-----------------

RAINFALL                                        (mm.)    :      91.40
INITIAL ABSTRACTION                             (mm.)    :        .00
  -- will default to the SCS method
TIME INCREMENT OF HYDROGRAPH FROM START OF RUNOFF  :        .10

RAINFALL DISTRIBUTION SELECTED                   :SCS TYPE 1 CURVE
=================================================================

*****************************************************************
SUBWATERSHED CONDITIONS AT CULVERT NO 5
*****************************************************************

RAINFALL PARAMETERS
-------------------

SCS CURVE NUMBER                                 :  70.00
UNIT HYDROGRAPH SELECTED                         :  DOUBLE TRIANGLE

MAP PARAMETERS
--------------

AREA                                   (ha.)     :       5.00
HYDRAULIC LENGTH                        (m.)     :     335.00
PERCENT FOREST                           (%)     :      25.00
PERCENT AGRICULTURE                      (%)     :        .00
PERCENT GRASSLAND                        (%)     :        .00
OVERLAND FLOW SLOPE                      (%)     :      30.00
CHANNEL SLOPE                            (%)     :       3.00
CHANNEL LENGTH FROM SUBWATERSHED         (m.)    :        .00
TYPE OF CHANNEL FROM SUBWATERSHED        :CONCRETE CHANNEL OR PIPE
CORRECTION FACTOR FOR IMPERVIOUS AREA            :       1.00
CORRECTION FACTOR FOR CHANNEL IMPROVEMENTS       :       1.00
AREAL REDUCTION FACTOR                           :       1.00



SEDIMENT PARAMETERS
-------------------

THERE IS NO SEDIMENT DATA FOR THIS SUBWATERSHED

=================================================================
```

********** STORM HYDROGRAPH GENERATED FROM START OF RAINFALL **********

TIME *	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9.0 *	.0	.0	.0	.0	.0	.0	.1	.1	.1	.2
10.0 *	.2	.1	.1	.1	.1	.1	.1	.1	.1	.1
11.0 *	.1	.1	.1	.1	.1	.0	.0	.0	.0	.0
12.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
13.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
14.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
15.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
16.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
17.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
19.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
20.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
21.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
22.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
23.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

INITIAL ABSTRACTION	=	21.77	mm.
ROUTED FLOW TIME FROM THE SUBWATERSHED	=	.00	hours.
TIME TO PEAK OF UNIT HYDROGRAPH	=	.05	hours.
THE DEPTH OF WATER ON WATERSHED	=	38.26	mm.
VOLUME OF RUNOFF	=	1.91	thousand cu.m.
PEAK RUNOFF RATE	=	.27	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.05	hours.

==========

THERE IS NO SEDIMENT CONTAINED IN THE STORM RUNOFF FROM THIS WATERSHED

==========

STORM HYDROGRAPH FOR WATERSHED CULVERT NO 5

TOTAL AREA OF THE WATERSHED	=	5.00	ha.
THE DEPTH OF WATER ON WATERSHED	=	38.26	mm.
VOLUME OF RUNOFF	=	1.91	thousand cu.m.
PEAK RUNOFF RATE	=	.27	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.05	hours.
TIME INCREMENT OF NEW HYDROGRAPH	=	.10	hours.
NUMBER OF RUNOFF VALUES	=	151	

9.5 cfs

******* STORM HYDROGRAPH GENERATED FROM START OF RUNOFF *******

.0	.0	.0	.0	.0	.0	.0	.1	.1	.1
.2	.3	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0									

```
*******************************************************
*                                                     *
*      H Y D R O L O G I C A L   S Y S T E M S        *
*                                                     *
*******************************************************
*                                                     *
*            PROGRAM   -   WASHED                     *
*                                                     *
*            WATERSHED MODELLING                      *
*                                                     *
*       PROGRAM TO DETERMINE RUNOFF HYDROGRAPHS       *
*       AND SEDIMENTGRAPHS FOR SMALL CATCHMENTS       *
*                                                     *
*******************************************************
```

```
COMPANY DOING ANALYSIS :   SRK
ENGINEER               :   RJF
DATE                   :   21-JUN-89
CLIENT                 :   MMCI
PROJECT DESCRIPTION    :   WISHBONE HILL HAUL R
MAJOR WATERSHED NAME   :   CULVERT NO 9

THE INPUT DATA FILE IS                    :A:C9.IN
THE FLOOD HYDROGRAPH AND SEDIMENTGRAPH IS NOT STORED
```

```
=====================================================================

*****************************************************************
WATERSHED CONDITIONS AT  CULVERT NO 9
*****************************************************************

GLOBAL PARAMETERS
-----------------

RAINFALL                                        (mm.)    :     91.40
INITIAL ABSTRACTION                             (mm.)    :       .00
  -- will default to the SCS method
TIME INCREMENT OF HYDROGRAPH FROM START OF RUNOFF  :       .10

RAINFALL DISTRIBUTION SELECTED                    :SCS TYPE 1 CURVE
=====================================================================

*****************************************************************
SUBWATERSHED CONDITIONS AT CULVERT NO 9
*****************************************************************

RAINFALL PARAMETERS
-------------------

SCS CURVE NUMBER                                :  70.00
UNIT HYDROGRAPH SELECTED                        :  DOUBLE TRIANGLE

MAP PARAMETERS
--------------

AREA                                   (ha.)    :     16.00
HYDRAULIC LENGTH                        (m.)    :    594.00
PERCENT FOREST                           (%)    :     25.00
PERCENT AGRICULTURE                      (%)    :       .00
PERCENT GRASSLAND                        (%)    :       .00
OVERLAND FLOW SLOPE                      (%)    :      3.00
CHANNEL SLOPE                            (%)    :      3.00
CHANNEL LENGTH FROM SUBWATERSHED        (m.)    :       .00
TYPE OF CHANNEL FROM SUBWATERSHED      :CONCRETE CHANNEL OR PIPE
CORRECTION FACTOR FOR IMPERVIOUS AREA           :      1.00
CORRECTION FACTOR FOR CHANNEL IMPROVEMENTS      :      1.00
AREAL REDUCTION FACTOR                          :      1.00



SEDIMENT PARAMETERS
-------------------

THERE IS NO SEDIMENT DATA FOR THIS SUBWATERSHED

=====================================================================
```

********** STORM HYDROGRAPH GENERATED FROM START OF RAINFALL **********

TIME *	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9.0 *	.0	.0	.0	.0	.0	.0	.1	.1	.1	.2
10.0 *	.3	.4	.3	.2	.2	.2	.2	.2	.2	.2
11.0 *	.2	.2	.2	.1	.1	.1	.1	.1	.1	.1
12.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
13.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
14.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
15.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
16.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
19.0 *	.0	.0	.0	.0	.1	.1	.1	.1	.1	.1
20.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
21.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
22.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
23.0 *	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
24.0 *	.1	.1	.0	.0	.0	.0				

INITIAL ABSTRACTION	=	21.77	mm.
ROUTED FLOW TIME FROM THE SUBWATERSHED	=	.00	hours.
TIME TO PEAK OF UNIT HYDROGRAPH	=	.15	hours.
THE DEPTH OF WATER ON WATERSHED	=	27.11	mm.
VOLUME OF RUNOFF	=	4.34	thousand cu.m.
PEAK RUNOFF RATE	=	.38	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.10	hours.

==========

THERE IS NO SEDIMENT CONTAINED IN THE STORM RUNOFF FROM THIS WATERSHED

==========

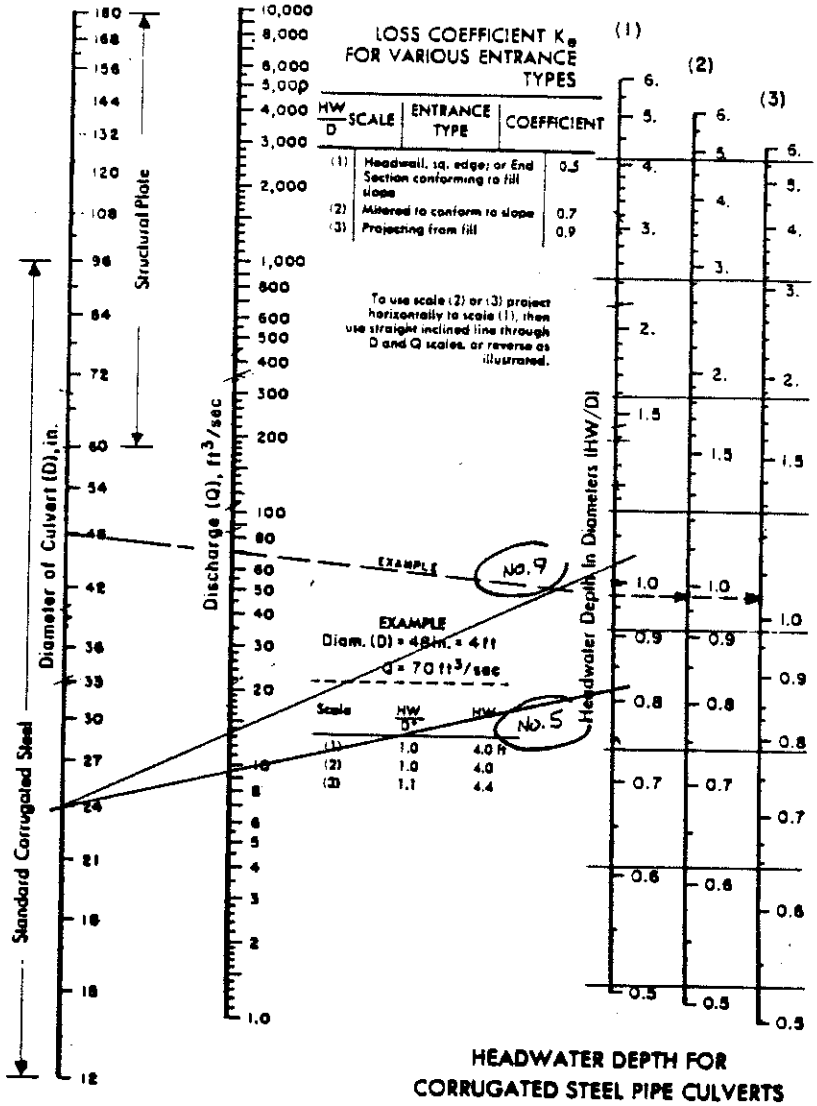
STORM HYDROGRAPH FOR WATERSHED CULVERT NO 9

TOTAL AREA OF THE WATERSHED	=	16.00	ha.
THE DEPTH OF WATER ON WATERSHED	=	27.11	mm.
VOLUME OF RUNOFF	=	4.34	thousand cu.m.
PEAK RUNOFF RATE	=	.38	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.10	hours.
TIME INCREMENT OF NEW HYDROGRAPH	=	.10	hours.
NUMBER OF RUNOFF VALUES	=	159	

13.4 cfs

******* STORM HYDROGRAPH GENERATED FROM START OF RUNOFF *******

.0	.0	.0	.0	.0	.0	.0	.0	.0	.1
.1	.1	.2	.3	.4	.3	.2	.2	.2	.2
.2	.2	.2	.2	.2	.2	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
.0	.0	.0	.0	.0	.0	.0	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
.1	.1	.1	.1	.1	.0	.0	.0	.0	



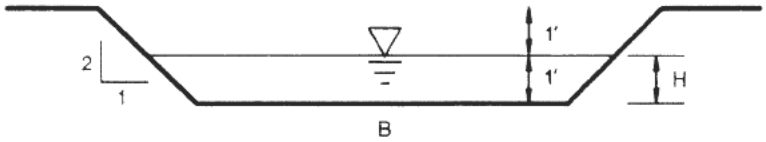
HEADWATER DEPTH FOR CORRUGATED STEEL PIPE CULVERTS WITH INLET CONTROL

From: Handbook of Steel Drainage and Highway Construction Products, American Iron and Steel Institute, 1971, Figure 4-18.

APPENDIX D.5
SPILLWAY SIZING

CRITERIA

NOT TO EXCEED 1 FT OF FLOW DEPTH THRU CHANNEL



USE: $Q = 3 \times BH^{3/2}$ $B = Q / (3 \times H^{3/2}) = Q/3$

WHERE Q = PEAK FLOW FROM TABLE D-1-2

B = CHANNEL BOTTOM WIDTH

H = HEIGHT OF FLOW IN CHANNEL

POND	Q	H	MIN. B×
SED. POND 1	21	1	7
SED. POND 2	33	1	11
SED. POND 3	5	1	1.7
SED. POND 4	2	1	0.7
SED. POND 5	32	1	11
SED. POND 6	3	1	1
SED. POND 7	3	1	1
FRESH WATER POND NO. 1	43	1	15
FRESH WATER POND NO. 2	8	1	2.7

× USE B=5' OR MIN B, WHICHEVER IS GREATER.

CERTIFICATE

I hereby certify that this drawing has been prepared under my direction and is correct to the best of my knowledge and belief.

David E. Germer

DESIGN BY:	POND EMERGENCY OVERFLOW INLET DESIGNS	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. D-1 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Aug-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT	17202
FEATURE	FRESH WATER POND NO. 2	SPILLWAY
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR	24 HR
FREEBOARD REQUIREMENT (FT)	1.0	

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	8.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	5.0		
TRIAL FLOW DEPTH (FT)	0.6	AREA	3.72 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	7.68 FT
CHANNEL LONGITUDINAL SLOPE (%)	0.9	HYD RADIUS	0.48 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	9.3	OK
MEAN FLOW VELOCITY (FPS)	2.5	
FREE SURFACE WIDTH (TOP WIDTH, FT)	7.4	
TOTAL DEPTH OF CHANNEL (FT)	1.6	
FROUDE NUMBER	0.6	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) NO RIPRAP REQUIRED

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Aug-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WIShBONE HILL PROJECT 17202
FEATURE	FRESh WATER POND NO. 1 SPILLWAY
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	42.6	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.7	AREA	8.11 SQ FT
CHANNEL SIDE SlOPE (H:1), H=	2.0	WET PERIM	13.18 FT
CHANNEL LONGITUDINAL SlOPE (%)	3.0	HYD RADIUS	0.62 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	43.3	OK
MEAN FLOW VELOCITY (FPS)	5.3	
FREE SURFACE WIDTH (TOP WIDTH, FT)	12.8	
TOTAL DEPTH OF CHANNEL (FT)	1.7	
FROUDE NUMBER	1.2	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) **SUPERCRITICAL FLOW!**

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

APPENDIX E

DESIGN CALCULATIONS FOR BUFFALO CREEK DIVERSION
AND CHANNEL RELOCATION

APPENDIX E - DESIGN CALCULATIONS FOR BUFFALO CREEK DIVERSION AND CHANNEL RELOCATION

This Appendix contains the design calculations for the Buffalo Creek diversion structure, relocated channel, and diversion pipeline.

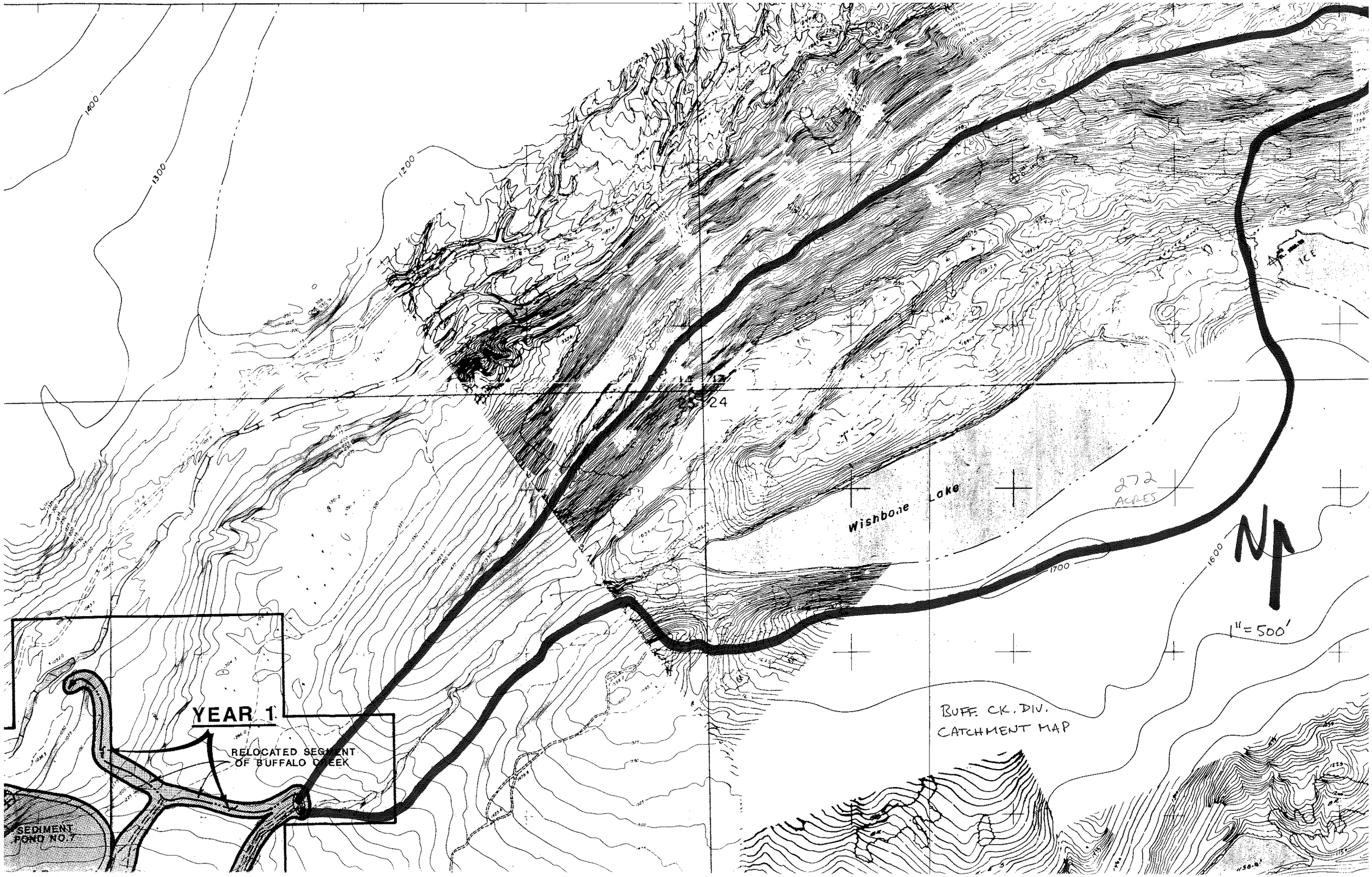
Calculation of the 100-yr stream flow was done using WASHED, an adaptation of WASHMO which utilizes SCS hydrograph techniques, developed by SRK for the IBM PC. Input parameters for WASHED include catchment areas, lengths and slopes, SCS curve number, and storm type and storm precipitation. The program calculates the runoff hydrograph for the catchment areas based on one of three hydrograph techniques, including double triangle, which was the technique used for these calculations. AMC II and a runoff curve number of 80 were assumed for the hydrograph calculation. The lead-in text of Appendix D gives further information on the site soil types and design assumptions. The higher curve number has been selected to reflect the likelihood of more predominant near-surface bedrock or bedrock outcrop in the catchment area as compared to the mine area. A working sketch is attached which shows the catchment boundary for the diversion.

The relocated channel segment was sized using the 100-yr peak flow and Manning's equation.

Riprap sizing was based on conservative urban design techniques (Wright-McLaughlin Engineers, 1969).

Sizing of the diversion pipeline was based on plant requirements provided by MMCI and anticipated creek flow based on the runoff assessment (Appendix B).

Depth of cover for the pipeline was based on estimated freezing depth for the materials anticipated along the alignment using the Stefan equation and regional information on Alaska climate (Andersland and Anderson, 1978 and Cold Regions Engineering Short Course, 1984).


1400
1300
1200
24
Wishbone Lake
272 ACRES
1700
1600
N
1" = 500'
BUFF. CK. DIV.
CATCHMENT MAP
YEAR 1
RELOCATED SEGMENT OF BUFFALO CREEK
SEDIMENT POND NO. 7
ICE

```
*****************************************************
*                                                   *
*      H Y D R O L O G I C A L   S Y S T E M S      *
*                                                   *
*****************************************************
*                                                   *
*            PROGRAM   -   WASHED                   *
*                                                   *
*            WATERSHED MODELLING                    *
*                                                   *
*       PROGRAM TO DETERMINE RUNOFF HYDROGRAPHS     *
*       AND SEDIMENTGRAPHS FOR SMALL CATCHMENTS     *
*                                                   *
*****************************************************
```

```
COMPANY DOING ANALYSIS :   SRK
ENGINEER               :   RJF
DATE                   :   30-MAY-89
CLIENT                 :   MMC
PROJECT DESCRIPTION    :   WISHBONE HILL
MAJOR WATERSHED NAME   :   BUFFALO CREEK CHANNEL RELOCATION

THE INPUT DATA FILE IS                    :A:BUFFDIV.
THE FLOOD HYDROGRAPH AND SEDIMENTGRAPH IS NOT STORED
```

```
=====================================================================

        ******************************************************************
        WATERSHED CONDITIONS AT  BUFFALO CREEK DIVERS
        ******************************************************************

        GLOBAL PARAMETERS
        -----------------

        RAINFALL                                        (mm.)     :     90.93
        INITIAL ABSTRACTION                             (mm.)     :       .00
          -- will default to the SCS method
        TIME INCREMENT OF HYDROGRAPH FROM START OF RUNOFF  :        .10

        RAINFALL DISTRIBUTION SELECTED                   :SCS TYPE 1 CURVE
=====================================================================

        ******************************************************************
        SUBWATERSHED CONDITIONS AT BUFF CR DIV
        ******************************************************************

        RAINFALL PARAMETERS
        -------------------

        SCS CURVE NUMBER                                :  80.00
        UNIT HYDROGRAPH SELECTED                        :  DOUBLE TRIANGLE

        MAP PARAMETERS
        --------------

        AREA                                   (ha.)    :    110.00
        HYDRAULIC LENGTH                        (m.)    :   2286.00
        PERCENT FOREST                           (%)    :     10.00
        PERCENT AGRICULTURE                      (%)    :       .00
        PERCENT GRASSLAND                        (%)    :       .00
        OVERLAND FLOW SLOPE                      (%)    :     25.00
        CHANNEL SLOPE                            (%)    :     10.00
        CHANNEL LENGTH FROM SUBWATERSHED        (m.)    :       .00
        TYPE OF CHANNEL FROM SUBWATERSHED               :AN UNLINED CHANNEL
        CORRECTION FACTOR FOR IMPERVIOUS AREA           :      1.00
        CORRECTION FACTOR FOR CHANNEL IMPROVEMENTS      :      1.00
        AREAL REDUCTION FACTOR                          :      1.00



        SEDIMENT PARAMETERS
        -------------------

        THERE IS NO SEDIMENT DATA FOR THIS SUBWATERSHED

=====================================================================
```

********** STORM HYDROGRAPH GENERATED FROM START OF RAINFALL **********

TIME *	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6.0 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7.0 *	.0	.0	.0	.1	.1	.1	.1	.1	.1	.1
8.0 *	.1	.1	.3	.5	.5	.4	.4	.3	.3	.3
9.0 *	.3	.3	.4	.5	.7	.9	1.3	1.8	2.5	3.2
10.0 *	4.3	5.0	3.9	3.1	3.0	2.9	2.7	2.5	2.4	2.2
11.0 *	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
12.0 *	1.0	1.0	.9	.9	.8	.8	.7	.7	.7	.7
13.0 *	.7	.6	.6	.6	.7	.7	.7	.7	.8	.8
14.0 *	.8	.9	.9	.9	.9	.9	.8	.8	.8	.8
15.0 *	.8	.8	.7	.7	.7	.7	.7	.6	.6	.6
16.0 *	.6	.6	.6	.5	.5	.5	.5	.5	.5	.5
17.0 *	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
18.0 *	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.0 *	.4	.4	.4	.4	.5	.5	.5	.5	.5	.5
20.0 *	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
21.0 *	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
22.0 *	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
23.0 *	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
24.0 *	.5	.4	.3	.2	.1	.1	.1	.1	.0	.0

INITIAL ABSTRACTION	=	12.70	mm.
ROUTED FLOW TIME FROM THE SUBWATERSHED	=	.00	hours.
TIME TO PEAK OF UNIT HYDROGRAPH	=	.15	hours.
THE DEPTH OF WATER ON WATERSHED	=	43.11	mm.
VOLUME OF RUNOFF	=	47.40	thousand cu.m.
PEAK RUNOFF RATE	=	5.00	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.10	hours.

==========

THERE IS NO SEDIMENT CONTAINED IN THE STORM RUNOFF FROM THIS WATERSHED

==========

STORM HYDROGRAPH FOR WATERSHED BUFFALO CREEK DIVERS

TOTAL AREA OF THE WATERSHED	=	110.00	ha.
THE DEPTH OF WATER ON WATERSHED	=	43.11	mm.
VOLUME OF RUNOFF	=	47.39	thousand cu.m.
PEAK RUNOFF RATE	=	5.00	cu. m./sec.
TIME TO PEAK RUNOFF	=	10.10	hours.
TIME INCREMENT OF NEW HYDROGRAPH	=	.10	hours.
NUMBER OF RUNOFF VALUES	=	186	

******* STORM HYDROGRAPH GENERATED FROM START OF RUNOFF *******

.0	.0	.0	.0	.0	.0	.0	.0	.1	.1
.1	.1	.1	.1	.1	.1	.1	.3	.5	.5
.4	.4	.3	.3	.3	.3	.3	.4	.5	.7
.9	1.3	1.8	2.5	3.2	4.3	5.0	3.9	3.1	3.0
2.9	2.7	2.5	2.4	2.2	2.0	1.8	1.7	1.6	1.5
1.4	1.3	1.2	1.2	1.1	1.0	1.0	.9	.9	.8
.8	.7	.7	.7	.7	.7	.6	.6	.6	.7
.7	.7	.7	.8	.8	.8	.9	.9	.9	.9
.9	.8	.8	.8	.8	.8	.8	.7	.7	.7
.7	.7	.6	.6	.6	.6	.6	.6	.5	.5
.5	.5	.5	.5	.5	.5	.4	.4	.4	.4
.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
.4	.4	.4	.4	.4	.4	.4	.4	.4	.5
.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
.5	.5	.5	.5	.5	.5	.4	.3	.2	.1
.1	.1	.1	.0	.0	.0				

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	BUFFALO CREEK RELOCATED SEGMENT- TYPE 1
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	180.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	2.5	AREA	37.50 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	21.18 FT
CHANNEL LONGITUDINAL SLOPE (%)	0.5	HYD RADIUS	1.77 FT
MANNINGS "n" VALUE	0.030		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	192.7	OK
MEAN FLOW VELOCITY (FPS)	5.1	
FREE SURFACE WIDTH (TOP WIDTH, FT)	20.0	
TOTAL DEPTH OF CHANNEL (FT)	3.5	
FROUDE NUMBER	0.7	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN)	1.3

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	BUFFALO CREEK RELOCATED SEGMENT- TYPE 2
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	180.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	0.9	AREA	10.62 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	14.02 FT
CHANNEL LONGITUDINAL SLOPE (%)	33.0	HYD RADIUS	0.76 FT
MANNINGS "n" VALUE	0.040		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	188.8	OK
MEAN FLOW VELOCITY (FPS)	17.8	
FREE SURFACE WIDTH (TOP WIDTH, FT)	13.6	
TOTAL DEPTH OF CHANNEL (FT)	1.9	
FROUDE NUMBER	3.5	**SUPERCRITICAL FLOW!**

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN) **SUPERCRITICAL FLOW!**

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

DITCH DESIGN SPREADSHEET
USING MANNINGS EQUATION
FOR TRAPEZOIDAL OR V-SHAPED DITCHES DATE: 29-Jul-89

GENERAL INFORMATION

PROJECT OR BILLING NO.	WISHBONE HILL PROJECT 17202
FEATURE	BUFFALO CREEK RELOCATED SEGMENT- TYPE 3
DESIGN EVENT: RETURN PERIOD AND DURATION	100.0 YR 24 HR
FREEBOARD REQUIREMENT (FT)	1.0

SIZING CRITERIA (INPUT)

DESIGN FLOW (CFS)	180.0	INTERIM CALCS	
TRIAL WIDTH (CHANNEL BOTTOM,FT)	10.0		
TRIAL FLOW DEPTH (FT)	2.0	AREA	28.00 SQ FT
CHANNEL SIDE SLOPE (H:1), H=	2.0	WET PERIM	18.94 FT
CHANNEL LONGITUDINAL SLOPE (%)	1.5	HYD RADIUS	1.48 FT
MANNINGS "n" VALUE	0.035		

CALCULATIONS (OUTPUT)

		COMMENT
FLOW CAPACITY (CFS)	189.4	OK
MEAN FLOW VELOCITY (FPS)	6.8	
FREE SURFACE WIDTH (TOP WIDTH, FT)	18.0	
TOTAL DEPTH OF CHANNEL (FT)	3.0	
FROUDE NUMBER	1.0	

RIPRAP REQUIREMENT

d50 OF REQUIRED RIPRAP (IN)	3.4

*NOTE: ASSUMED SPECIFIC GRAVITY OF ROCK
USED FOR RIPRAP = 2.65

TABLE E-1

BUFFALO CREEK PIPELINE DIVERSION

Length = 6,700 ft (scaled from Plate 3-1)
Elevation difference = 1,217 - 890 = 327 ft

Slope (overall average) = $\Delta E/L$ = 4.9%

Pipe-full flow for various dia. pipes @ 4.97%*

Pipe Diameter	Flow (GPM)
8 inches	1,775
12 inches	5,000
18 inches	15,000

*Reference: Driscopipe Design Manual produced by Phillips 66. See attached nomograph.

Est peak monthly average flow for Buffalo Creek is 908 gpm

Est 100-yr storm flow $\leq$ 180 cfs (81,000 gpm)
Est 10-yr storm flow is 3.5 cfs (16,000 gpm)

8 inch diameter pipe will work.

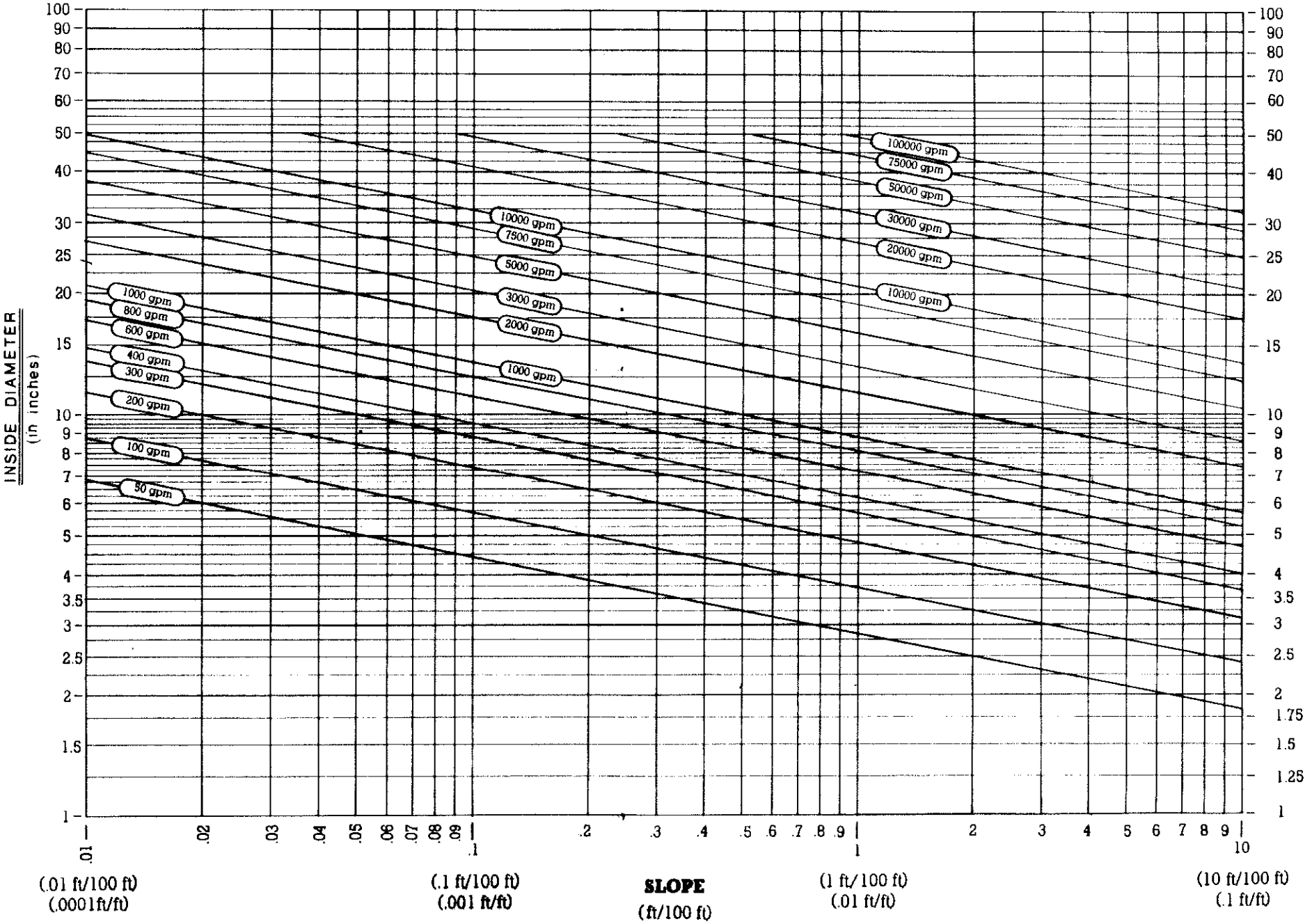
8 inch diameter gate valve should pass approximately 5 cfs or 2,000 gpm with outlet control.

FIGURE E-1

CHART 7

INSIDE DIAMETER VERSUS FLOW RATE AT A GIVEN SLOPE

GRAVITY FULL FLOW: WATER



From: Phillips 66, Driscopipe Systems Design, 1981.

TABLE E-2

RIPRAP SIZING

- Assume
  Q = 180 cfs
  channel width = 10 ft
  Max slope = 33% (3:1)
  Take n = 0.04

- Using Manning's Eqn:

  Depth of flow = 0.9 ft
  velocity = 18 fps

- From the Urban Storm Drainage Criteria Manual (Vol. 2):

$$d_{50} = \left[\frac{V \times S^{0.17}}{4.5 \times (Ss-1)^{0.66}}\right]^2$$

$$= \left[\frac{18 \times 0.33^{0.17}}{4.5 \times (2.65-1)^{.66}}\right]^2$$

$$= 2.4 \text{ ft } (29")$$

Blanket thickness = 1.75 x d_{50} = 4 ft

Granular bedding 8" of Type II material
Type II material gradation specification:

Sieve size or dia. (in)	% Passing
3"	90-100
3/4"	20-90
#4	0-20
#200	0-3

Riprap Gradation: (VH)

Dia. (in)	% Smaller
42	100
33	50-70
24	35-50
9	2-10

TABLE E-3

BUFFALO CREEK PIPELINE DIVERSION
ESTIMATION OF FREEZING DEPTH

FI* = freezing index 3,000 degree days for Palmer

$u^* = \frac{\text{Surface freezing index}}{\text{air freezing index}}$ = 0.5 ft for turf
0.33 for stripped soil
use 0.50

L* = latent heat = 144 (w) (xd)

sandy soils - L = (144) (0.07) (125) = 1,260 btu/ft^3
silty soils - L = (144) (0.35) (80) = 4.032 btu/ft^3

K_f** = thermal conductivity

sandy soils - k_f = 2.5
silty soils - k_f = 1.05

Stefan Formula*

$$x = \text{freezing depth} = \left(\frac{48\ k_f\ uFI}{L}\right)^{1/2}$$

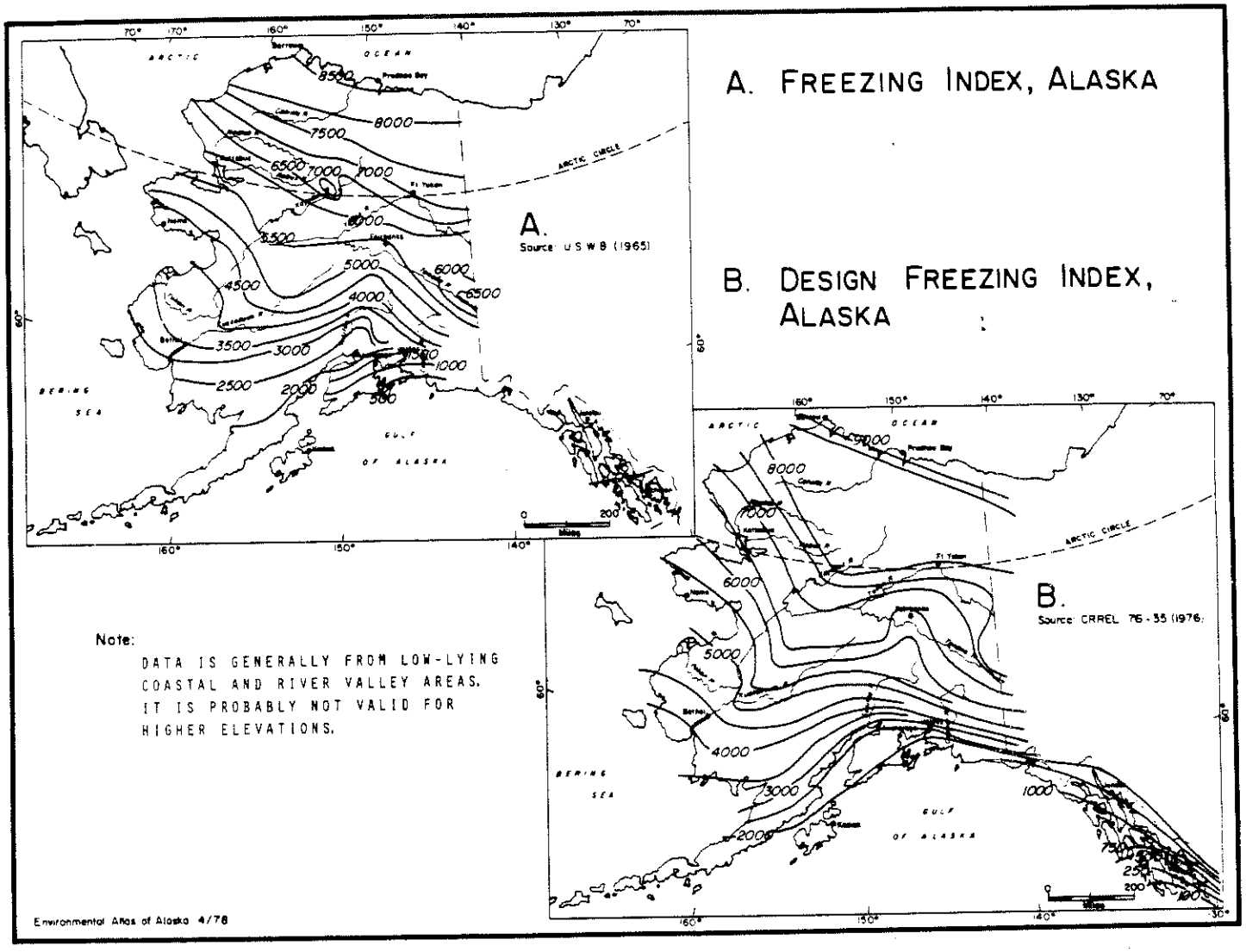
$$\text{sandy soils - } x = \left[\frac{(48)\ (2.5)\ (0.50)\ (3000)}{1260}\right]^{1/2} = 12.0 \text{ ft}$$

$$\text{silty soils - } x = \left[\frac{(48)\ (1.05)\ (0.50)\ (3000)}{4032}\right]^{1/2} = 4.3 \text{ ft}$$

* Cold Regions Engineering Short Course, June 14-17, 1984, Denver, Colorado, by University of Alaska and University of Washington.

** Geotechnical Engineering for Cold Regions, by G.B. Anderstand and D.M. Anderson, McGraw-Hill Book Company, New York, 1978.

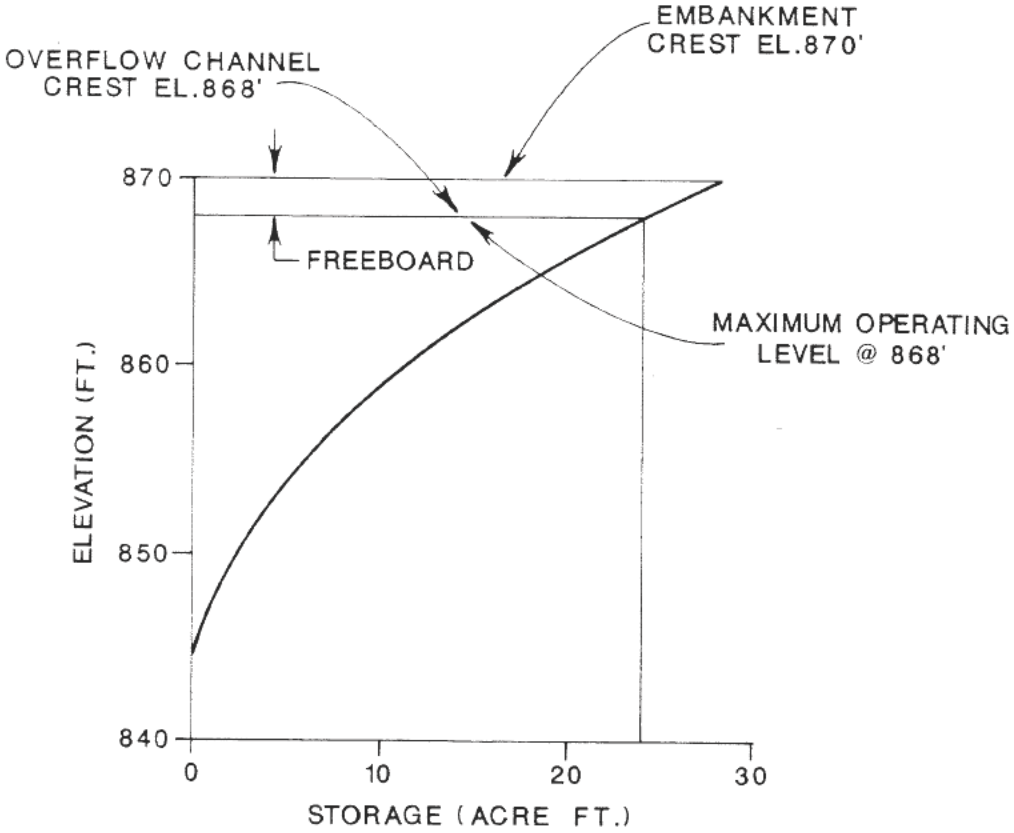
FIGURE E-2



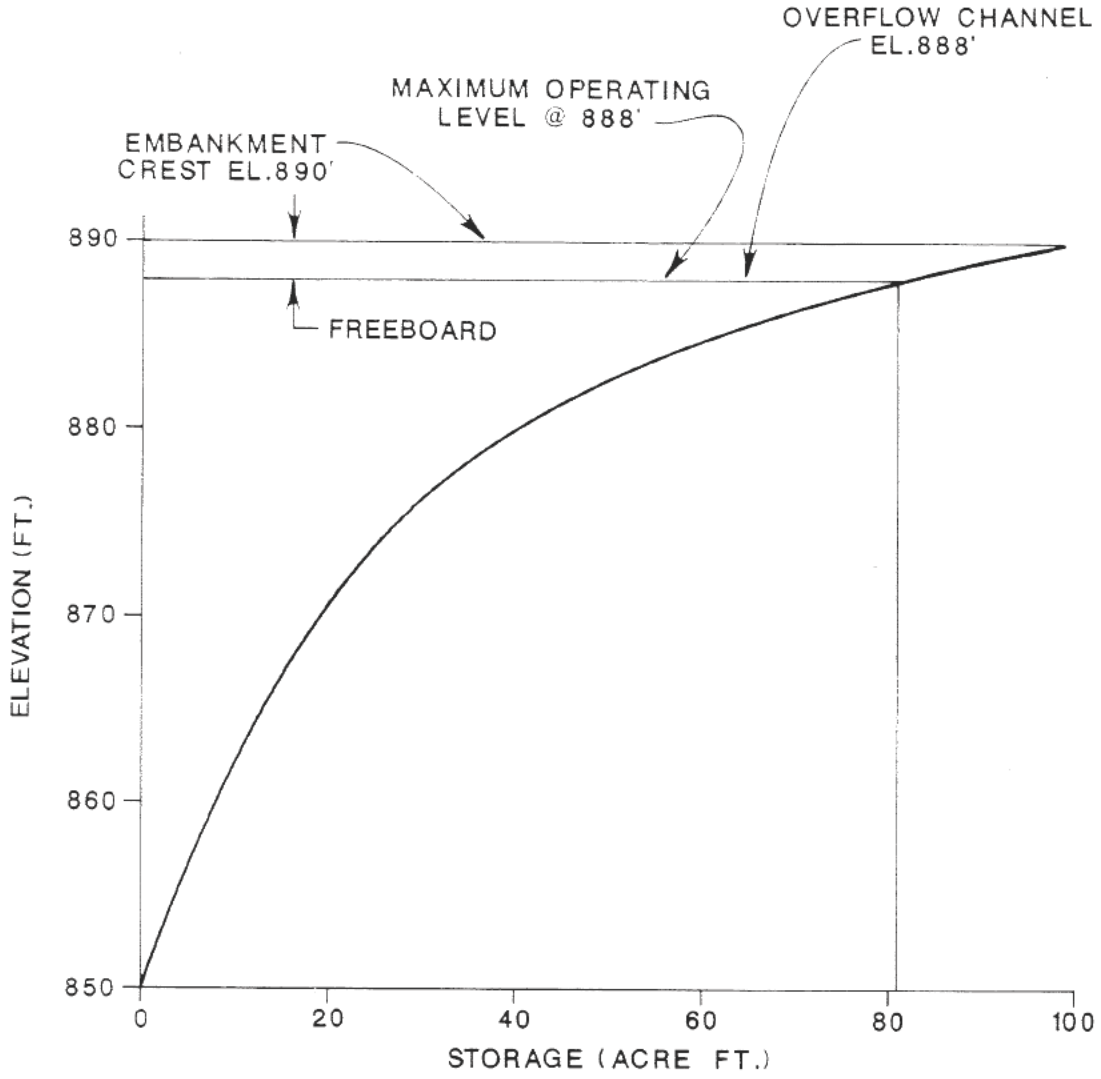
FREEZING INDICES FOR ALASKA

From Cold Regions Engineering Short Course, June 14-17, 1984, Denver, Colorado.

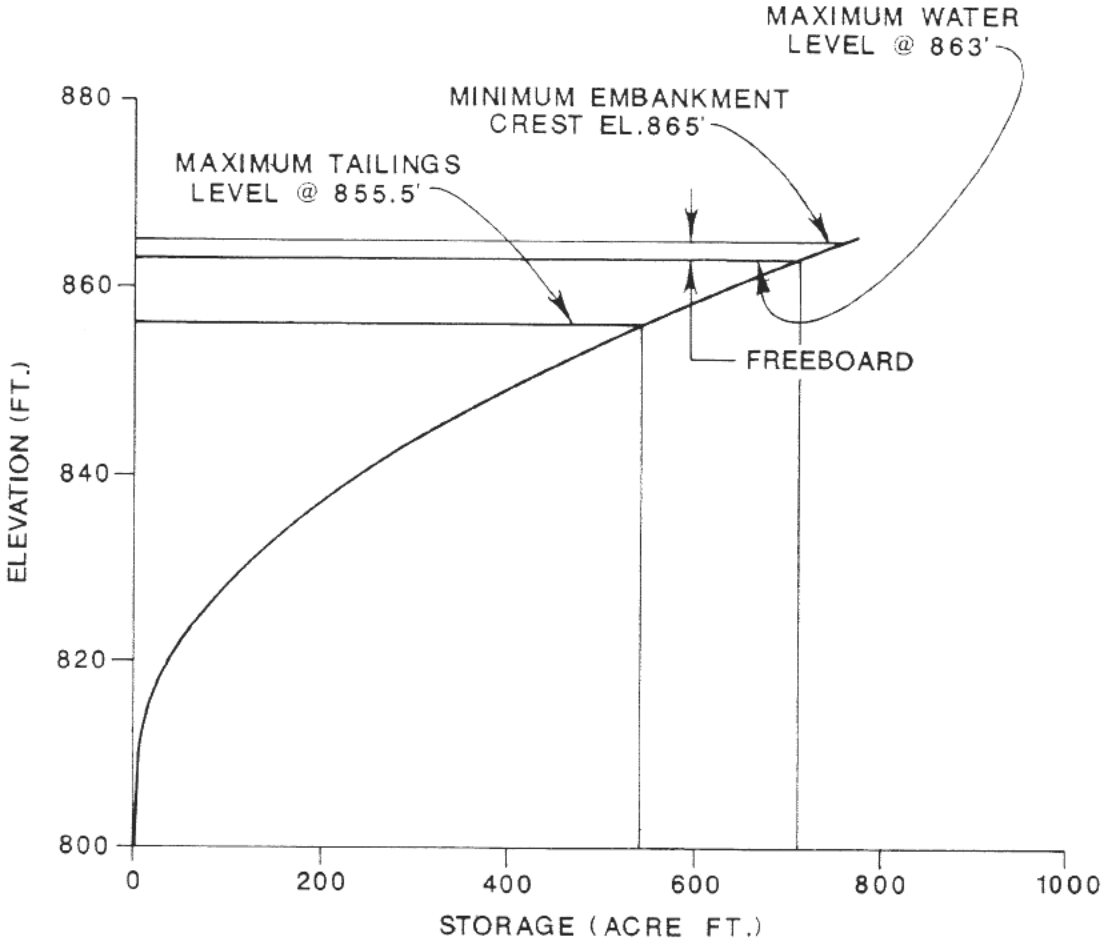
APPENDIX F
HEIGHT CAPACITY CURVES



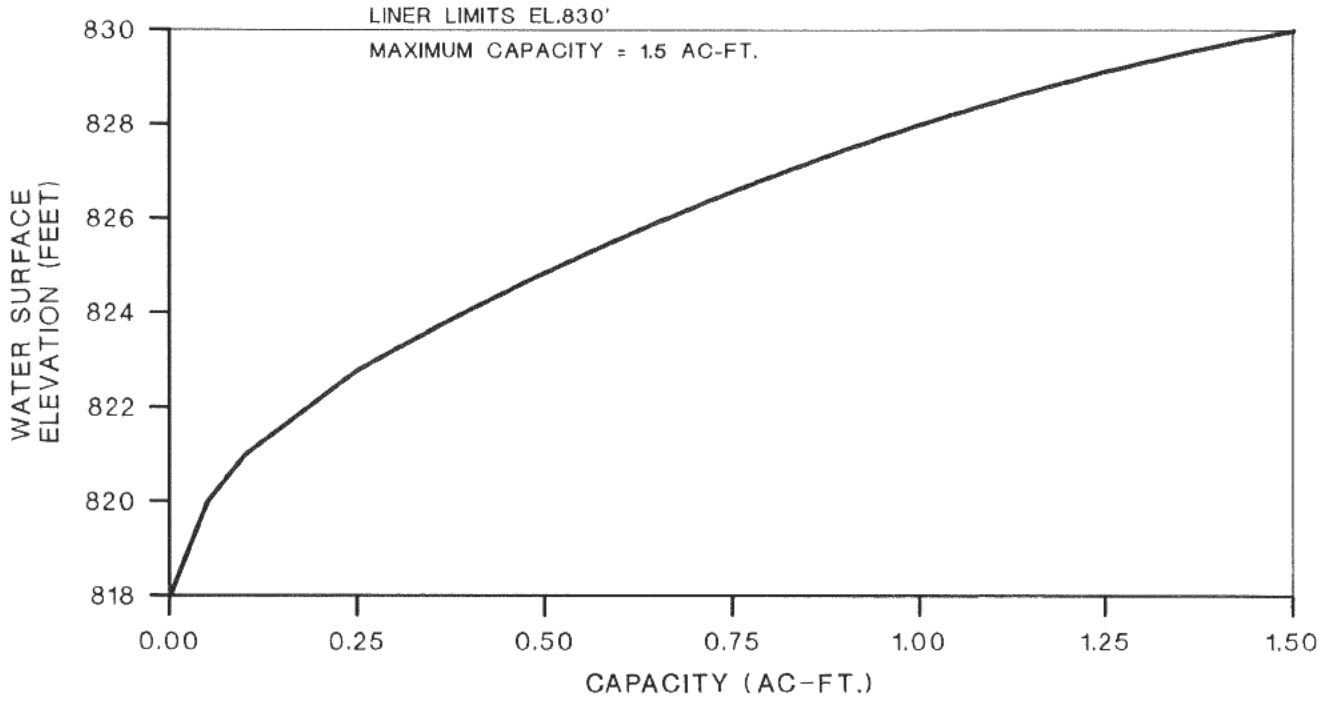
DESIGN BY:	HEIGHT CAPACITY CURVE FRESH WATER POND No. 1	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-1 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN



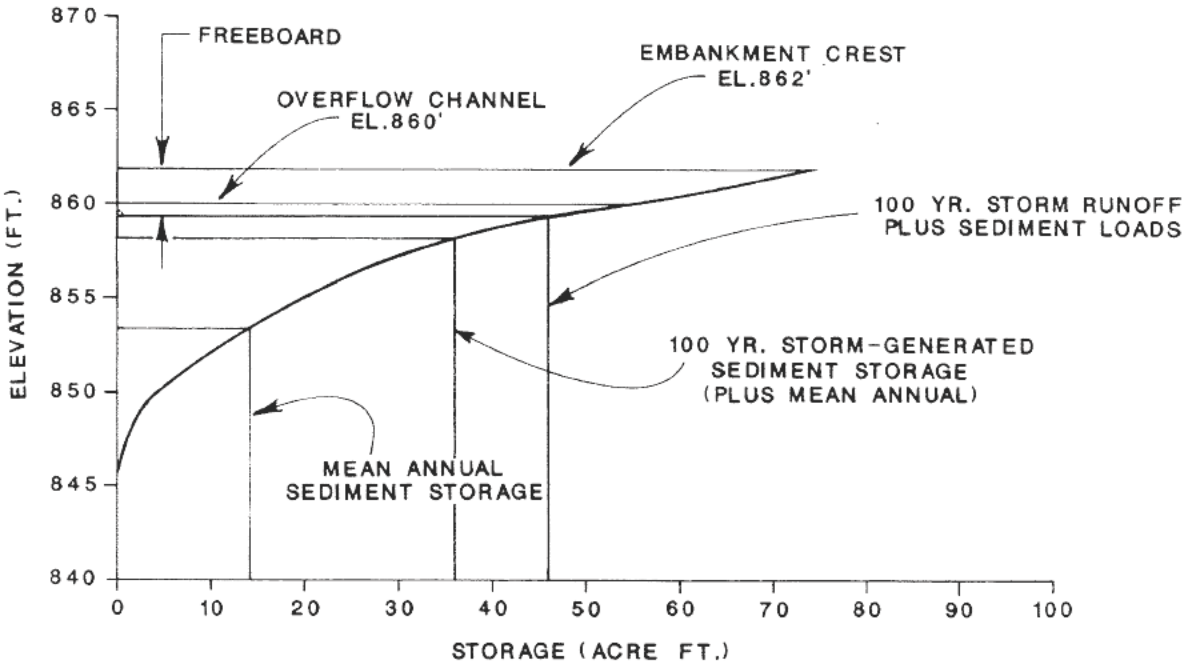
DESIGN BY:	HEIGHT CAPACITY CURVE FRESH WATER POND No. 2	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-2 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN



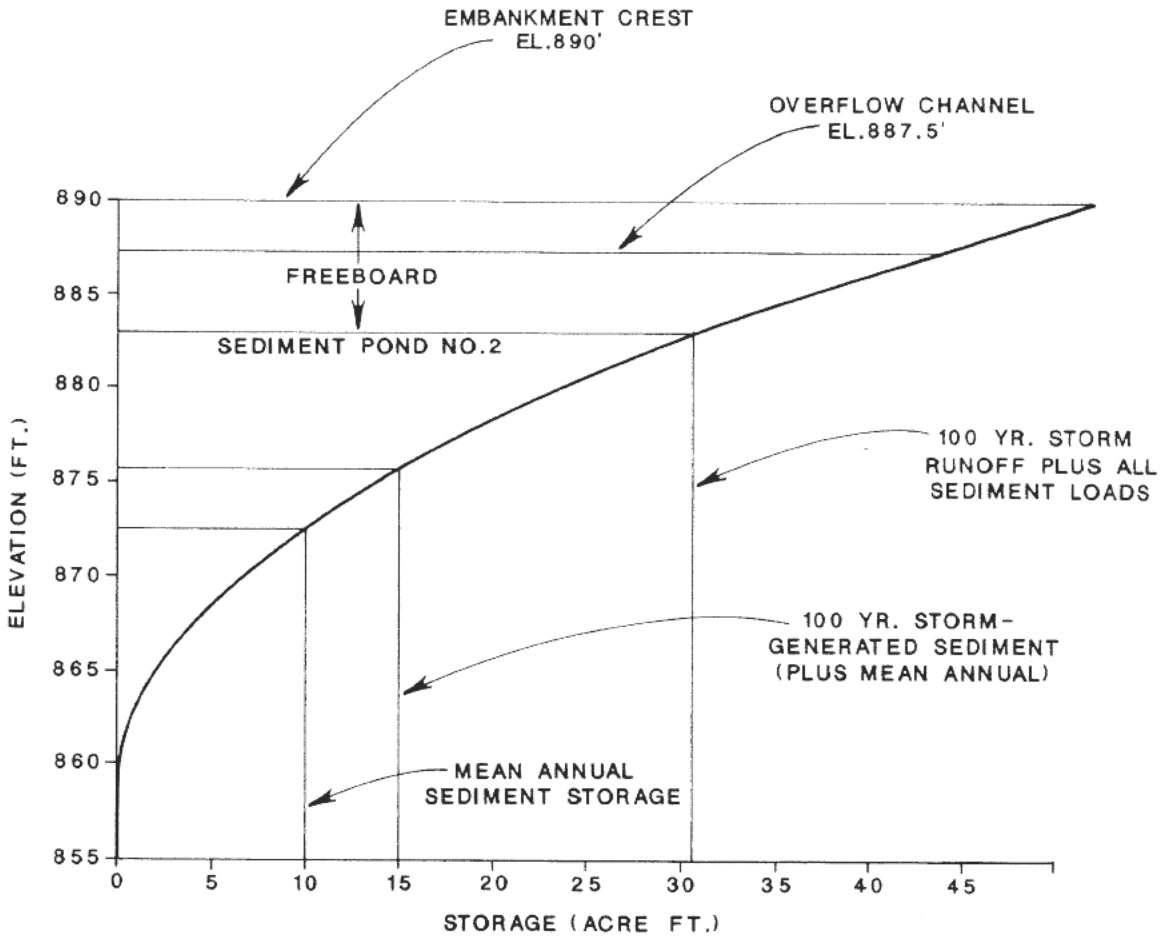
DESIGN BY:	HEIGHT CAPACITY CURVE SLURRY POND	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-3 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN



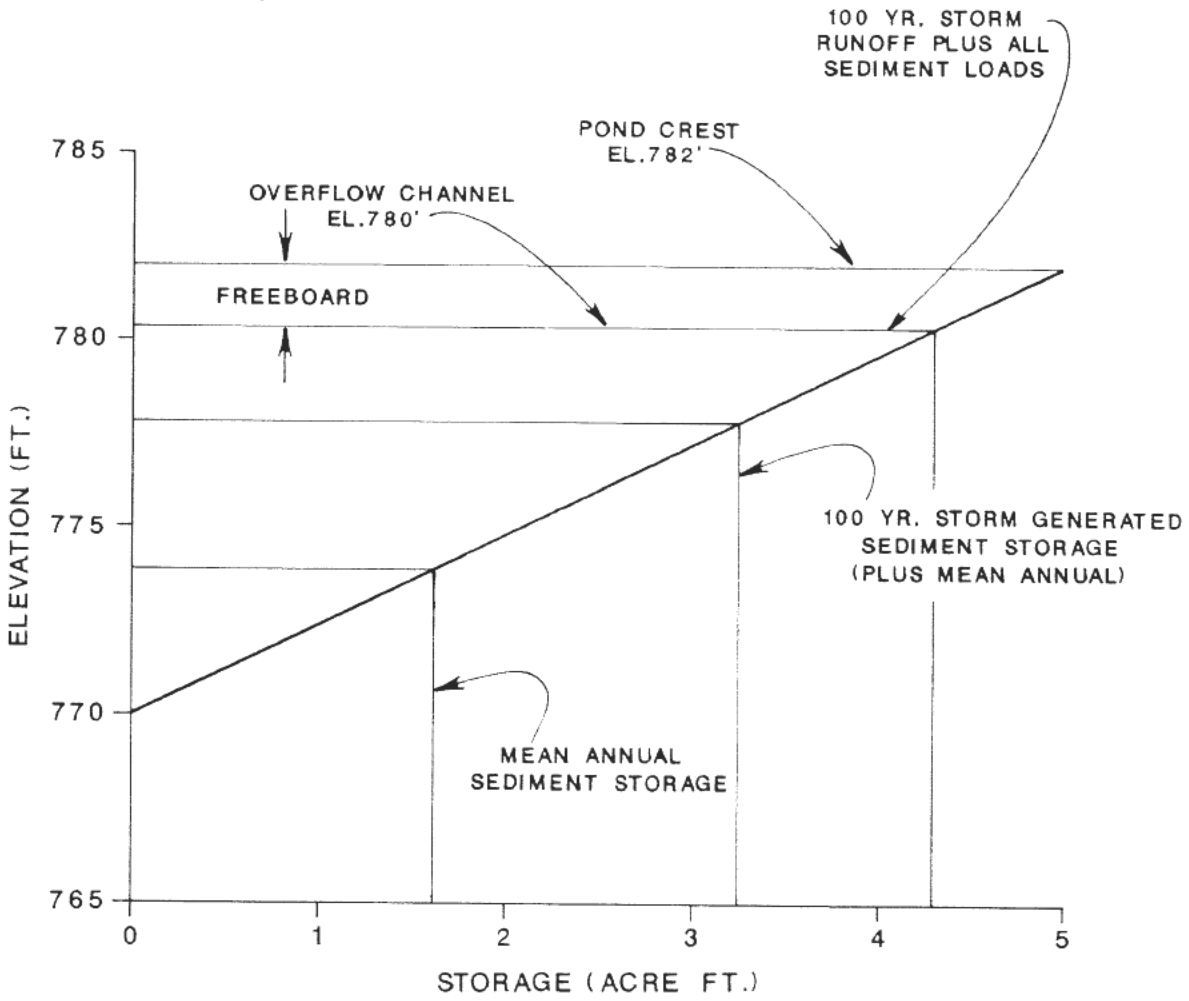
DESIGN BY:	HEIGHT CAPACITY CURVE WASH DOWN WATER RECYCLE POND	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-4	REV. 0
DATE DRAWN: 7/90		SCALE: AS SHOWN	



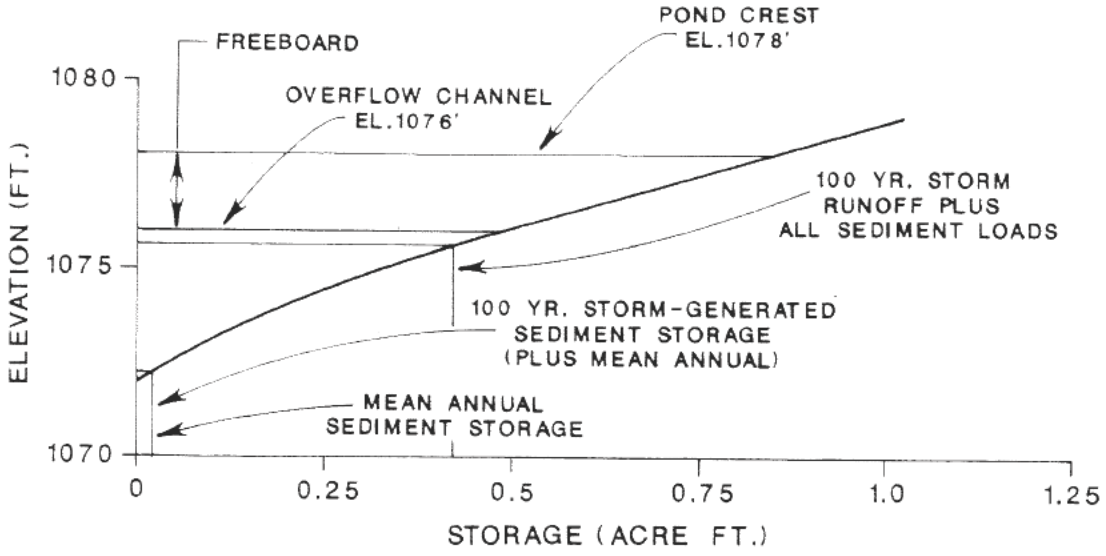
DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 1	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-5	REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN	



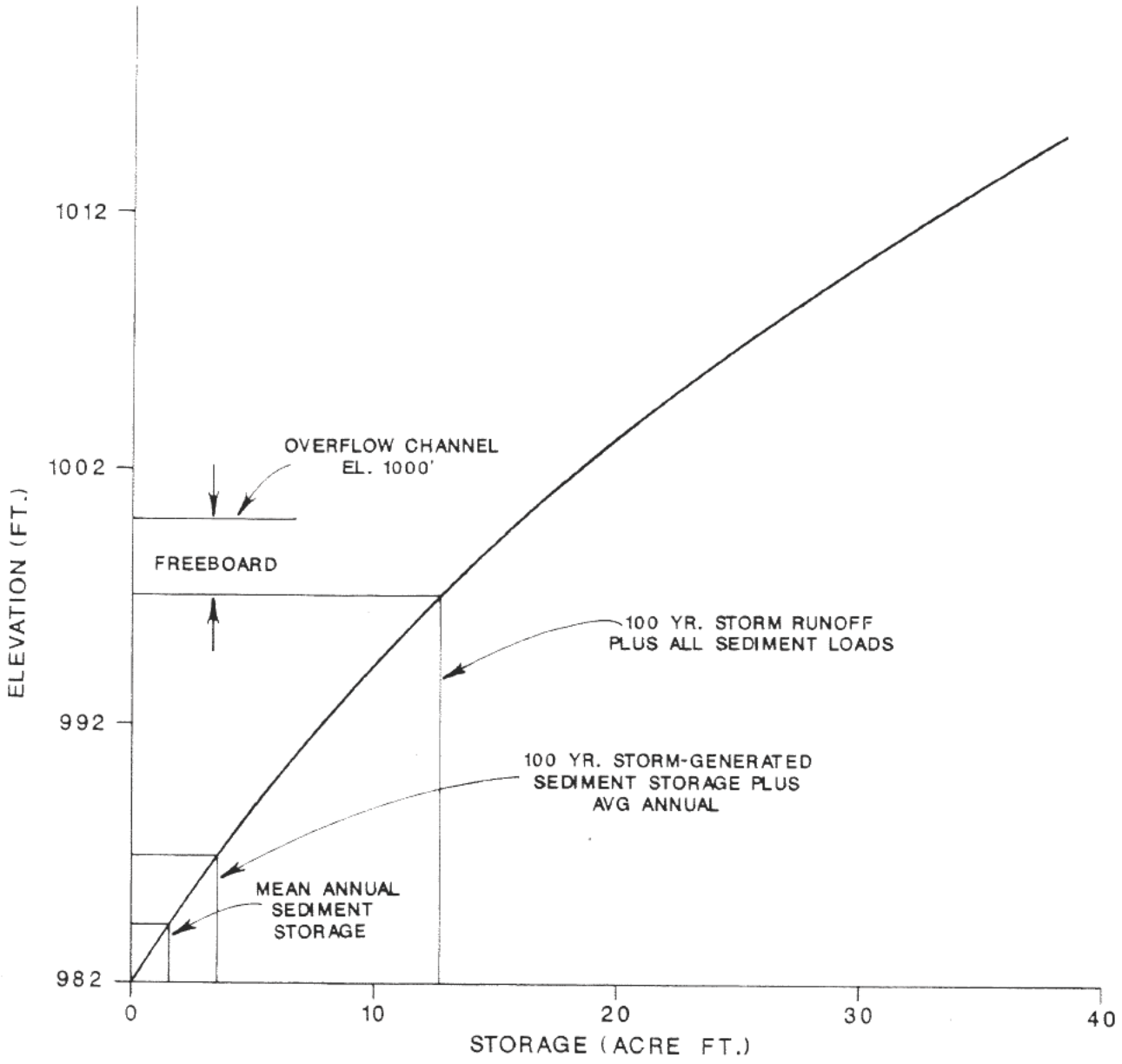
DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 2	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-6 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN



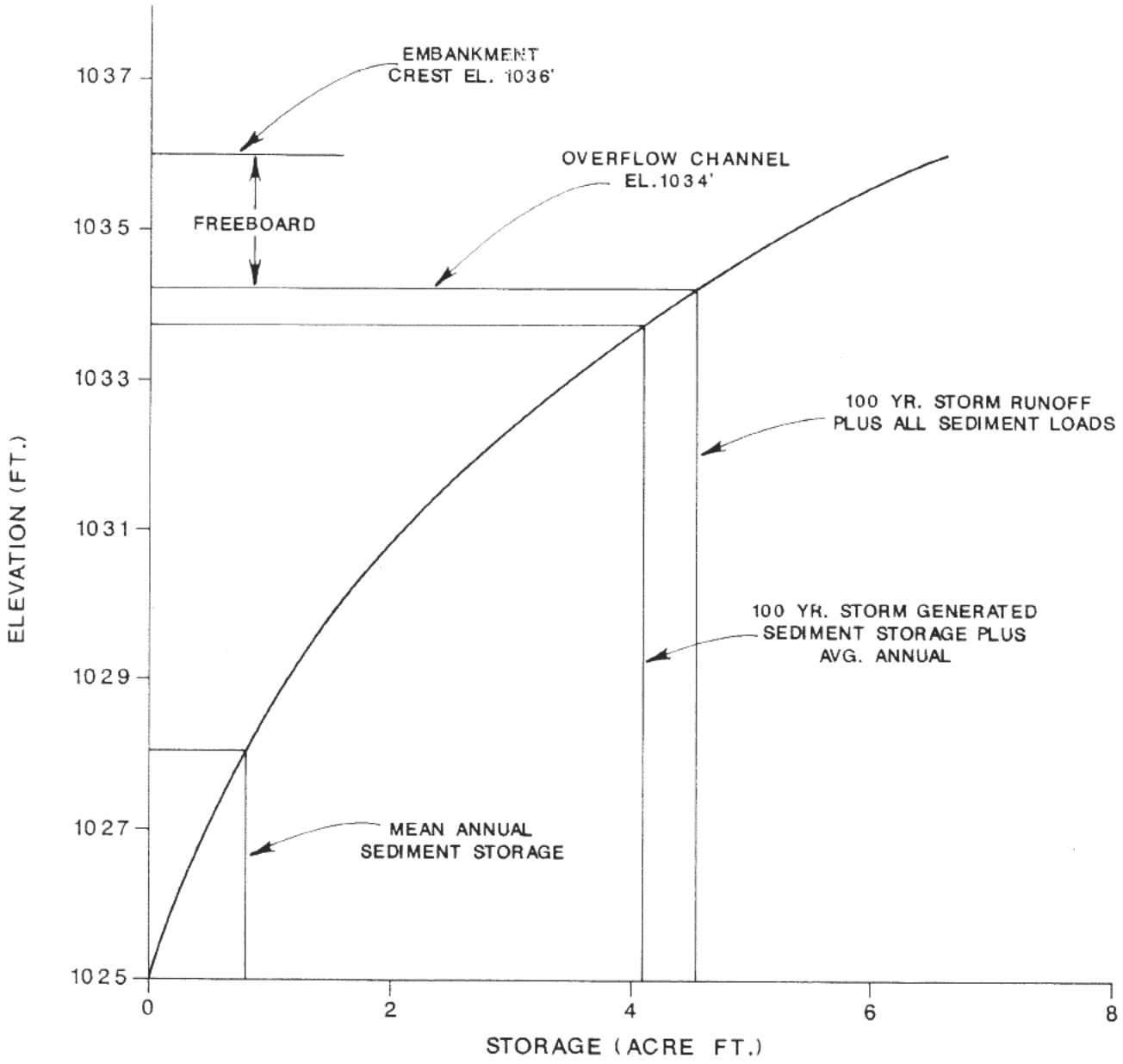
DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 3	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-7 — REV. 0
DATE DRAWN: 8/89		SCALE: AS SHOWN



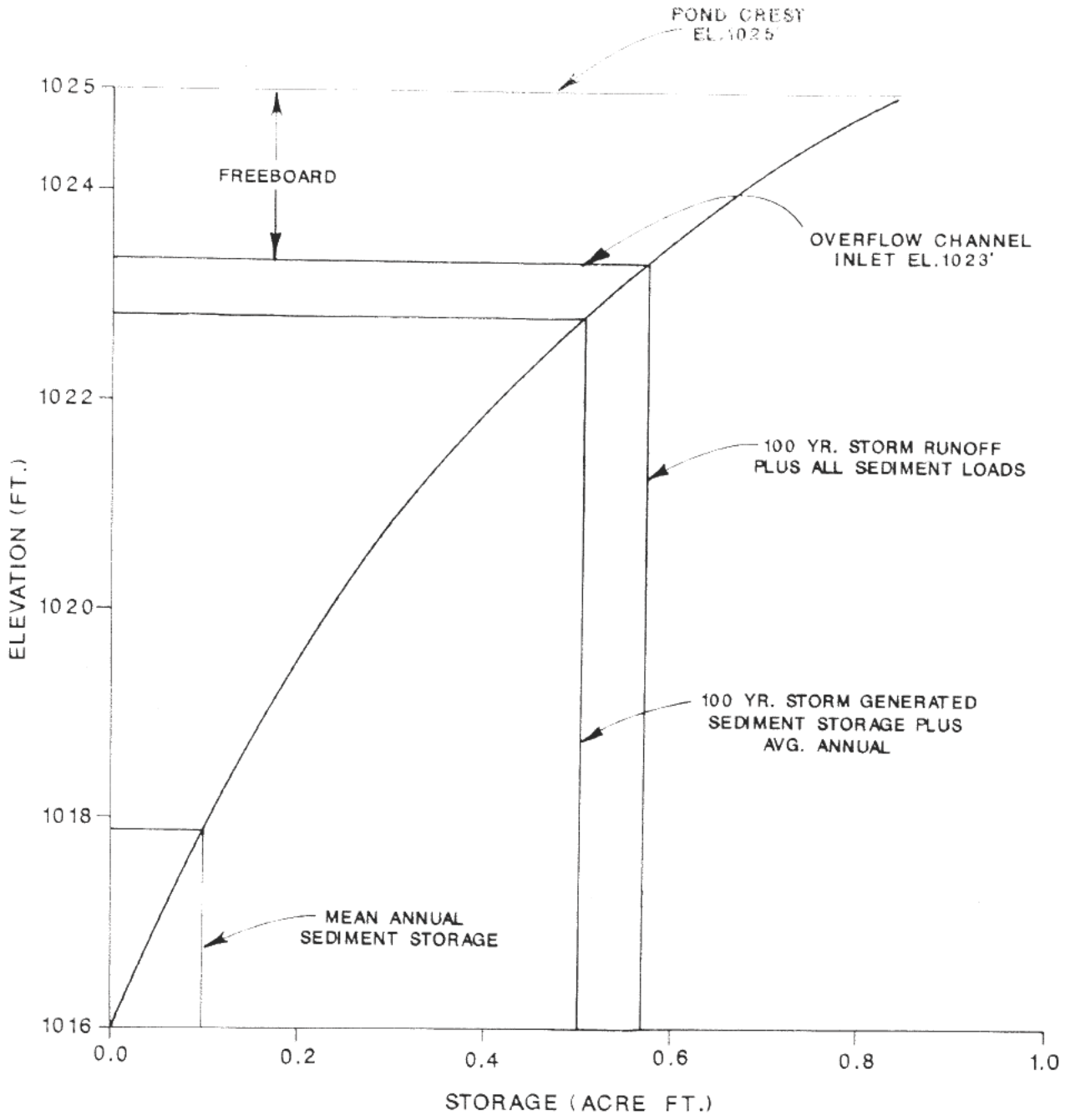
DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 4	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-8 — REV. 0
DATE DRAWN: 8/89		SCALE:



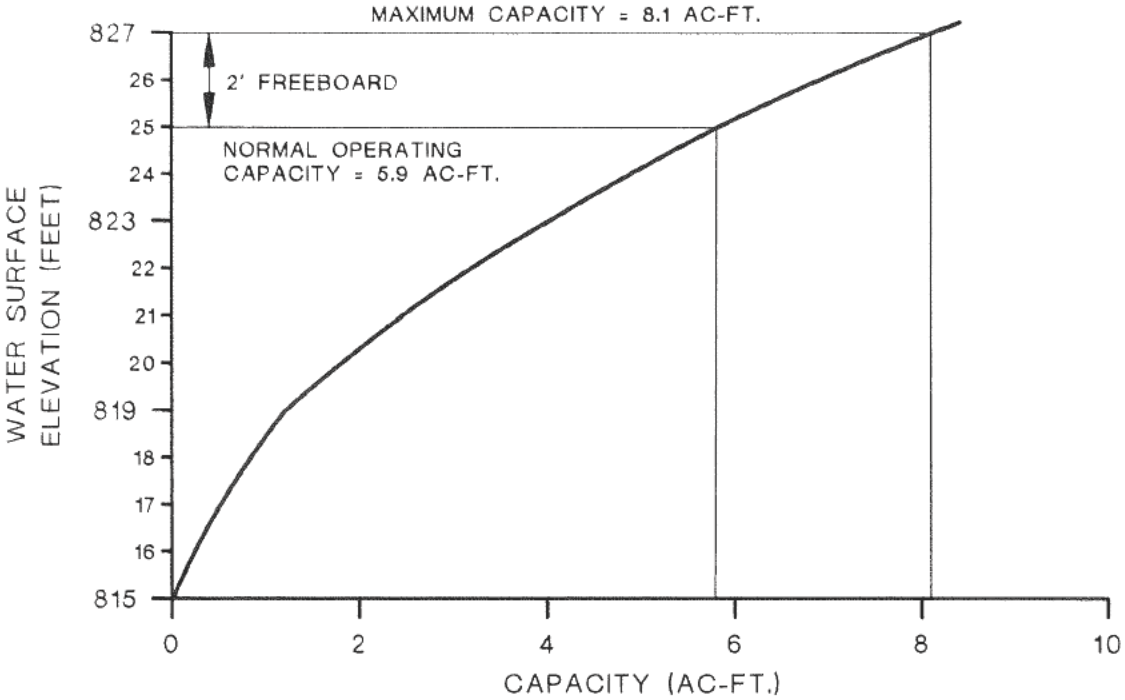
DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 5	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-9	REV. 0
DATE DRAWN: 8/89		SCALE:	



DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 6	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-10 — REV. 0
DATE DRAWN: 8/89		SCALE:



DESIGN BY:	HEIGHT CAPACITY CURVE SEDIMENT POND No. 7	WISHBONE HILL MINE	PERMIT No. 01-89-796
DRAWN BY:			
CHECK BY:			
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-11	REV. 0
DATE DRAWN: 8/89		SCALE:	



DESIGN BY:	HEIGHT CAPACITY CURVE FACILITIES AREA SEDIMENT POND	WISHBONE HILL MINE — PERMIT No. 01-89-796
DRAWN BY:		
CHECK BY:		
DWG FILE:	USIBELLI COAL MINE, INC. P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226	FIGURE No. F-12 — REV. 0
DATE DRAWN: 8/89		SCALE:

APPENDIX G
STABILITY CALCULATIONS

APPENDIX G - STABILITY CALCULATIONS

G.1 General

Slope stability analyses were performed in accordance with the Alaska Surface Coal Mining Control and Reclamation Regulations, Mine Safety and Health Administration (MSHA) requirements and proposed State of Alaska Dam Safety requirements. The most conservative combination of these regulations required that a stability analysis be performed on any structure impounding more than 20 acre feet of water or having an embankment height of 20 feet or greater as measured from the embankment centerline to either the upstream or downstream toe, whichever provides the higher height. The stability of each berm was evaluated at the maximum cross-section utilizing two-dimensional force-equilibrium techniques. Conditions that were considered in the stability analyses included static and pseudostatic loading, rapid drawdown from a maximum pool elevation, and critical pool elevations which could potentially adversely influence the stability of upstream and downstream embankment slopes. The stability of each overburden stockpile and Topsoil Stockpile No. 1 were also evaluated. These structures were evaluated for static and pseudostatic conditions only since they will not impound water.

G.2 Material Properties

The material properties utilized for the stability analyses were based on results of geotechnical laboratory testing, field observations, and interpretations of probable strength characteristics obtained from engineering literature. The material properties are tabulated on each stability figure.

G.3 Seismological Considerations

The seismicity of the Wishbone Hill Project site was evaluated on a preliminary basis using a seismic zone map of Alaska presented in Safety of Existing Dams, Evaluation and Improvement, published by National Academy Press in 1983. The map indicates that the site is located in seismic zone 3 which incorporates most of south-central Alaska between Fairbanks and Anchorage. An accompanying table indicates that the peak ground accelerations in this seismic zone are 0.4g and 0.2g for the Maximum Credible Earthquake (MCE) and Operating Basis Earthquake (OBE), respectively.

The peak ground accelerations for the Wishbone Hill Project site were converted to pseudostatic earthquake coefficients using correlations presented in the paper titled "Evaluation of Seismic Effects on Embankment Dams" by Robert B. Jansen, presented at the Hawaii Dam Safety Conference in Honolulu on December 5, 1989. The resultant pseudostatic coefficients range from 0.16g to 0.28g for the MCE and 0.08g to 0.14g for the OBE. Intermediate values of 0.2g and 0.1g were selected for use in stability analyses in their long-term, post-reclamation and operational configurations, respectively.

For the stability analysis, a pseudostatic method of analysis was employed to assess the performance of structures under dynamic earthquake loads. A peak Operational Basis Earthquake (OBE) of 0.1 g was chosen as the pseudostatic coefficient. The use of this pseudostatic coefficient is reasonable considering the hazard class and relatively short life-span of the impounding structures.

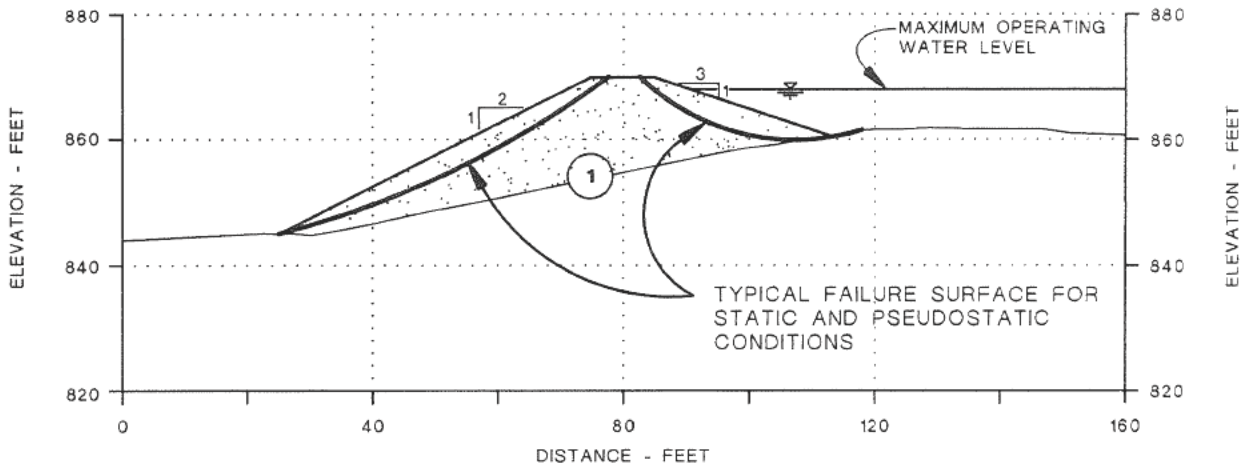
G.4 Stability Analyses Results and Conclusions

The stability was evaluated using judgement based on past experience with similar facilities in conjunction with computerized slope stability analytical methods. The computer program used, PCSTABL4, was developed at Purdue University and is described in detail by Carpenter in the PCSTABL4 User Manual published by Purdue University in 1985. The circular (CIRCLE2) subroutine was used to evaluate the stability of each facility. Each facility was evaluated for static and pseudostatic loading conditions.

The results of the stability analyses indicate that all pond embankment structures will be stable under each condition evaluated. The analyses also indicate that the overburden and topsoil stockpiles will be stable under the anticipated static and pseudostatic loading conditions. As these facilities do not impound water the rapid drawdown and critical pool conditions do not apply and have not been evaluated for the stockpiles. The factors of safety achieved for the static and pseudostatic analyses on the overburden and topsoil stockpiles compare favorably with the minimum values of 1.2 and 1.0, respectively, as recommended by the U.S. Forest Service in their document titled Dump Stability Performance Objectives and Evaluation Standards. Summaries of calculated factors of safety are presented on Figure G-1 through G-12.

The factors of safety achieved for static and pseudostatic analyses compare favorably with the minimum values of 1.5 and 1.0 recommended by the U.S. Army Corps of Engineers for static and pseudostatic embankment stability, respectively (Corps of Engineers, 1970). The minimum recommended safety factor of 1.2 for rapid drawdown was met or exceeded by all but one of the embankment structures. The exception was the upstream face of the large berm on the east perimeter of the slurry pond, which achieved a minimum static factor of safety of 1.1 for drawdown conditions. This factor of safety was determined to be acceptable for this structure

based on the very low probability of occurrence of any significant drawdown during operation of the slurry pond. The presence of settled coal fines behind the embankment further reduces the potential for rapid drawdown conditions and acts to buttress the upstream faces of all the slurry pond embankments.



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.6
2	DOWNSTREAM - STATIC	1.5
3	UPSTREAM - PSEUDOSTATIC *	1.8
4	DOWNSTREAM - PSEUDOSTATIC*	1.1
5	UPSTREAM - DRAWDOWN	1.8

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

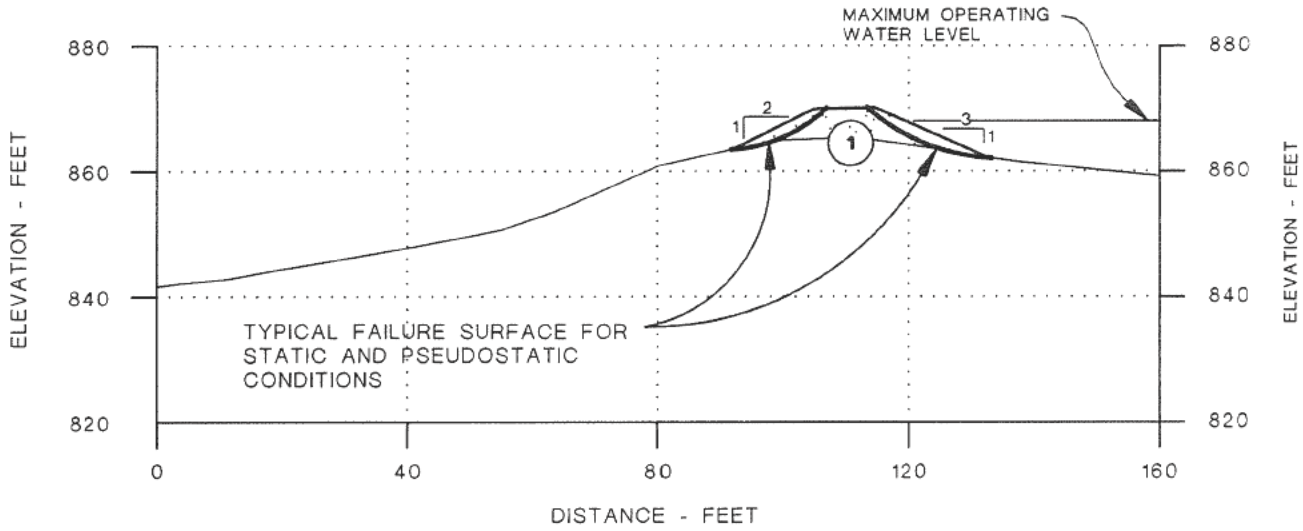
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S5 – FRESH WATER POND No. 1

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-1
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.2
2	DOWNSTREAM - STATIC	1.7
3	UPSTREAM - PSEUDOSTATIC *	1.5
4	DOWNSTREAM - PSEUDOSTATIC *	1.1
5	UPSTREAM - DRAWDOWN	1.3

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

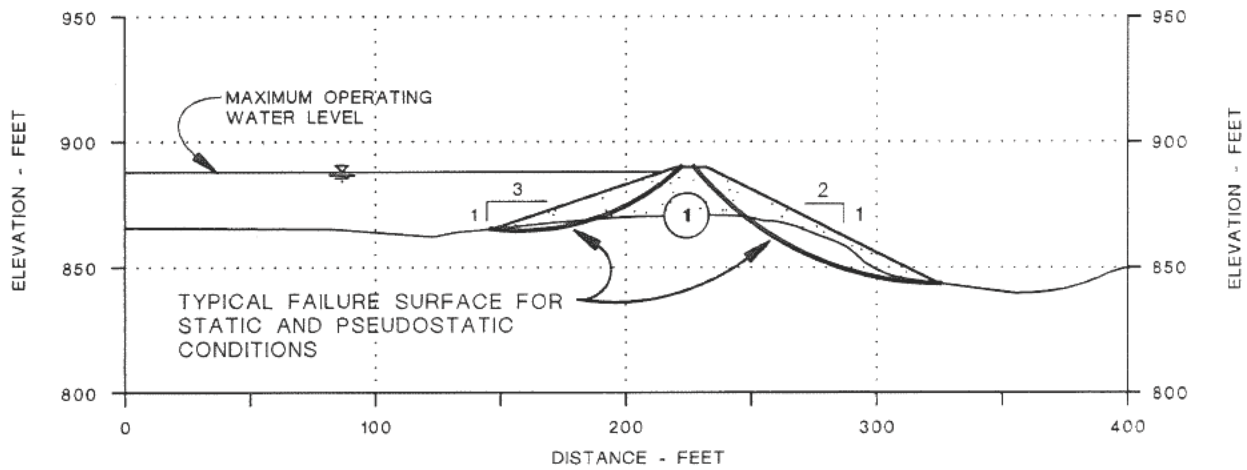
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S4 – SLURRY POND & FRESH WATER POND No. 1

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-2
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.3
2	DOWNSTREAM - STATIC	1.6
3	UPSTREAM - PSEUDOSTATIC *	1.7
4	DOWNSTREAM - PSEUDOSTATIC*	1.1
5	UPSTREAM - DRAWDOWN	1.2

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

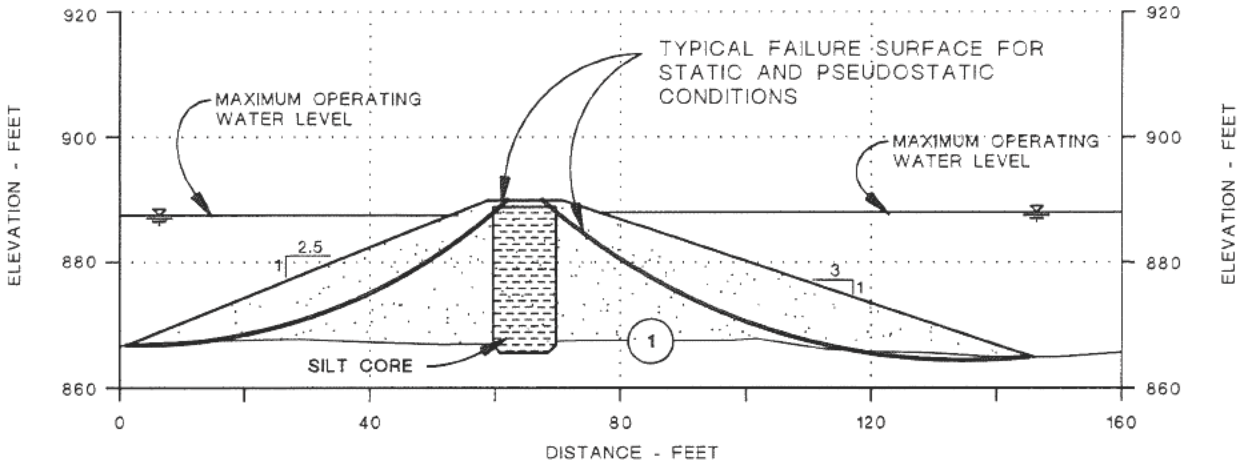
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S7 – FRESH WATER POND No. 2

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-3
SCALE:
REV. 0



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.4
2	DOWNSTREAM - STATIC	2.0
3	UPSTREAM - PSEUDOSTATIC *	1.5
4	DOWNSTREAM - PSEUDOSTATIC*	1.3
5	UPSTREAM - DRAWDOWN	1.3
6	DOWNSTREAM - DRAWDOWN	1.2

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

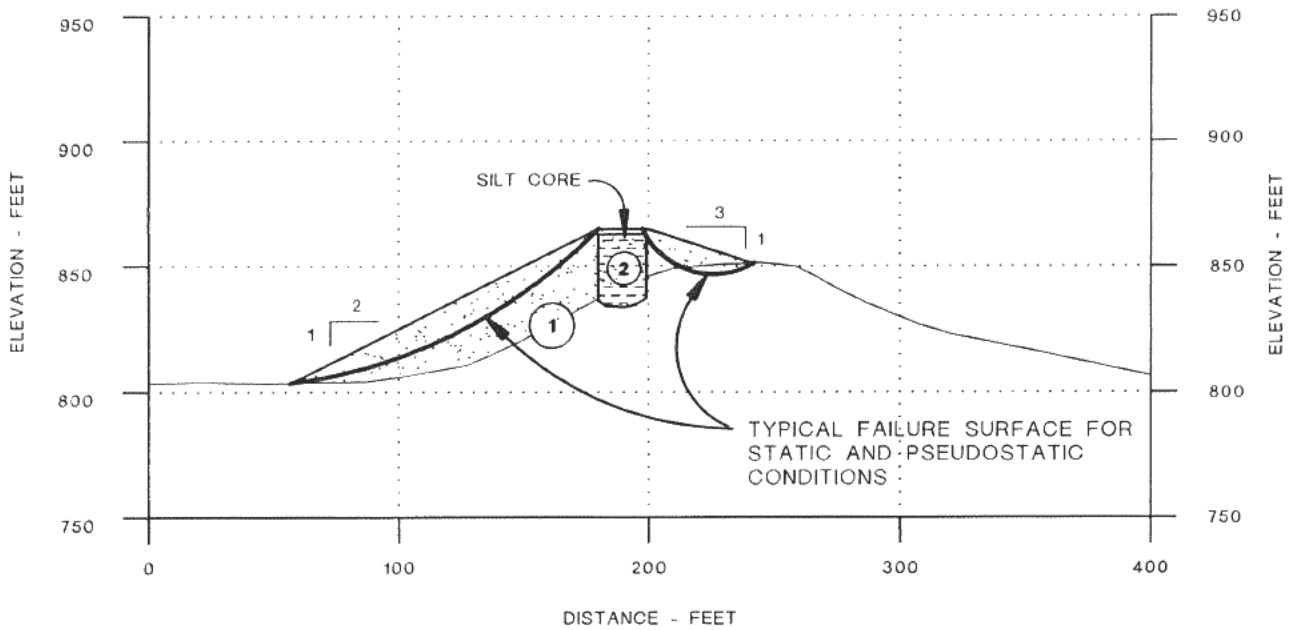
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S6 – SEDIMENT POND No. 2 & FRESH WATER POND No. 2

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-4
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0
2	EMBANKMENT SILT CORE	108	111	34°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	1.6
2	DOWNSTREAM - STATIC	2.1
3	UPSTREAM - PSEUDOSTATIC *	1.3
4	DOWNSTREAM - PSEUDOSTATIC *	1.5
5	UPSTREAM - DRAWDOWN	1.1

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

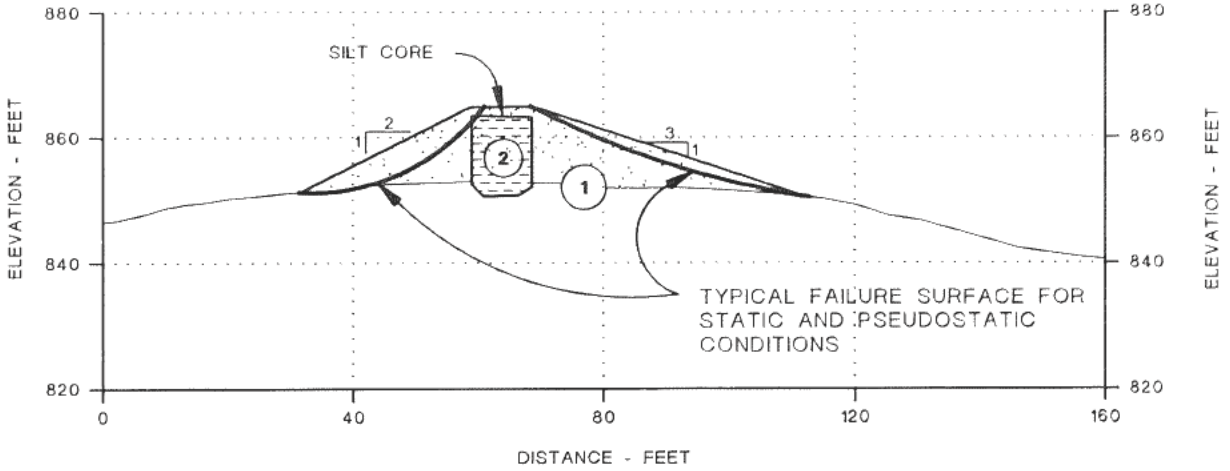
SLOPE STABILITY SUMMARY
S1 - SLURRY POND

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-5
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0
2	EMBANKMENT SILT CORE	108	111	34°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.2
2	DOWNSTREAM - STATIC	1.6
3	UPSTREAM - PSEUDOSTATIC *	1.7
4	DOWNSTREAM - PSEUDOSTATIC *	1.2
5	UPSTREAM - DRAWDOWN	1.4

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

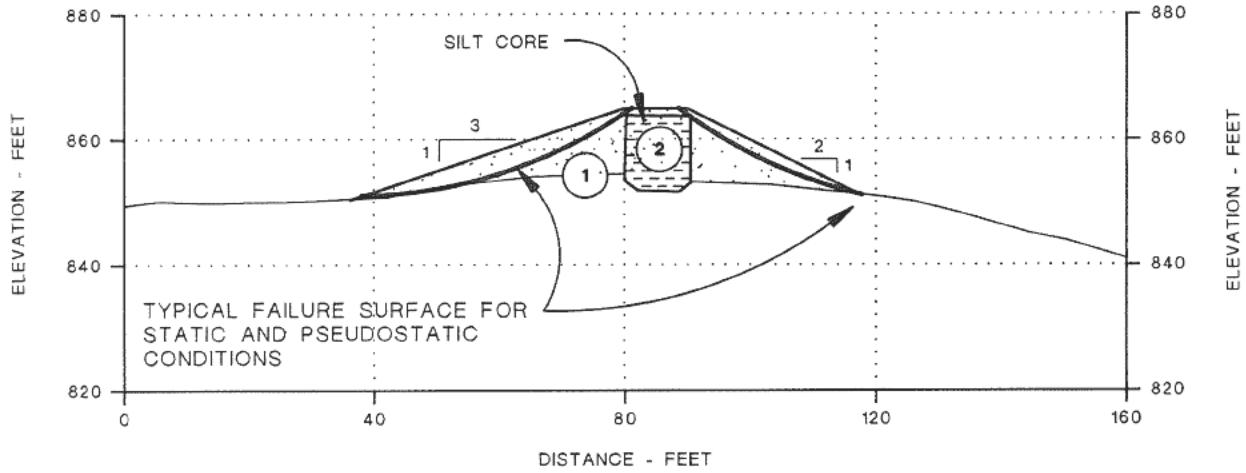
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S2 - SLURRY POND

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-6
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0
2	EMBANKMENT SILT CORE	108	111	34°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	1.8
2	DOWNSTREAM - STATIC	1.5
3	UPSTREAM - PSEUDOSTATIC *	1.2
4	DOWNSTREAM - PSEUDOSTATIC *	1.2
5	UPSTREAM - DRAWDOWN	1.7

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

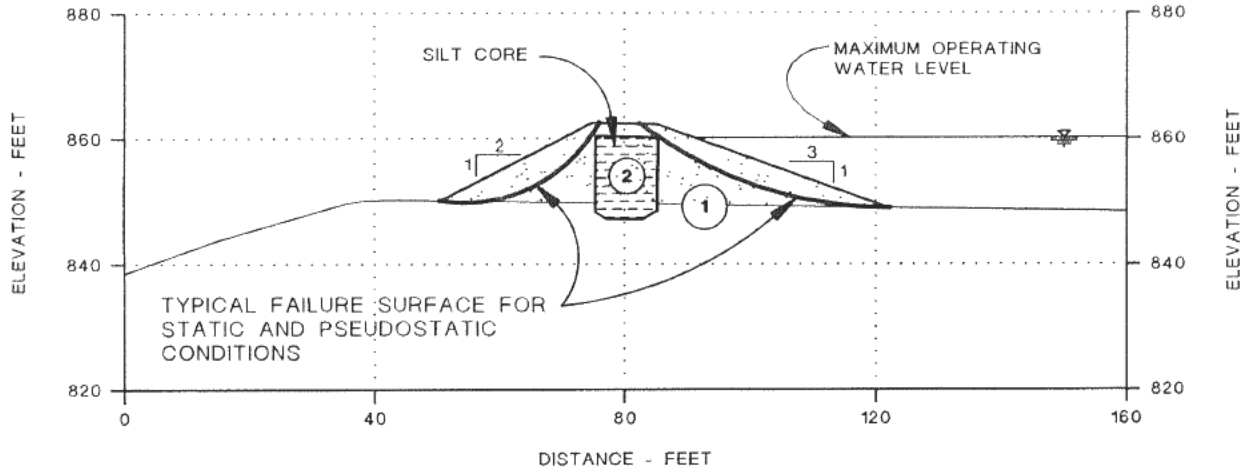
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
S3 - SLURRY POND

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-7
SCALE:
REV. 0



MATERIAL PROPERTIES

MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	COARSE EMBANKMENT FILL	138	143	38°	0
2	EMBANKMENT SILT CORE	108	111	34°	0

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS

CASE	DESCRIPTION	SAFETY FACTOR
1	UPSTREAM - STATIC	2.4
2	DOWNSTREAM - STATIC	1.5
3	UPSTREAM - PSEUDOSTATIC *	1.5
4	DOWNSTREAM - PSEUDOSTATIC *	1.1
5	UPSTREAM - DRAWDOWN	1.4

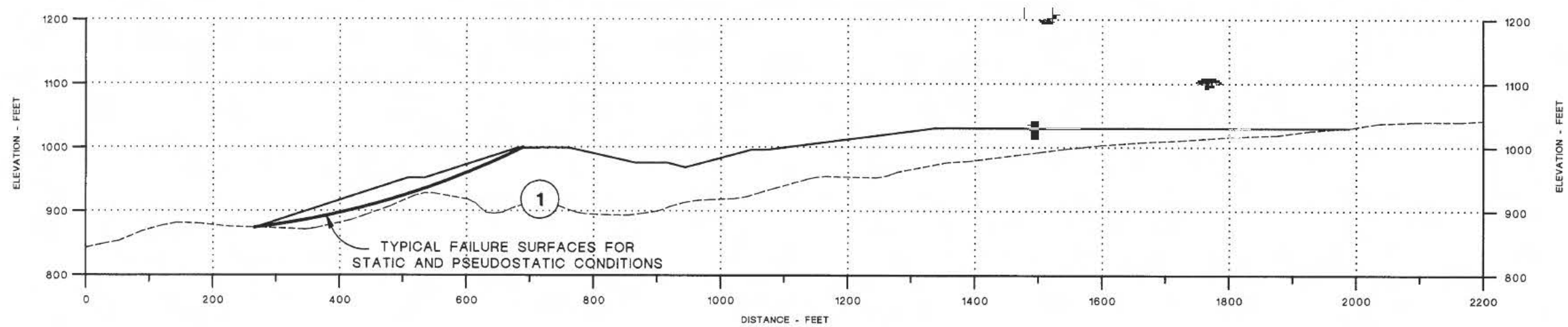
* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

SLOPE STABILITY SUMMARY
S8 – SEDIMENT POND No. 1

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE
PERMIT No. 01-89-796
FIGURE No. G-8
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	TOPSOIL	100	110	33°	--

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	STATIC	2.1
2	PSEUDOSTATIC *	1.6

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

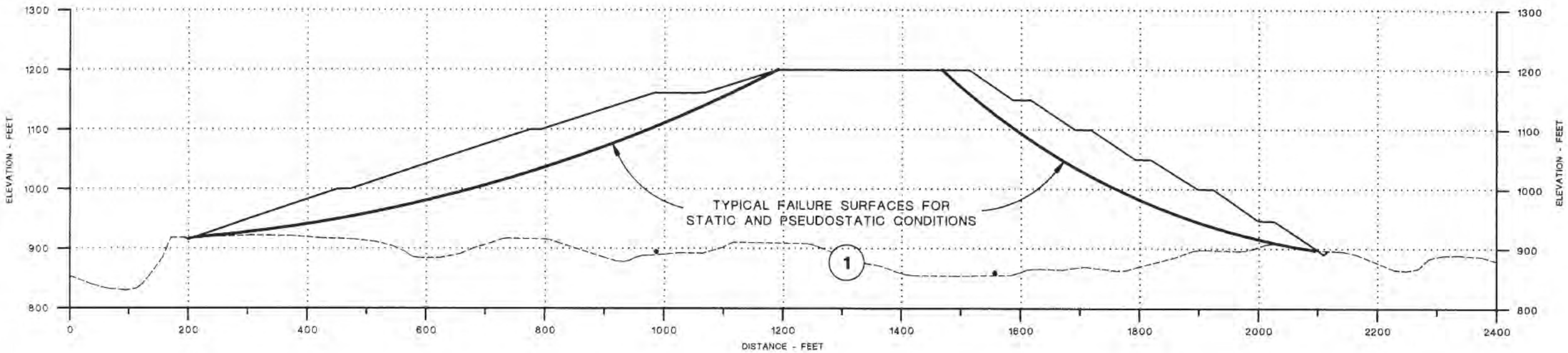
WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

SLOPE STABILITY SUMMARY
TOPSOIL STOCKPILE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

FIGURE No. G-9
SCALE: N/A
REV. 1



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	GRANULAR OVERBURDEN	110	125	36°	--

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	STATIC - LEFT SLOPE	2.5
2	STATIC - RIGHT SLOPE	1.3
3	PSEUDOSTATIC * - LEFT SLOPE	1.8
4	PSEUDOSTATIC * - RIGHT SLOPE	1.0

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE

PERMIT NUMBER 01-89-796

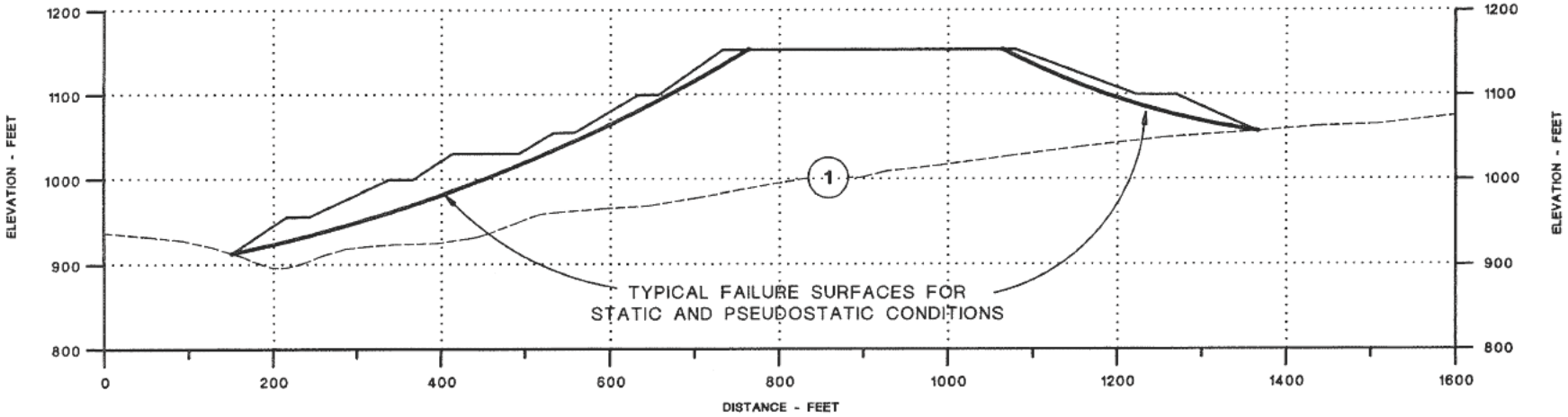
SLOPE STABILITY SUMMARY
OVERBURNDEN STOCKPILE No. 1

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

FIGURE No. G-10

SCALE: N/A

REV. 1



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	GRANULAR OVERBURDEN	110	125	36°	--

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	STATIC - LEFT SLOPE	1.8
2	STATIC - RIGHT SLOPE	2.2
3	PSEUDOSTATIC* - LEFT SLOPE	1.4
4	PSEUDOSTATIC* - RIGHT SLOPE	1.7

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

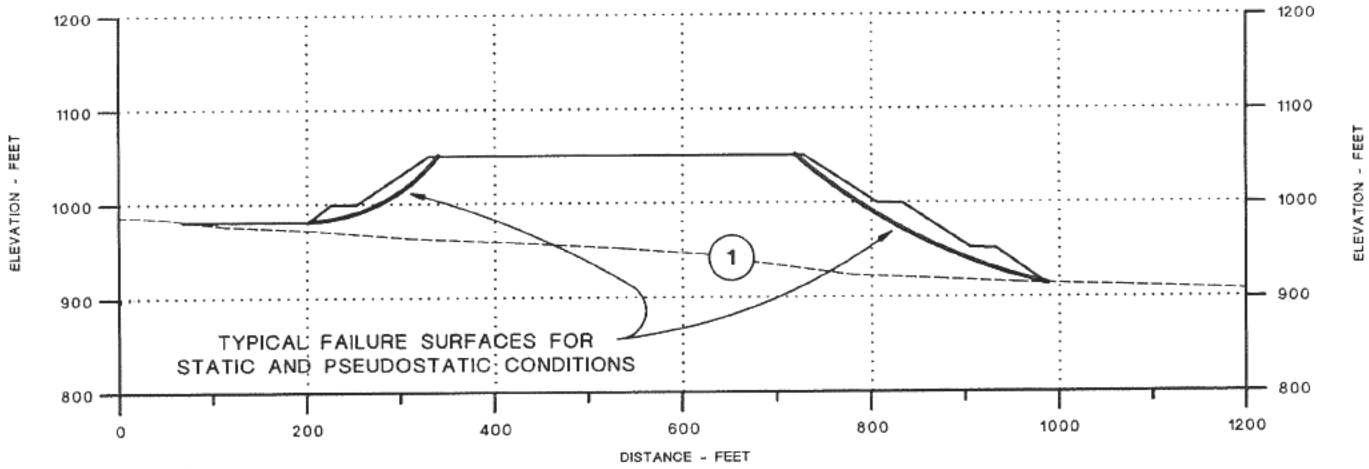
DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
OVERBURDEN STOCKPLIE No. 2

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-11
REV. 0
SCALE:



MATERIAL PROPERTIES					
MATERIAL TYPE	MATERIAL DESCRIPTION	γ (PCF)	γ_{SAT} (PCF)	ϕ (DEG)	c (PSF)
1	GRANULAR OVERBURDEN	110	125	36°	--

NOTE: FOUNDATION MATERIAL ASSUMED TO BE SIMILAR TO MATERIAL TYPE 1.

RESULTS OF STABILITY ANALYSIS		
CASE	DESCRIPTION	SAFETY FACTOR
1	STATIC - LEFT SLOPE	2.3
2	STATIC - RIGHT SLOPE	1.4
3	PSEUDOSTATIC* - LEFT SLOPE	1.7
4	PSEUDOSTATIC* - RIGHT SLOPE	1.1

* PSEUDOSTATIC COEFFICIENT OF 0.1g USED

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN: 8/89

SLOPE STABILITY SUMMARY
OVERBURDEN STOCKPLIE No. 3

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743 (907) 683-2226

WISHBONE HILL MINE
PERMIT No. 01-89-796

FIGURE No. G-12
REV. 0
SCALE:

APPENDIX H
FIELD INVESTIGATION PROGRAM

APPENDIX H - FIELD INVESTIGATION PROGRAM

A site investigation program was conducted from June 6 to 13, 1989 to assess the site subsoils with regard to their suitability as construction materials and infiltration characteristics within the proposed water-related mine facilities.

During the field program, a total of 20 backhoe test pits were excavated on site using a caterpillar 416 backhoe and a case 450 bulldozer. The locations of the test pits are shown on Plate H-1. The test pits were excavated to 8 to 11 ft depth and logged by an SRK engineer. Infiltration test results are contained in Appendix I. Test pit logs are summarized on Plate H-2.

Sample were retrieved from the test pits and shipped to SRK's geotechnical laboratory for further classification and testing. Lab testing is summarized in Appendix J.

R 2 E

PERMIT BOUNDARY

RELOCATED SEGMENT OF BUFFALO CREEK

SEDIMENT POND NO. 7

SEDIMENT POND NO. 6

SEDIMENT POND NO. 5

SEDIMENT POND NO. 4

TOPSOIL STOCKPILE NO. 2

MINE AREA 2

OVERBURDEN STOCKPILE NO. 3

TOPSOIL STOCKPILE NO. 1

FRESH WATER POND NO. 2

RUN OF MINE STOCKPILES

FACILITIES AREA SEDIMENT POND

EXPLOSIVES STORAGE AREA

WASH DOWN WATER RECYCLE POND

LEACH FIELD

PLANT AREA

SHOP/WAREHOUSE OFFICE AREA

SEWAGE TREATMENT

MAIN SUBSTATION

GUARD HOUSE

PREP PLANT

SLURRY POND

OVERBURDEN STOCKPILE NO. 1

OVERBURDEN STOCKPILE NO. 1 EXTENSION

DIVERSION BERM

SEDIMENT POND NO. 1

R.O.W. 52715

R.O.W. 216234

RELOCATED SEGMENT OF R.O.W. 52715

RELOCATED SEGMENT OF R.O.W. 216234

ACCESS ROAD LIMITS OF DISTURBANCE

PERMIT BOUNDARY

PERMIT BOUNDARY

T 19 N

T 18 N

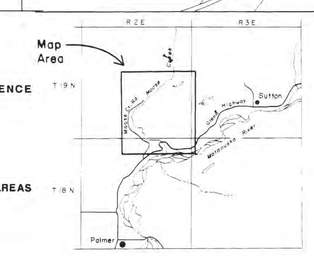
The core map area was photogrammetricaly mapped from photography of 5/8/84, 5/8/83, 6/22/85 by Air Photo Tech, Inc. of Anchorage, Alaska.
The core map area meets National Map Accuracy Standards at 1" = 200' and smaller scales.
Topographic and Planimetric features outside of the core area were taken from a photo enlarged 1" = 1 mile USGS Anchorage C-6 quad map of 1987.
Horizontal datum is Alaska State Plane, zone 4.
Vertical datum is based on USC & GS monumentation.

STATE OF ALASKA 49th
IAN P. G. HUTCHISON
CE-6817
REGISTERED PROFESSIONAL ENGINEER

I HEREBY CERTIFY THAT THESE DRAWINGS FOR THE DESIGN OF THE WISHBONE HILL MINE PROJECT, WERE PREPARED BY STEFFEN ROBERTSON AND KIRSTEN (U.S.) INC. UNDER MY DIRECT SUPERVISION FOR IDEMITSU ALASKA, INC.

LEGEND

- PERMIT BOUNDARY
- x——x FENCE
- FACILITIES AREAS
- ACCESS ROAD
- DIVERSION DITCHES
- PIPELINE
- MINE ROADWAYS
- OVERBURDEN STOCKPILES CONSTRUCTED ON BACKFILLED PIT AREAS
- BUFFALO CREEK RELOCATION
- TEST PIT LOCATION
- INFILTRATION TEST LOCATION



North

500 250 0 500 1000 1500

SCALE IN FEET
1" = 500'
CONTOUR INTERVAL
5 FEET

SUBJECT REVISIONS			
REV.	DATE:	BY:	DESCRIPTION
1	2009	JEN	MINOR REVISIONS

DESIGN BY:
DRAWN BY:
CHECK BY:
DWG FILE:
DATE DRAWN:

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.

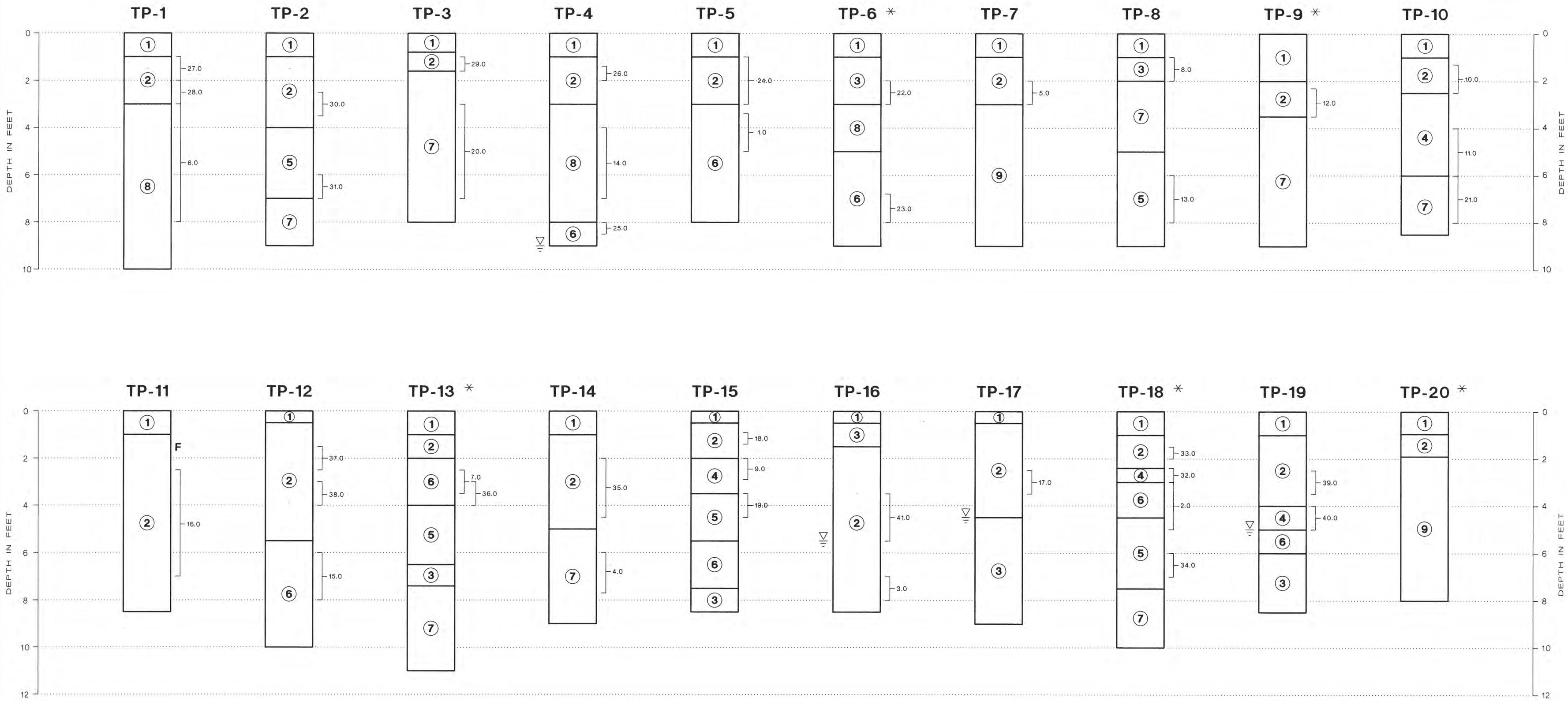
PERMIT NUMBER 01-89-796

GEOTECHNICAL TEST LOCATIONS FOR THE DRAINAGE CONTROL PLAN

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. H-1
SHEET No. 1 OF 1
REV. 1



DESCRIPTION OF SOIL TYPES

(1) TOPSOIL - GREY BLACK, HUMUS, CONTAINS ABUNDANT VEGETAL MATERIAL AND LITTER, SOME LOGS AND BOULDERS (HUMOCKY APPEARANCE).

(2) SILT - LIGHT REDDISH BROWN TO ORANGE BROWN TO GREY BROWN TO MEDIUM BROWN COLOR, CONTAINS VARYING AMOUNTS OF SAND, GRAVEL AND COBBLES TO BOULDER SIZED MATERIAL, COBBLES AND BOULDERS (TO >12" DIA.) ARE GENERALLY LOCATED ALONG THE BASE OF THIS ZONE OF MATERIAL, GENERALLY MOIST TO VERY MOIST AND SLIGHTLY SOFT TO MEDIUM DENSE.

(3) SANDY SILT - REDDISH BROWN TO GREY BROWN, CONTAINS VARYING AMOUNTS OF SAND AND SOME GRAVEL TO BOULDER SIZE (TO >12" DIA.) MATERIAL, TYPICALLY MOIST, GENERALLY LOOSE BUT CAN BE UP TO MEDIUM DENSE WHEN FOUND IN THINNER LAYERS (LENSES).

(4) SILTY SAND - GREY BROWN TO BROWN, CONTAINS SOME GRAVEL AND COBBLES WHICH ARE GENERALLY IN LENSES AND POCKETS, TYPICALLY MOIST AND MEDIUM DENSE.

(5) SAND - GREY BROWN TO GREY BLACK WITH "SALT AND PEPPER" APPEARANCE, FAIRLY CLEAN, SOME GRAVEL AND COBBLE TO BOULDER SIZE (TO >12" DIA.) MATERIAL GENERALLY IN LENSES AND POCKETS, TYPICALLY MOIST AND LOOSE.

(6) GRAVELLY SAND - FAIRLY CLEAN, CONTAINS COBBLE TO BOULDER SIZE (TO >24" DIA.) MATERIAL GENERALLY IN LENSES AND POCKETS, TYPICALLY MOIST AND MEDIUM DENSE.

(7) GRAVEL/SAND MIXTURE - GRAVEL TO BOULDER SIZE (TO >24" DIA.) MATERIAL IN A MATRIX, SAND IS GENERALLY CLEAN, TYPICALLY MOIST AND MEDIUM DENSE.

(8) SANDY GRAVEL - FAIRLY CLEAN, CONTAINS COBBLE TO BOULDER SIZE (TO >24" DIA.) MATERIAL GENERALLY IN LENSES AND POCKETS, SOMETIMES CONTAINS SOME SILT, TYPICALLY MOIST AND MEDIUM DENSE, BUT OCCASIONALLY LOOSE.

(9) SLOPE WASH - HIGHLY VARIABLE DEPOSIT, CONTAINS MOST OF THE ABOVE SOIL TYPES AS A MIXTURE OR IN POCKETS AND LENSES, BOULDERS ARE TO >36" DIA, TYPICALLY MOIST AND LOOSE TO MEDIUM DENSE.

KEY TO SYMBOLS:

* NOTEWORTHY VARIABILITY IN LITHOLOGIC TYPES, THICKNESSES AND POSITION WITHIN TEST PIT.

]-6.0 INTERVAL SAMPLED AND SAMPLE NO. FOR LABORATORY REFERENCE

SEEP NOTED IN TEST PIT

F NOTEWORTHY DEGREE OF FROZEN SOIL IN TEST PIT.

(3) SOIL TYPE IDENTIFIED DURING TEST PIT LOGGING (SEE DESCRIPTION OF SOIL TYPES).

NOTE:

SEE PLATE H-1 FOR TEST PIT LOCATIONS.

STATE OF ALASKA 49th IAN P. G. HUTCHISON CE-6817 REGISTERED PROFESSIONAL ENGINEER

SUBJECT REVISIONS

REV.	DATE:	BY:	DESCRIPTION
A	8/89	RF	CHECK BY: RF; APPROVED BY: WF
1	2009	JEH	MINOR REVISIONS

DESIGN BY:
DRAWN BY: RL
CHECK BY: MAC
DWG FILE:
DATE DRAWN: 8/89

WISHBONE HILL MINE

USIBELLI COAL MINE INC. UCM

PERMIT NUMBER 01-89-796

TEST PIT LOGS

WISHBONE HILL MINE

USIBELLI COAL MINE, INC.
P.O. BOX 1000, HEALY, ALASKA 99743
(907) 683-2226

PLATE No. H-2
SHEET No. 1 OF 1
REV. 1

APPENDIX I

FIELD PERMEABILITY TEST RESULTS

APPENDIX I - FIELD PERMEABILITY TEST RESULTS

This Appendix contains the field data and interpretation for the well permeameter field infiltration testing performed during the field site investigation program of June 1989.

Field testing to determine foundation permeability was conducted during the June 1989 site investigation program. The test procedure and apparatus complied with the USBR Field Permeability Test (Well Permeameter Method) Designation E-19 which is documented in Earth Manual (U.S. Department of the Interior, 2nd Edition, 1974).

In short, the testing for the Wishbone Hill Project consisted of excavating a borehole or well into the material to be tested, backfilling with coarse gravel brought onsite from Palmer to stabilize the hole and running water from Moose Creek at a constant head into the hole through the test apparatus while measuring flow rate.

This test procedure was conducted at seven locations within the areas of the proposed Wishbone Hill facilities. Test locations are shown on the field exploration program map (Plate H-1).

In general, the depth interval tested ranged from about 2 to 2 1/2 ft within an 8 to 12 inch diameter hole. Most of the tests were conducted in the coarser foundation materials which are prevalent onsite, sand to sandy gravel. One test (Test No. 6) was conducted within a deposit of silt.

The results of the testing indicate a range of foundation permeabilities of approximately 10^{-2} to 10^{-4} cm/sec. The test results are documented and summarized on the following pages.

TABLE I-1

WELL PERMEAMETER TEST RESULTS

TEST NO.	cm/sec
1	$> 2 \times 10^{-3}$
2	10^{-2}
3	4×10^{-3}
4	2×10^{-3}
5	2×10^{-2}
6	2×10^{-4}
7	2×10^{-2}

See Plate H-1 for test site locations.

INFILTRATION TEST NO. 1

Test Location: Sed Pond 1: Near Test Pit No. 10

Augering Information

Depth Interval	Strata	Notes
0 to 6-12	Topsoil	
6-12 to 18"	Reddish brown silt	

1.	Depth to water table (in) Well dimensions (depths measured from string baseline or other).	NA
2.	Depth to ground surface (in)	9.625"
3.	Depth ot bottom of well (in)	46.0625"
4.	Depth to top of gravel (in)	~10" (est.)
5.	Depth of gravel (3)-(4) (in)	~36"
6.	Depth to water surface in well (in)	~4" (est.)
7.	Depth of water in well, h=(3)-(6) (in)	~42"

Determination of well radius

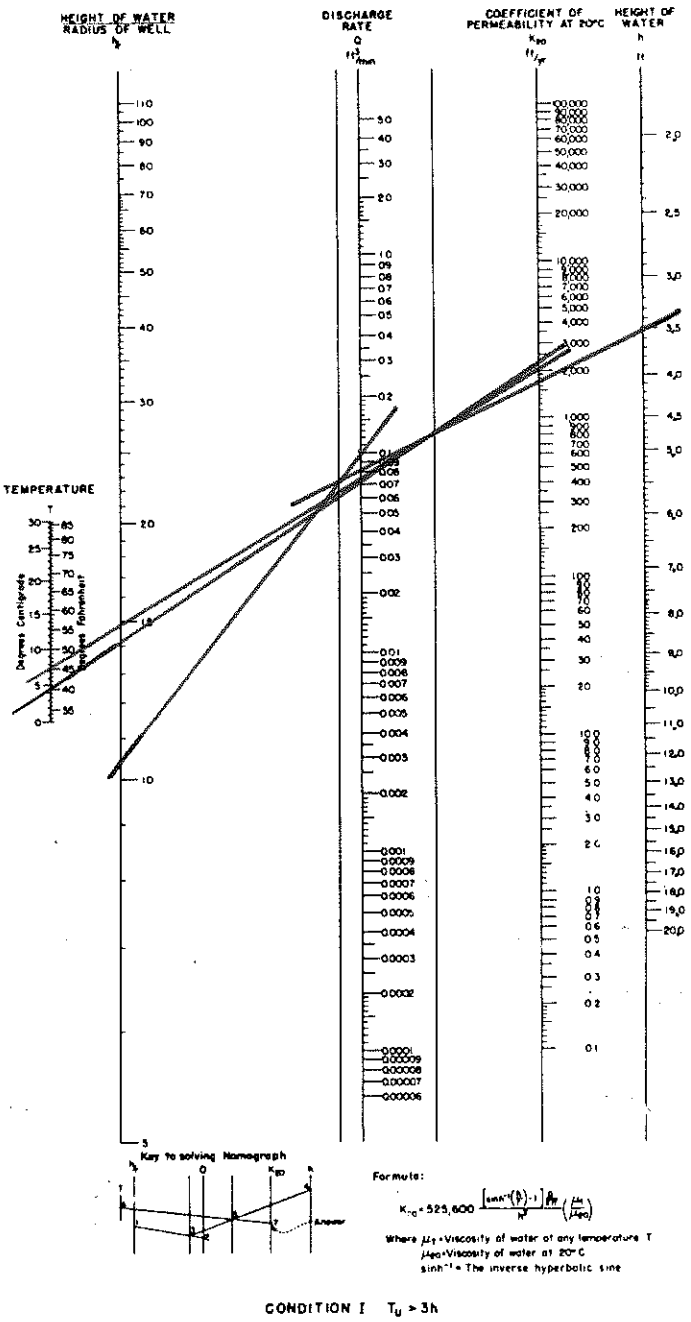
8.	Density of calibrated gravel (pcf)	95
9.	Weight of gravel used to fill well (total weighed out) (LB) 67.52 + 35.31 - 1.72	101.11
10.	Weight of excess gravel (not used) (LB)	---
11.	Weight of gravel actually used (9)-(10) (LB)	101.11
12.	Volume of well (11)÷(8) (cu ft)	1.064
13.	Radius of well. $=\sqrt{\frac{(12)}{(s)\ \pi}}$ (ft)	0.336 ft

INFILTRATION TEST NO. 1 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
4:14:15	0	0.87	0	0.18
:40	0.42	1.05	0.18	0.18
:50	0.58	1.18	0.13	0.31
:15:00	0.75	1.25	0.07	0.38
:10	0.92	1.32	0.07	0.45
:20	1.08	1.42	0.10	0.55
:30	1.25	1.52	0.10	0.65
:16:00	1.75	1.90	0.38	1.03
:20	2.08	2.30	0.40	1.43
:40	2.42	2.75	0.45	1.88
:17:00	2.75	3.16	0.41	2.29
:30	3.25	3.73	0.57	2.86
:18:00	3.75	4.30	0.57	3.43
:30	4.25	4.80	0.50	3.93
:19:00	4.75	5.35	0.55	4.48
:30	5.25	5.90	0.55	5.03
:20:00	5.75	6.30	0.40	5.43
:30	6.25	6.80	0.50	5.93

TEST NO. 1



K = 2,000 ft/year or

2×10^{-3} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974.

Figure 19-6

INFILTRATION TEST NO. 2

Test Location: Slurry Pond-Adjacent to Test Pit No. 5

Augering Information

Depth Interval	Strata	Notes
0 to 31"	1 ft Topsoil Sandy silt, gravel to boulders to 36"	Stripped with dozer
0 ft to 2.5 ft	Gravel to cobbles in a slightly silty sand material	Rough augering - basically at refusal

1.	Depth to water table (in)	NA
	Well dimensions (depths measured from string baseline or other).	
2.	Depth to ground surface (in)	0
3.	Depth ot bottom of well (in)	24-26"
4.	Depth to top of gravel (in)	9"
5.	Depth of gravel (3)-(4) (in)	~ 16"
6.	Depth to water surface in well (in)	~ 3"
7.	Depth of water in well, h=(3)-(6) (in)	~ 22"

Determination of well radius

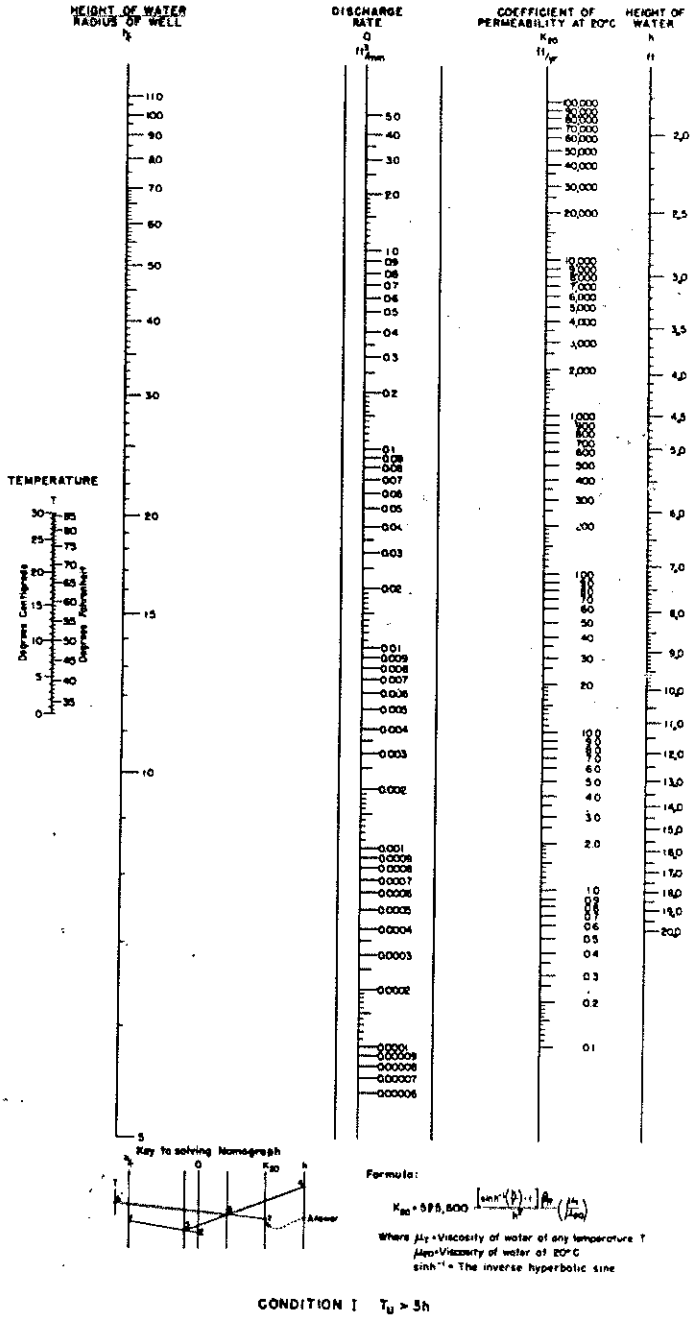
8.	Density of calibrated gravel (pcf)	95
9.	Weight of gravel used to fill well (total weighed out) (LB) 35.84 - 1.71 + 35.97 - 1.72 + 35.75 - 1.7 (?) 67.52 + 35.31 - 1.72	102.43
10.	Weight of excess gravel (not used) (LB)	0
11.	Weight of gravel actually used (9)-(10) (LB)	102.43
12.	Volume of well (11)÷(8) (cu ft)	1.078
13.	Radius of well $= \sqrt{\frac{(12)}{(5)\ \pi}}$ (ft)	0.507 12" (meas.)

INFILTRATION TEST NO. 2 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
11:03	0	0.0	0	0
:10	0.17	0.1	0.1	0.1
:20	0.33	0.17	0.07	0.17
:30	0.5	.25	0.08	0.25
:40	0.67	.35	0.10	0.35
:50	0.83	.47	0.12	0.47
:04:00	1.0	.6	0.13	0.60
:10	1.17	.68	0.08	.68
:20	1.33	.78	.10	.78
:30	1.5	.9	.12	.9
:40	1.67	1.0	.10	1.0
:05:00	2.0	1.22	.22	1.22
:30	2.5	1.5	.28	1.5
:06:00	3.0	1.7	.2	1.7
:30	3.5	1.9	.2	1.9
:07:00	4.0	2.08	.18	2.08
:30	4.5	2.28	.2	2.28
:08:00	5.0	2.45	.17	2.45
:30	5.5	2.6	.15	2.6
:09:00	6.0	2.8	.2	2.8
:30	6.5	2.98	.18	2.98
:10:00	7.0	3.12	.14	3.12
:30	7.5	3.3	.18	3.3
:11:00	8.0	3.45	.15	3.45
:30	8.5	3.6	.15	3.6
:12:00	9.0	3.78	.18	3.78
:13:00	10.0	4.1	.32	4.1
:14:00	11.0	4.4	.3	4.4
:15:00	12.5	4.9	.5	4.9
:16:00	13.0	5.05	.15	5.05
:17:00	14.0	5.35	.3	5.35
:19:00	16.0	5.92	.57	5.92
:21:00	18.0	6.35	.43	6.35

TEST NO. 2



h = 1.83 ft
h/r = 3.62
h/r too small for use of figure
From equation:
Assuming UT/U20 = 1.54 for a temperature of 40°F
q = 0.3 cfm
k = 11,519 ft/year or
10^{-2} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

INFILTRATION TEST NO. 3

Test Location: Slurry Pond: Near Test Pit No. 7

Augering Information

Depth Interval	Strata	Notes
0 to 12-18"	Topsoil	
18 to 35"	Boulders/gravel in sandy silt matrix	

R.P. = Rebar Stake: Top @ MNGL

1.	Depth to water table (in)	NA
	Well dimensions (depths measured from string baseline or other).	
2.	Depth to ground surface (in)	35"
3.	Depth ot bottom of well (in)	65.25"
4.	Depth to top of gravel (in)	41.25"
5.	Depth of gravel (3)-(4) (in)	24"
6.	Depth to water surface in well (in)	35.25" (est.)
7.	Depth of water in well, h=(3)-(6) (in)	30"

Determination of well radius

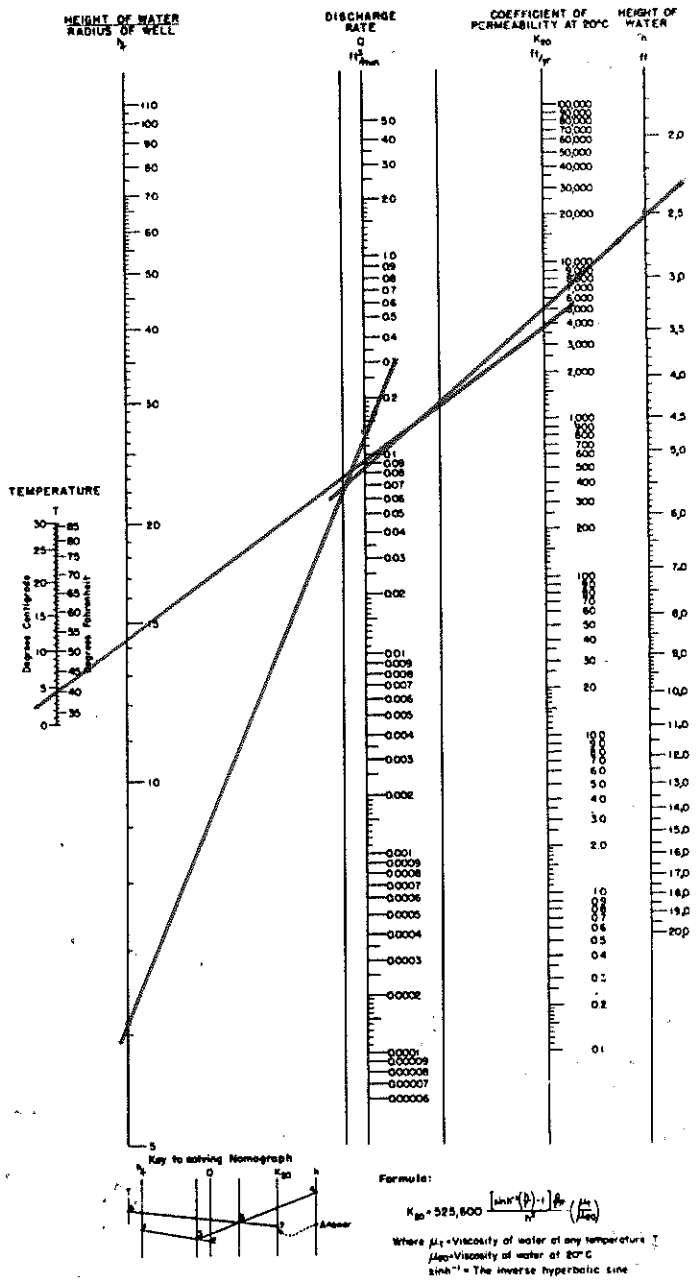
8.	Density of calibrated gravel (pcf)	96.4
9.	Weight of gravel used to fill well (total weighed out) (LB) 67.52 + 35.31 - 1.72	102.54
10.	Weight of excess gravel (not used) (LB)	---
11.	Weight of gravel actually used (9)-(10) (LB)	102.54
12.	Volume of well (11)÷(8) (cu ft)	1.064
13.	Radius of well $= \sqrt{\frac{(12)}{(5)\ \pi}}$ (ft)	0.411 9" (meas.)

INFILTRATION TEST NO. 3 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
2:05:00	0.00			
:10	0.17			
:20	.39			
:30	.60			
:40	.80			
Stop water flowing out of hole				
Restart				
2:08:30	0	1.00	0	0
:40	0.17	1.05	.05	.05
:50	0.33	1.10	.05	.10
:09:00	0.50	1.15	.05	.15
:10	0.67	1.22	.07	.22
:30	1.0	1.35	.13	.35
:10:00	1.5	1.48	.13	.48
:30	2.0	1.55	.07	.55
:11:00	2.5	1.63	.08	.63
:30	3.0	1.72	.09	.72
:12:20	3.83	1.85	.13	.85
:13:00	4.5	1.95	.10	.95
:14:00	5.5	2.13	.18	1.13
:15:00	6.5	2.28	.15	1.28
:16:00	7.5	2.42	.14	1.42
:18:00	9.5	2.71	.29	1.71
:20:00	11.5	3.00	.29	2.00
:22:00	13.5	3.27	.27	2.27
:24:00	15.5	3.52	.25	2.52
:26:00	17.5	3.80	.28	2.80
:28:00	19.5	4.08	.28	3.08
:30:00	21.5	4.30	.22	3.30
:35:00	26.5	4.87	.57	3.87
:40:00	31.5	5.58	.71	4.58
:45:00	36.5	6.2	.62	5.2
:48:30	40.0	6.6	.4	5.6

TEST NO. 3



h/r = 6.1
q = 0.13 cfm
k = 4,000 ft/year or
10^{-3} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

INFILTRATION TEST NO. 4

Test Location: Sed Pond 2B, Near Test Pit No. 15

Augering Information

Depth Interval	Strata	Notes
0 to 12"	Topsoil	
12 to 35"	Reddish brown silt	
35 to 60"	Gray brown sand	
≥ 60"	Cobbles	

R.P. = Rebar @ NGL

1.	Depth to water table (in) Well dimensions (depths measured from string baseline or other).	NA
2.	Depth to ground surface (in)	35.25"
3.	Depth ot bottom of well (in)	66.00"
4.	Depth to top of gravel (in)	44" (est.)
5.	Depth of gravel (3)-(4) (in)	22"
6.	Depth to water surface in well (in)	38" (est.)
7.	Depth of water in well, h=(3)-(6) (in)	28"

Determination of well radius

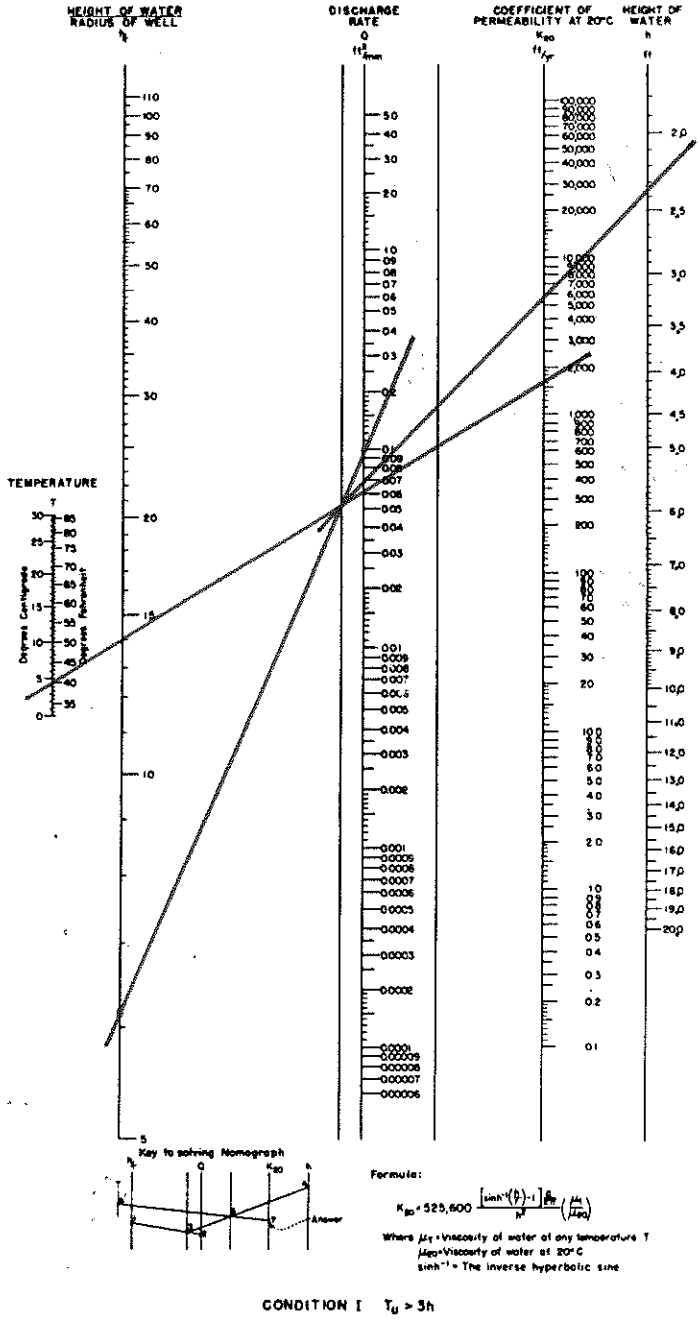
8.	Density of calibrated gravel (pcf)	96
9.	Weight of gravel used to fill well (total weighed out) (LB) 36.00 - 1.72 + 35.73 - 1.72 + 35.85 - 1.72 + 35.39 - 1.72	136.09
10.	Weight of excess gravel (not used) (LB) 23.72 - 1.7 + 35.39 - 1.72	55.69
11.	Weight of gravel actually used (9)-(10) (LB)	80.4
12.	Volume of well (11)÷(8) (cu ft)	0.8375
13.	Radius of well $= \sqrt{\frac{(12)}{(s)\ \pi}}$ (ft)	0.381 8" (meas.)

INFILTRATION TEST NO. 4 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
6:39:30	0	0.00	0	0
:40	0.17	0.15	0.15	0.15
:50	0.33	0.35	0.2	.35
:40:00	0.5	0.60	.25	.6
:10	0.67	0.70	.1	.7
:20	0.83	0.75	.05	.75
:30	1.10	0.8	.05	.8
:41:00	1.5	0.85	.05	.85
:30	2.0	0.93	.08	.93
:42:00	2.5	1.00	.07	1.0
:30	3.0	1.07	.07	1.07
:43:00	3.5	1.12	.05	1.12
:44:00	4.5	1.23	.11	1.23
:45:00	5.5	1.35	.12	1.35
:46:00	6.5	1.47	.12	1.47
:48:00	8.5	1.67	.2	1.67
:50:00	10.5	1.85	.18	1.85
:55:00	15.5	2.38	.53	2.83
7:00:00	20.5	2.87	.49	2.87
:05:00	25.5	3.37	.5	3.37
:10:00	30.5	3.88	.51	3.88
:15:00	35.5	4.37	.49	4.37
:20:00	40.5	4.89	.52	4.89
:25:00	45.5	5.35	.46	5.35
:30:00	50.5	5.83	.48	5.83

TEST NO. 4



h = 2.33
h/r = 6.12
q = 0.10 cfm
k = 1,700 ft/year
2×10^{-3} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

INFILTRATION TEST NO. 5

Test Location: Sed Pond 2A: Near Test Pit No. 13

Augering Information

Depth Interval	Strata	Notes
0 to 12"	Topsoil	
12 to 45"	Reddish brown silt	
46 to 63"	Cobbles to boulders in silty sand matrix	Mostly hand dig

R.P. = Rebar = 6" below NGL

1.	Depth to water table (in)	NA
	Well dimensions (depths measured from string baseline or other).	
2.	Depth to ground surface (in)	45.75"
3.	Depth ot bottom of well (in)	63.5"
4.	Depth to top of gravel (in)	48.1875"
5.	Depth of gravel (3)-(4) (in)	15.3125"
6.	Depth to water surface in well (in)	39.75" (est.)
7.	Depth of water in well, h=(3)-(6) (in)	23.75"

Determination of well radius

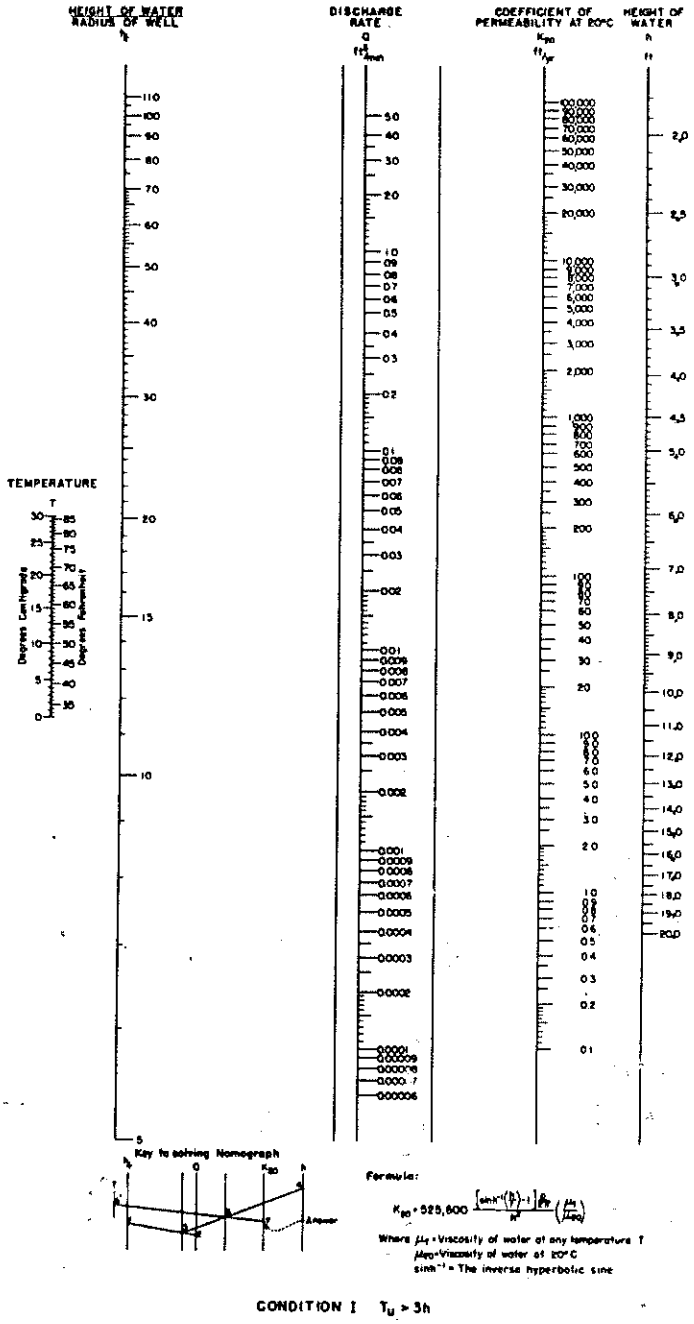
8.	Density of calibrated gravel (pcf)	101.6
9.	Weight of gravel used to fill well (total weighed out) (LB)	136.55
10.	Weight of excess gravel (not used) (LB)	0
11.	Weight of gravel actually used (9)-(10) (LB)	136.55
12.	Volume of well (11)÷(8) (cu ft)	1.343
13.	Radius of well $= \sqrt{\frac{(12)}{(s)\ \pi}}$ (ft)	0.5789 14" (meas.) V. irregular

INFILTRATION TEST NO. 5 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
11:34:00	0	0.0		
Restart - Discharge too slow				
:35:00	0	0.05	0	0
:10	.13	0.17	.12	.12
:20	.33	0.30	.13	.25
:30	.5	0.48	.18	.43
:36:00	1.0	0.90	.42	.85
:30	1.5	1.30	.4	1.25
:37:00	2.0	1.70	.4	1.65
:30	2.5	2.16	.46	2.11
:38:00	3.0	2.57	.41	2.52
:39:00	4.0	3.38	.81	3.33
:40:00	5.0	4.07	.69	4.02
:41:00	6.0	4.85	.78	4.80
:42:00	7.0	5.50	.65	5.45
:43:00	8.0	6.17	.67	6.12
:43:40	8.67	6.6 (end of barrel)	.49	6.55

TEST NO. 5



h = 1.98 ft
h/r = 3.42
h/r too small to use figure
Using equation:
Assuming UT/U20 = 1.54 at a temperature of $40^{o}F$
q = 0.72 cfm
k = 22,323 ft/year
or
2×10^{-2} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

INFILTRATION TEST NO. 6

Test Location: Fresh Water Pond: Near Test Pit No. 9

Augering Information

Depth Interval	Strata	Notes
0 to 12"	Topsoil	
12 to 49"	Silt medium brown to reddish brown	
49 to 76"	SAA but more cobbles to boulders	

R.P. = Rebar = 8" below NGL

1. Depth to water table (in) — NA
   Well dimensions (depths measured from string baseline or other).
2. Depth to ground surface (in) — 41" (from RP)
3. Depth ot bottom of well (in) — 67.375" (from RP)
4. Depth to top of gravel (in) — 49"
5. Depth of gravel (3)-(4) (in) — 18.375"
6. Depth to water surface in well (in) — 43" (est.)
7. Depth of water in well, h=(3)-(6) (in) — 24.375"

Determination of well radius

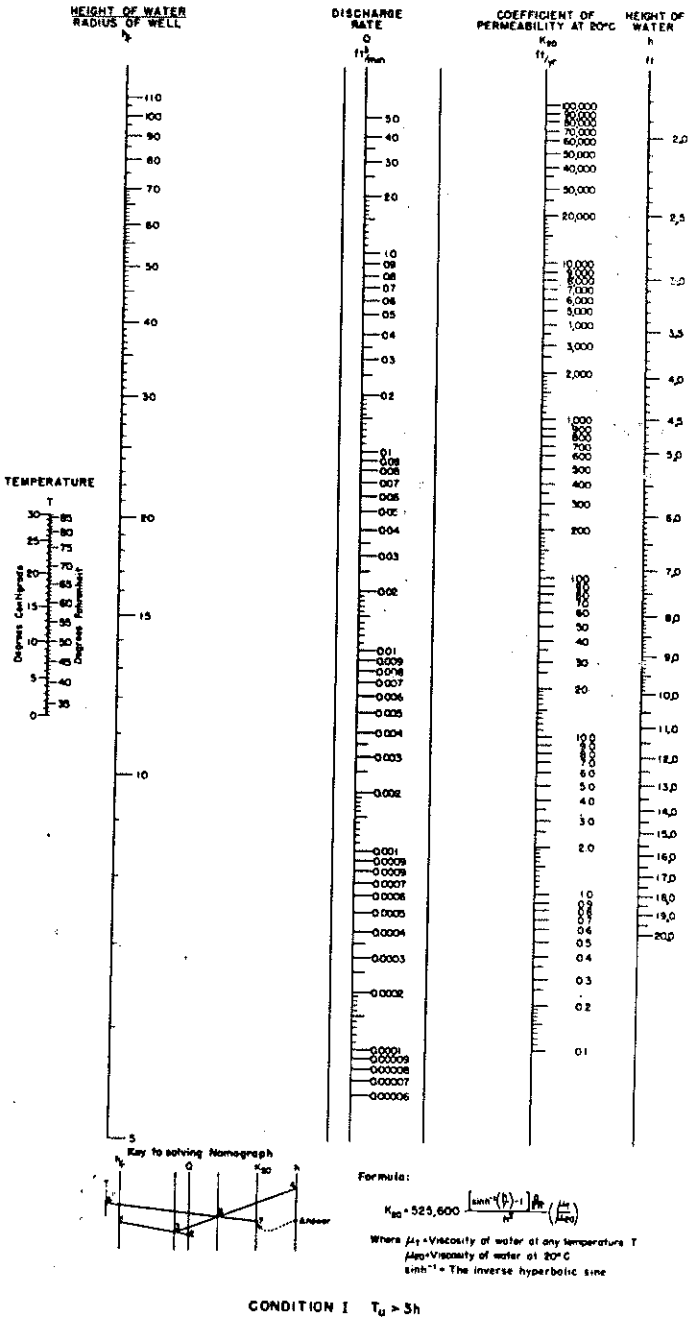
8. Density of calibrated gravel (pcf) — 97.5
9. Weight of gravel used to fill well (total weighed out) (LB) — 136.79
   35.20 - 1.72 + 36.00 - 1.71 + 36.00 - 1.72 + 35.94 - 1.7
10. Weight of excess gravel (not used) (LB) — 34.24
    35.94 - 1.7
11. Weight of gravel actually used (9)-(10) (LB) — 102.55
12. Volume of well (11)÷(8) (cu ft) — 1.052
13. Radius of well $= \sqrt{\frac{(12)}{(s)\ \pi}}$ (ft) — 0.4676
    12" (meas.)

INFILTRATION TEST NO. 6 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
3:15:00	0	0.35	0	0
:20	0.33	0.55	0.2	.2
:30	0.5	0.69	.14	.34
:40	0.67	0.80	.11	.45
:16:00	1.0	1.05	.25	0.70
:30	1.5	1.16	.11	.81
:18:00	3.0	1.22	.06	.87
:20:00	5.0	1.25	.03	.9
:22:00	7.0	1.30	.05	.95
:24:00	9.0	1.34	.04	.99
:29:00	14.0	1.42	.08	1.07
4:26:00	71.0	2.05	.63	1.70
4:42:00	87.0	2.20	.15	1.85
6:45:00	210.0	3.26	1.06	2.91

TEST NO. 6



h = 2.03 ft
h/r = 4.34
h/r is too small to use figure
Using equation:
Assuming UT/U20 = 1.54 at a temperature of 40°F
k = 316 ft/year
or
3×10^{-4} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

INFILTRATION TEST NO. 7

Test Location: Sed Pond No. 4: Near Test Pit No. 18

Augering Information

Depth Interval	Strata	Notes
0 to 6	Topsoil	
6 to 10	Reddish brown silt	
10 to 34	Sand	
≥34	Sandy gravel and cobbles	

R.P. = Rebar = 28" above NGL

1.	Depth to water table (in) Well dimensions (depths measured from string baseline or other).	NA
2.	Depth to ground surface (in)	38" (from RP)
3.	Depth ot bottom of well (in)	67 1/4" (from RP)
4.	Depth to top of gravel (in)	44 3/8" (from RP)
5.	Depth of gravel (3)-(4) (in)	22.875"
6.	Depth to water surface in well (in)	38.375 (est.)
7.	Depth of water in well, h=(3)-(6) (in)	28.875"

Determination of well radius

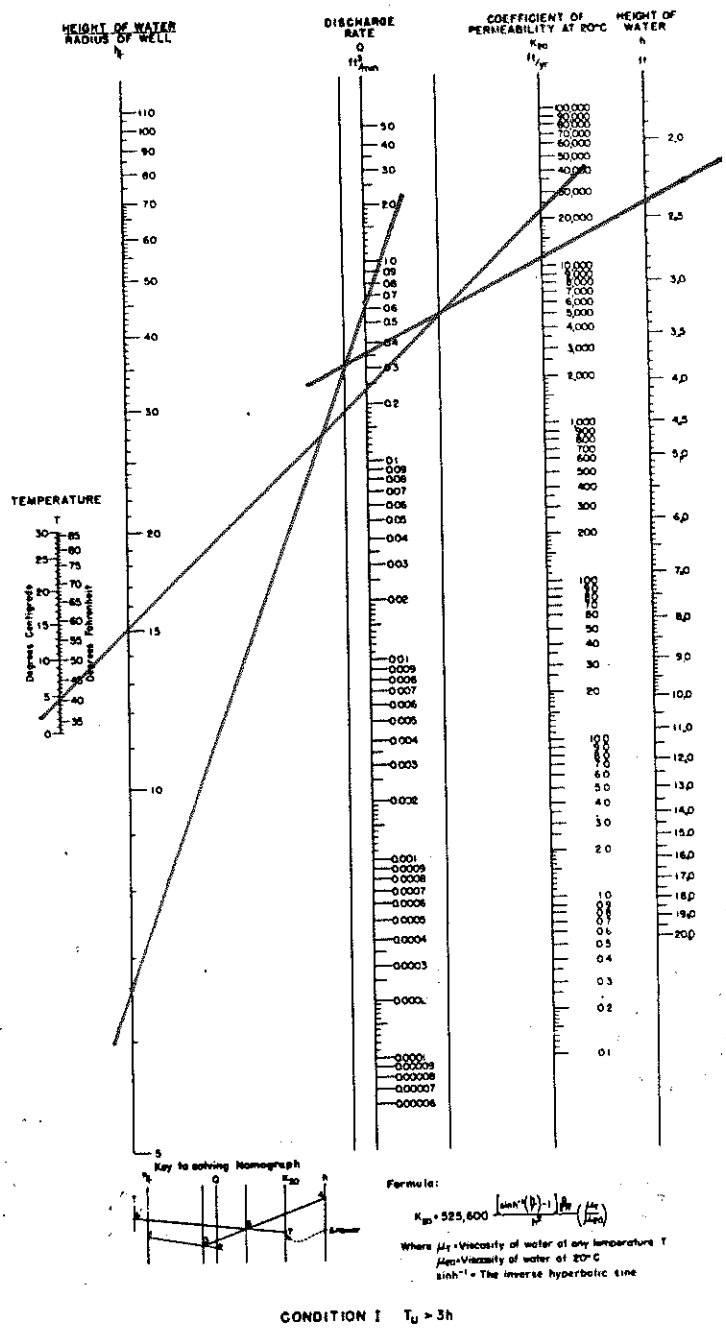
8.	Density of calibrated gravel (pcf)	97.5
9.	Weight of gravel used to fill well (total weighed out) (LB) 36 - 1.7 + 76 - 1.7 + 36 - 1.7 + 36 - 1.7	137.2
10.	Weight of excess gravel (not used) (LB) 36 - 1.7 + 28.03 - 1.7	60.63
11.	Weight of gravel actually used (9)-(10) (LB)	76.57
12.	Volume of well (11)÷(8) (cu ft)	0.785
13.	Radius of well $= \sqrt{\frac{(12)}{(5)\ \pi}}$ (ft)	0.362 7 1/2" (meas.)

INFILTRATION TEST NO. 7 (Con't)

Infiltration Test Readings

Time		Water Volume		
Clock	Accum (min.)	Reading (cu ft)	Difference (cu ft)	Accum (cu ft)
7:37:30	0	0.0	0	0
:40	.17	.18	.18	.18
:50	.33	0.4	.22	.4
:38:00	0.5	0.6	.2	.6
:30	1.0	1.2 stop test	.6	1.2
Restart				
:39:30	0	1.2		
:45	.25	1.5	.3	.3
:40:20	.83	1.9	.4	.7
:30	1.0	2.0	.1	.8
:50	1.33	2.2	.2	1.0
:41:00	1.5	2.3	.1	1.1
:30	2.0	2.55	.25	1.35
:42:00	2.5	2.84	.29	1.64
:30	3.0	3.10	.26	1.90
:43:00	3.5	3.38	.28	2.18
:30	4.0	3.68	.3	2.48
:44:00	4.5	3.95	.27	2.75
:30	5.0	4.24	.29	3.04
:45:00	5.5	4.55	.31	3.35
:30	6.0	4.90	.35	3.70
:46:00	6.5	5.35	.45	4.15
:30	7.0	5.65	.2	4.35
:47:00	7.5	6.04	.39	4.74
:30	8.0	6.38	.34	5.08
:48:00	8.5	6.6	EMPTY .22	5.30

TEST NO. 7



h = 2.4
h/r = 6.65
q = 0.65 cfm
k = 24,000 ft/year
or
2×10^{-2} cm/sec

Figure from Earth Manual, U.S. Department of the Interior, 1974, Figure 19-6.

APPENDIX J
LABORATORY TESTING OF SITE SOILS

APPENDIX J - LABORATORY TESTING OF SITE SOILS

This Appendix contains the geotechnical lab test results produced for the native soils of the project area. Soils samples were retrieved from backhoe test pits which were excavated as part of the field site investigation program of June 1989 as described in Appendix H.

Grain-size analyses, Atterberg limits testing, and proctor compaction testing were performed on selected samples to characterize the site materials and assess their suitability as construction materials for the proposed facilities.

Table J-1 of this appendix presents a summary of all the lab test results obtained for this program. The subsequent information includes the detailed results including compaction curves and gradation curves.

TABLE J-1.
GEOTECHNICAL LABORATORY TEST RESULTS SUMMARY
NATIVE SITE SUBSOILS

SAMPLE NO.	TEST PIT NO.	LOCATION	SAMPLE INTERVAL FT	MINUS NO. 200 SIEVE %	ATTERBERG LIMITS LL %	PL %	PI %	STANDARD PROCTOR DRY DENSITY PCF	O.M.C. %	CLASSIFICATION USCS
1.0	5	SP	3.5-5	1				134.6	7.2	GW
2.0	18	SED3	3-5	1				122.5	6.8	GW
5.0	7	SP	2-3	76			N/P	77.9	38.5	ML
6.0	1	SED1	3-8	1				132.9	5.7	GP
9.0	15	FWP2	2-3	2				127.9	7.5	GW
10.0	10	SED1	1.5-2.5	79			N/P			ML
11.0	10	SED1	4-6	1						SP
12.0	9	FWP1	2.5-3.5	46						SM
13.0	8	FWP1	6-8	0						SP
14.0	4	SP	4-7	1				129.1	5.5	GW
16.0	11	PD	2.5-7	97	29	20	9			CL
17.0	17	PD	2.5-3.5	43						SC
19.0	15	FWP2	3.5-4.5	2						SP
24.0	5	SP	1-3	80						ML
26.0	4	SP	1.5-2	86			N/P			ML
28.0	1	SED1	2-3	52	31	24	7			ML
30.0	2	WWP	2.5-3.5	2						SP
35.0	14	SED2	2-4.5	83			N/P			ML
39.0	19	BCD	2.5-3.5	75						ML

KEY TO LOCATIONS:

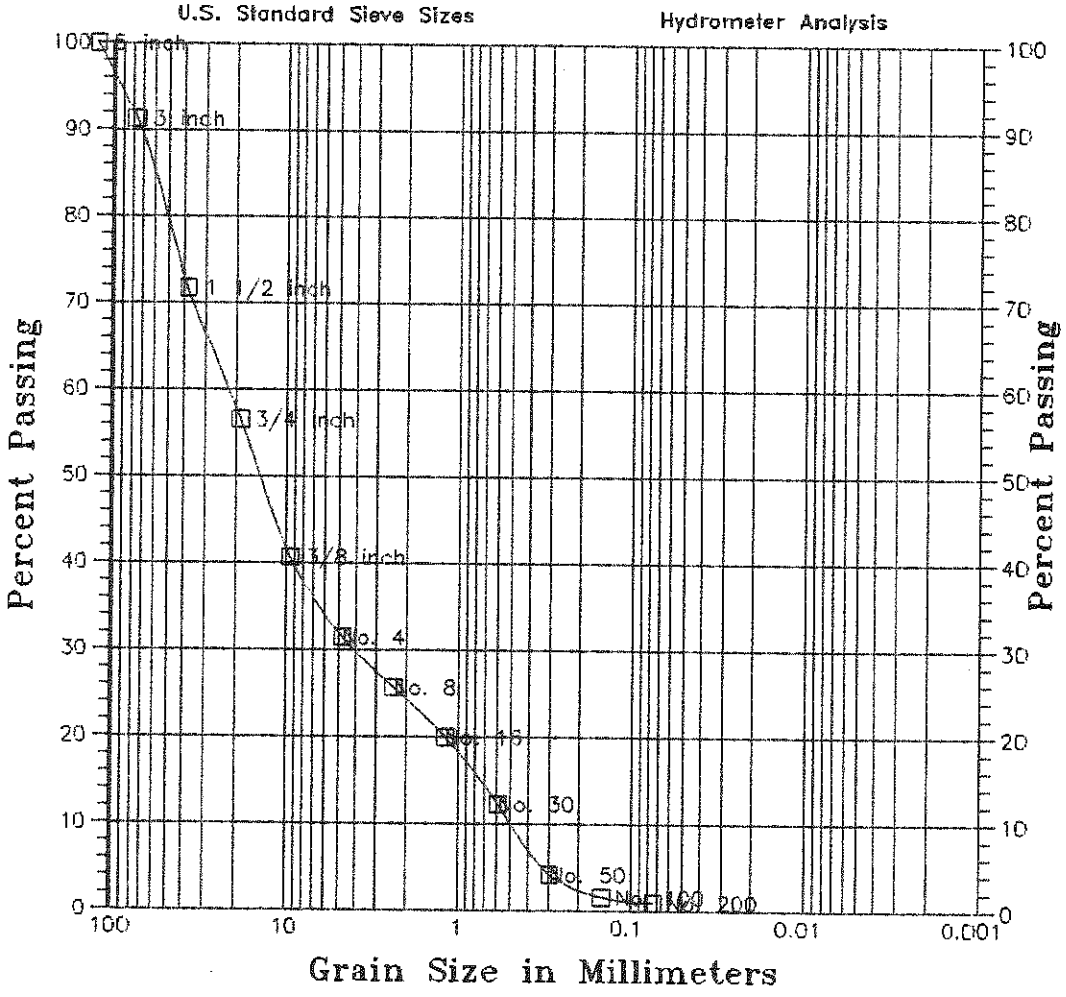
SP SLURRY POND AREA
SED3 SEDIMENT POND NO. 3 AREA
SED1 SEDIMENT POND NO. 1 AREA
FWP2 FRESH WATER POND NO. 2 AREA
FWP1 FRESH WATER POND NO. 1 AREA
PD BUFFALO CREEK PIPELINE DIVERSION ALIGNMENT
WWP WASTE WATER POND AREA
SED2 SEDIMENT POND NO. 2 AREA
BCD BUFFALO CREEK RELOCATION ALIGNMENT

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 5 DEPTH 3.5-5.0ft	SAMPLE NO. 1.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



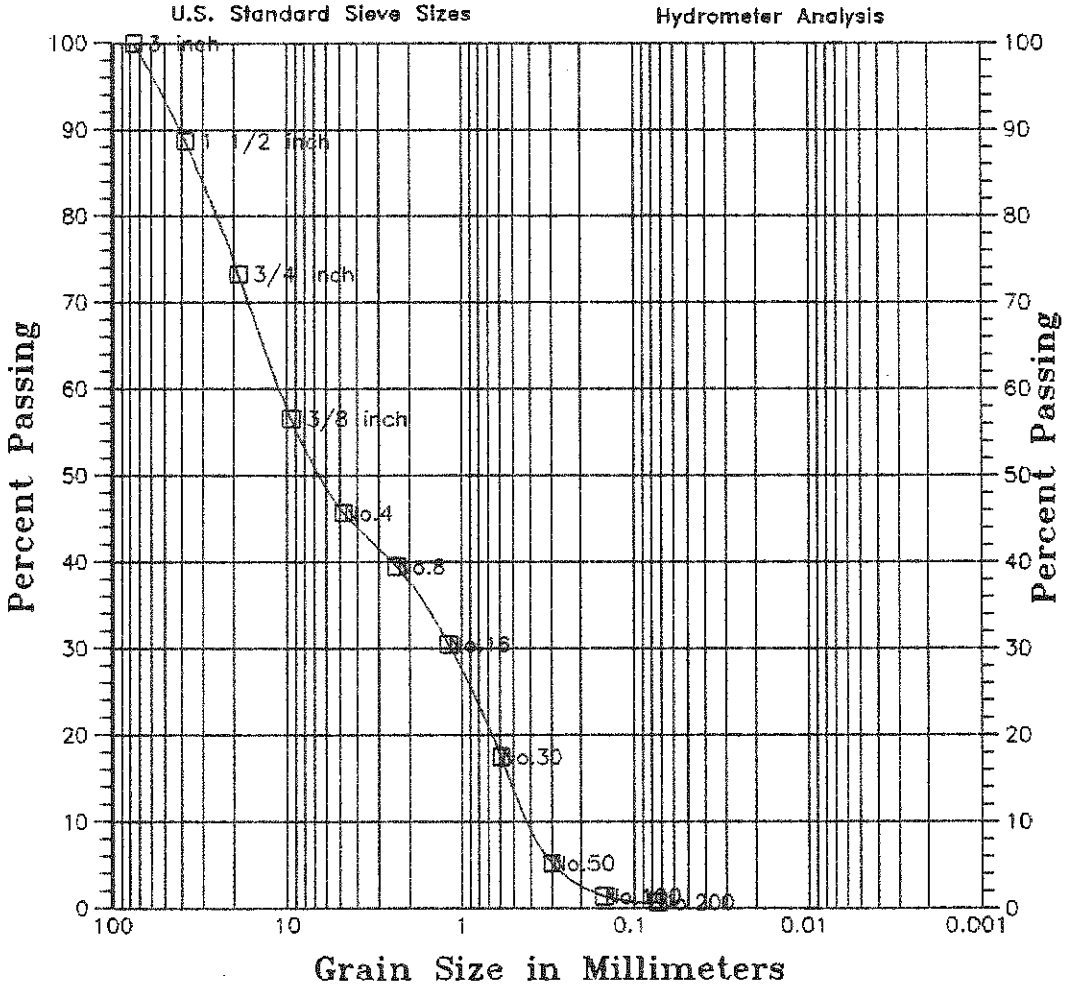
Description - Well Graded Gravel with Sand USCS-GW

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 18 DEPTH 3.0-5.0ft	SAMPLE NO. 2.0 DATE TESTED 7/25/89

GRAIN SIZE ANALYSIS



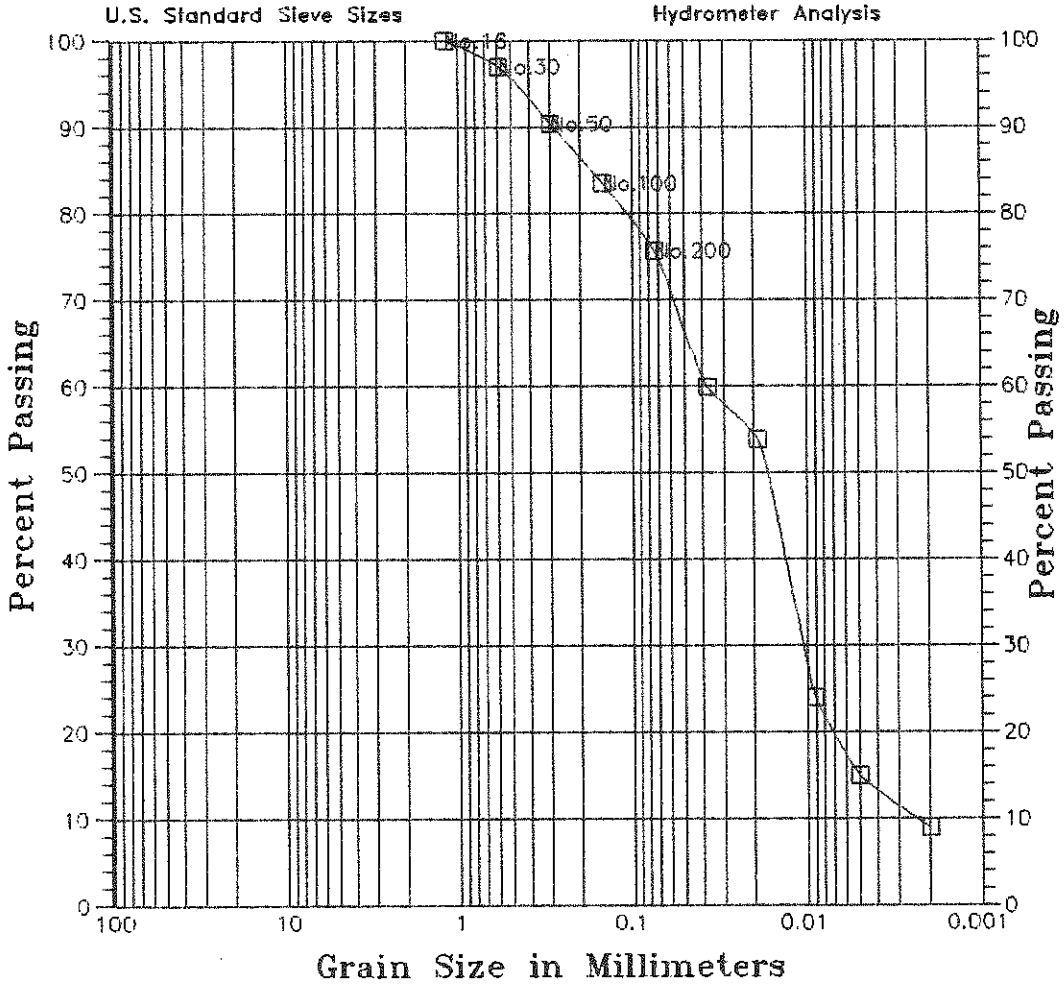
Description - Well Graded Gravel with Sand USCS-GW

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 7 DEPTH 2.0-3.0 ft	SAMPLE NO. 5.0 DATE TESTED 7/25/89

GRAIN SIZE ANALYSIS



Plasticity Index - Non-plastic

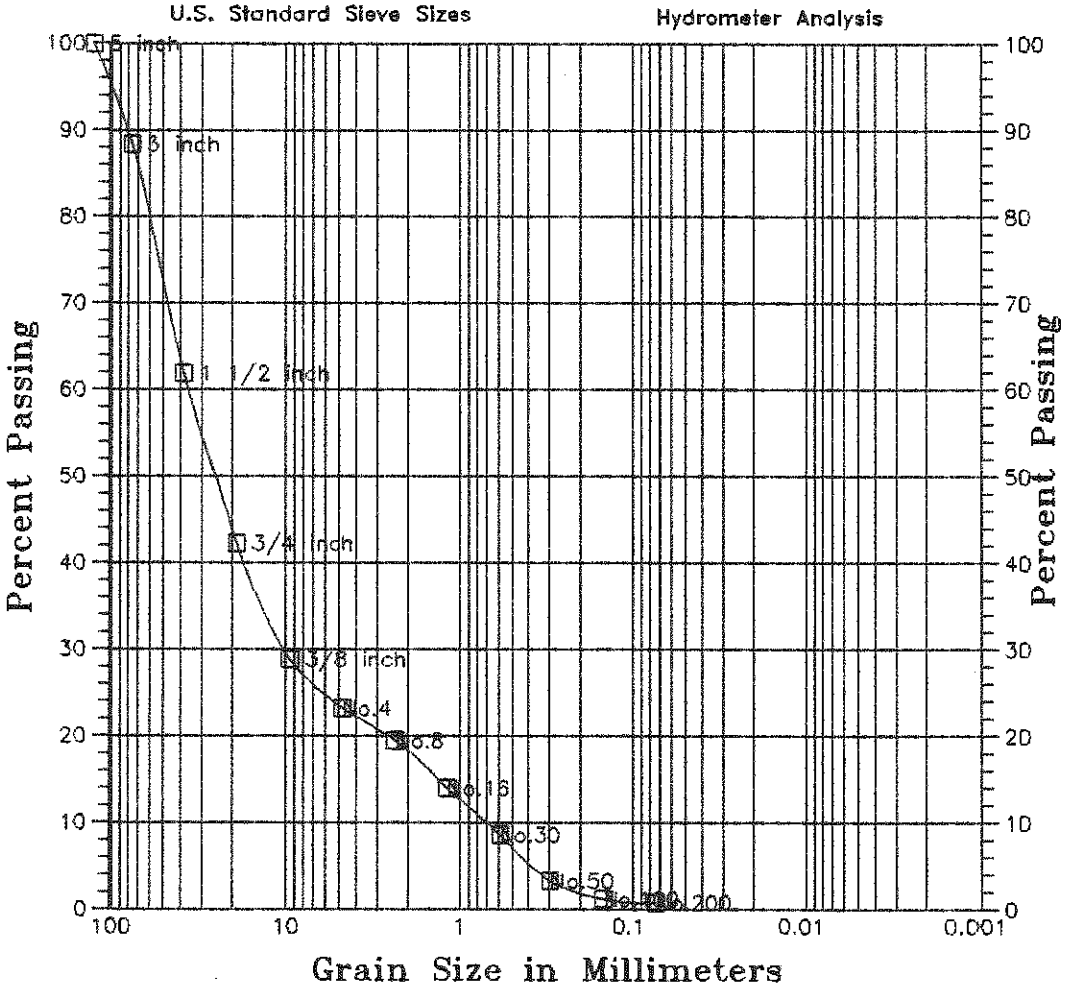
Description - Silt with Sand USCS - ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK-US	LAB NO. 1392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 1 DEPTH 3.0-8.0ft	SAMPLE NO. 6.0 DATE TESTED 7/25/89

GRAIN SIZE ANALYSIS



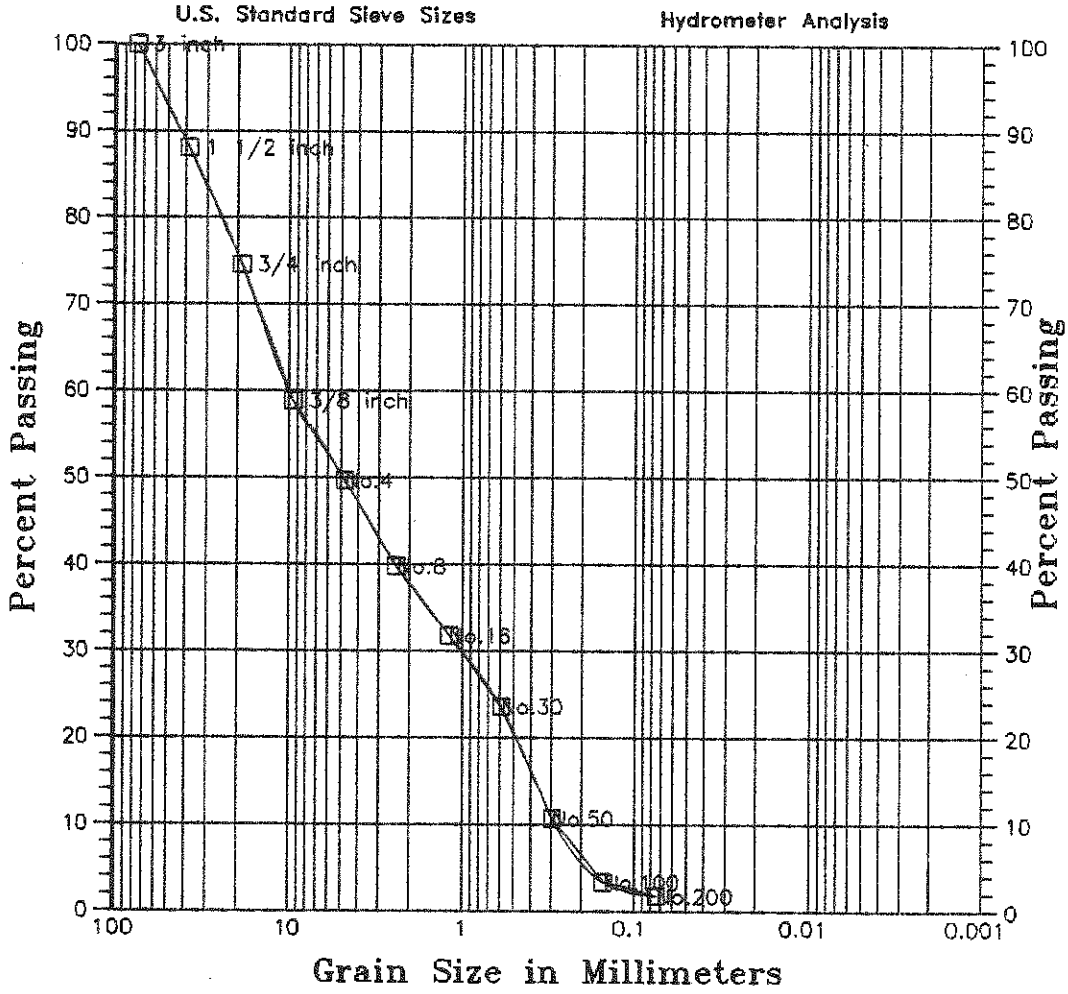
Description - Poorly Graded Gravel With Sand USCS - GP

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK-US	LAB NO. 1392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoil	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 15 DEPTH 2.0-3.0 ft	SAMPLE NO. 9.0 DATE TESTED 7/25/89

GRAIN SIZE ANALYSIS



Description - Well Graded Gravel with Sand USCS-GW

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

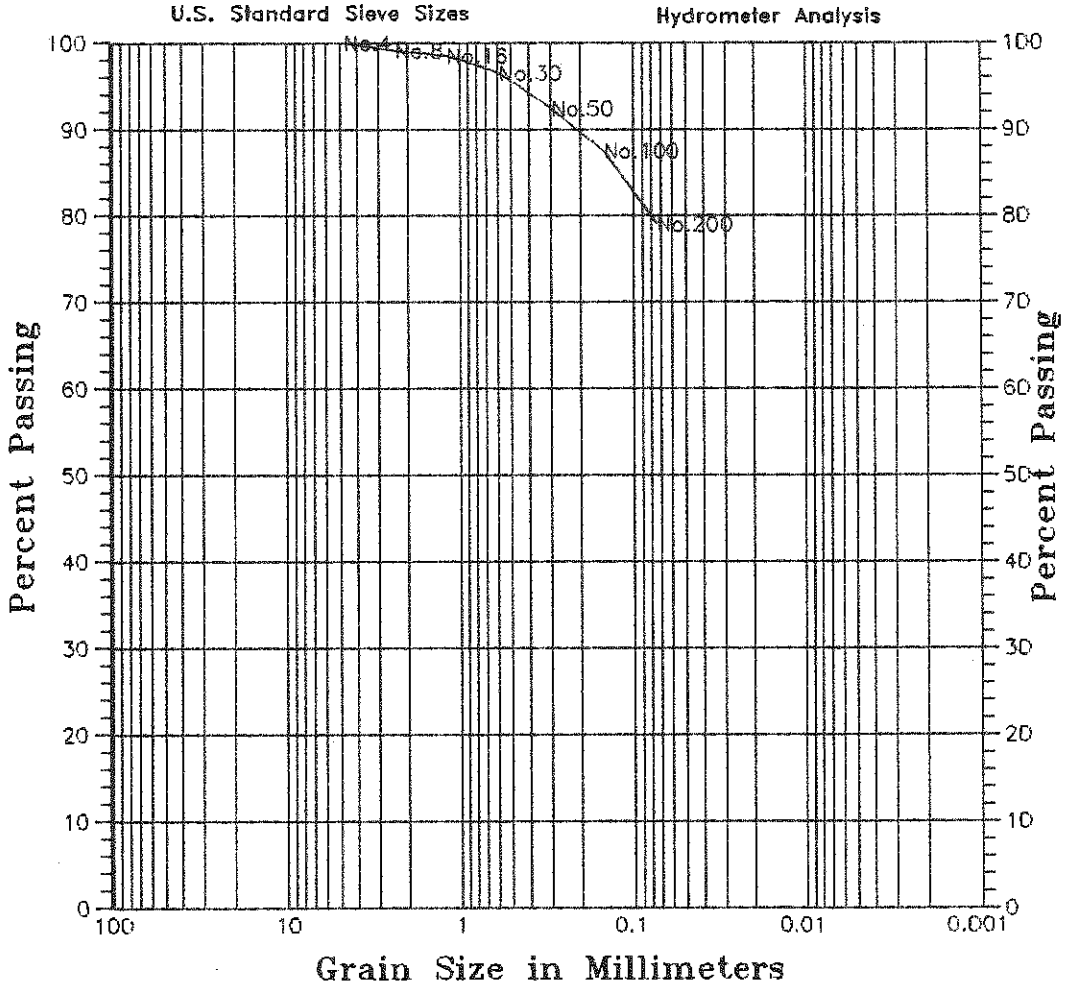
LAB SRK (U.S.),Inc. LAB NO. L-392.0

CLIENT McKinley Mining PROJECT Wishbone Hill

FEATURE Project Area Subsoils PROJECT NO. 17202

BOREHOLE OR TEST PIT NO. 10 DEPTH 1.5-2.5 ft SAMPLE NO. 10.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



Plasticity Index: Non-Plastic

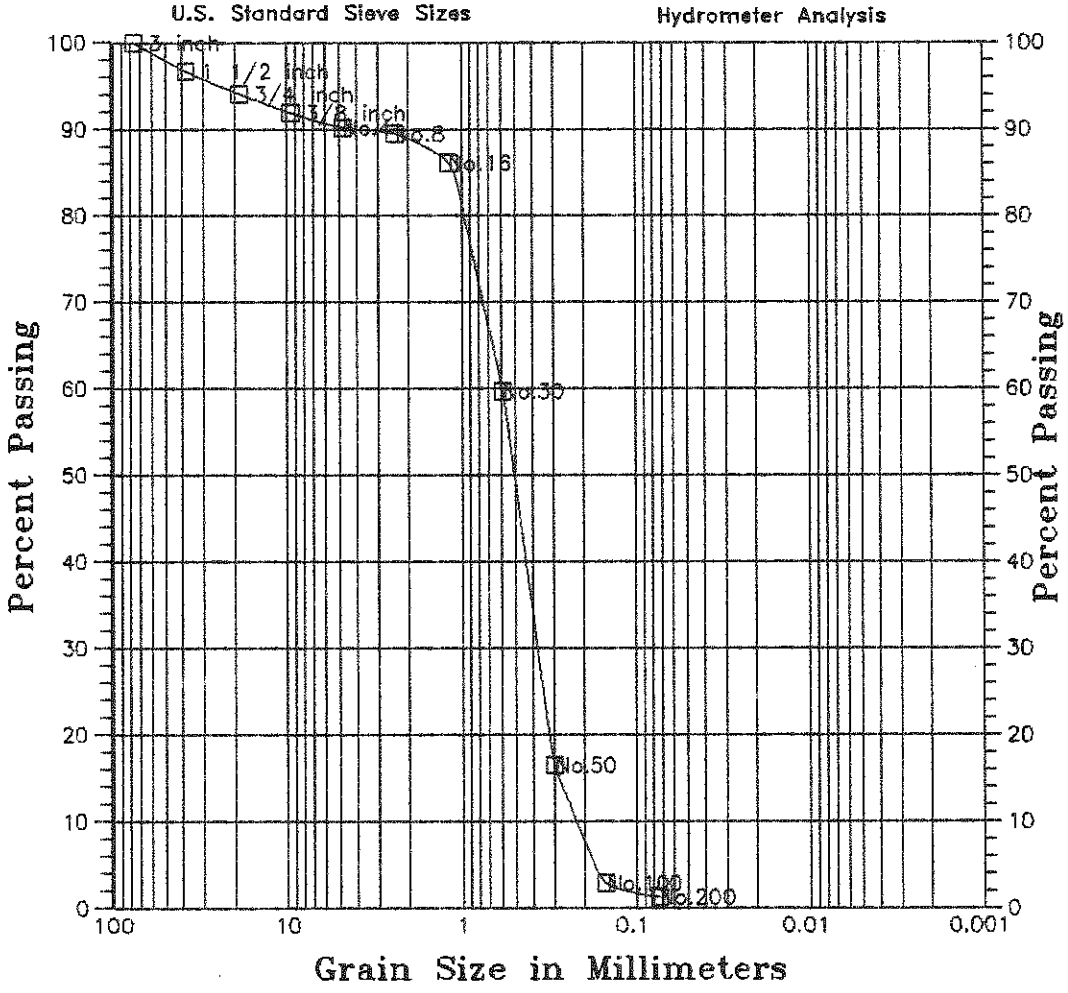
Description: Silt with Sand USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	10	DEPTH	4-6 ft
SAMPLE NO.	11.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



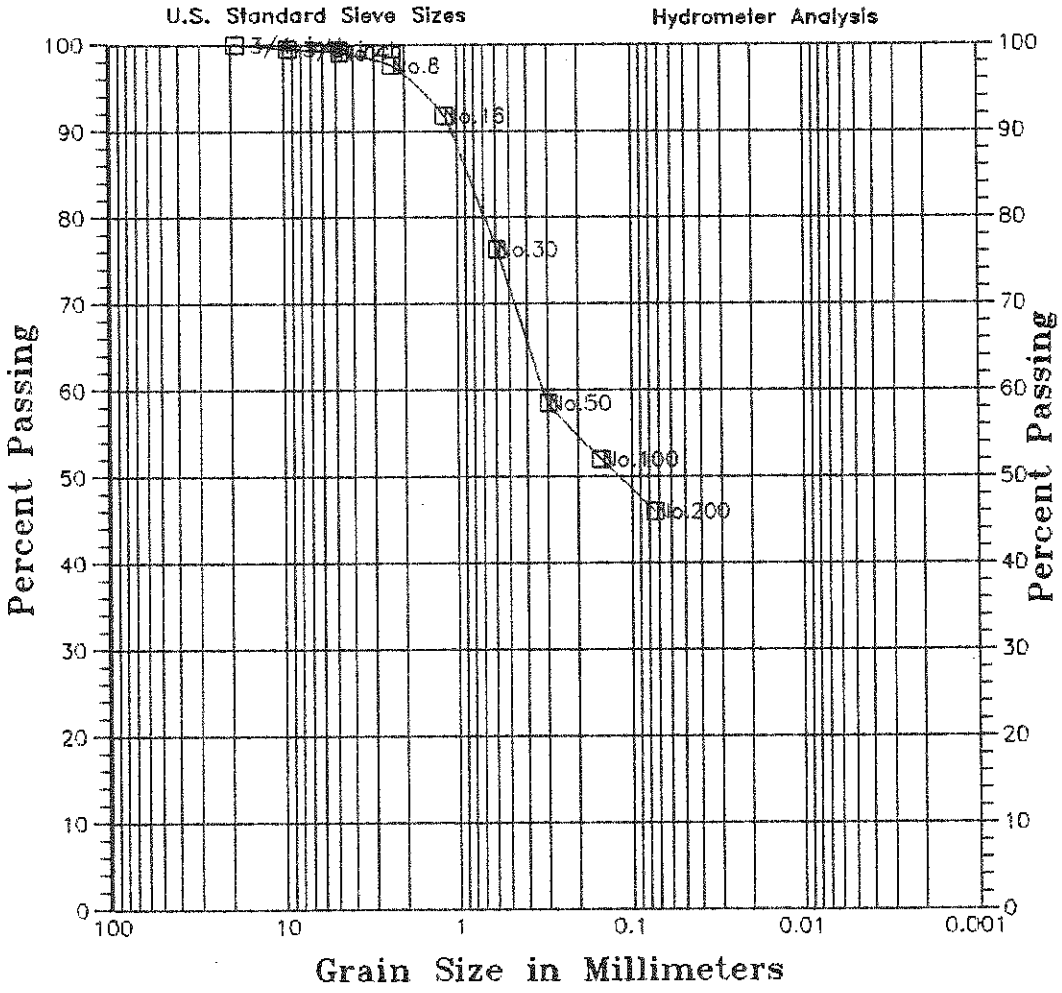
Description: Poorly Graded Sand USCS: SP

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	9	DEPTH	2.5-3.5 ft
SAMPLE NO.	12.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



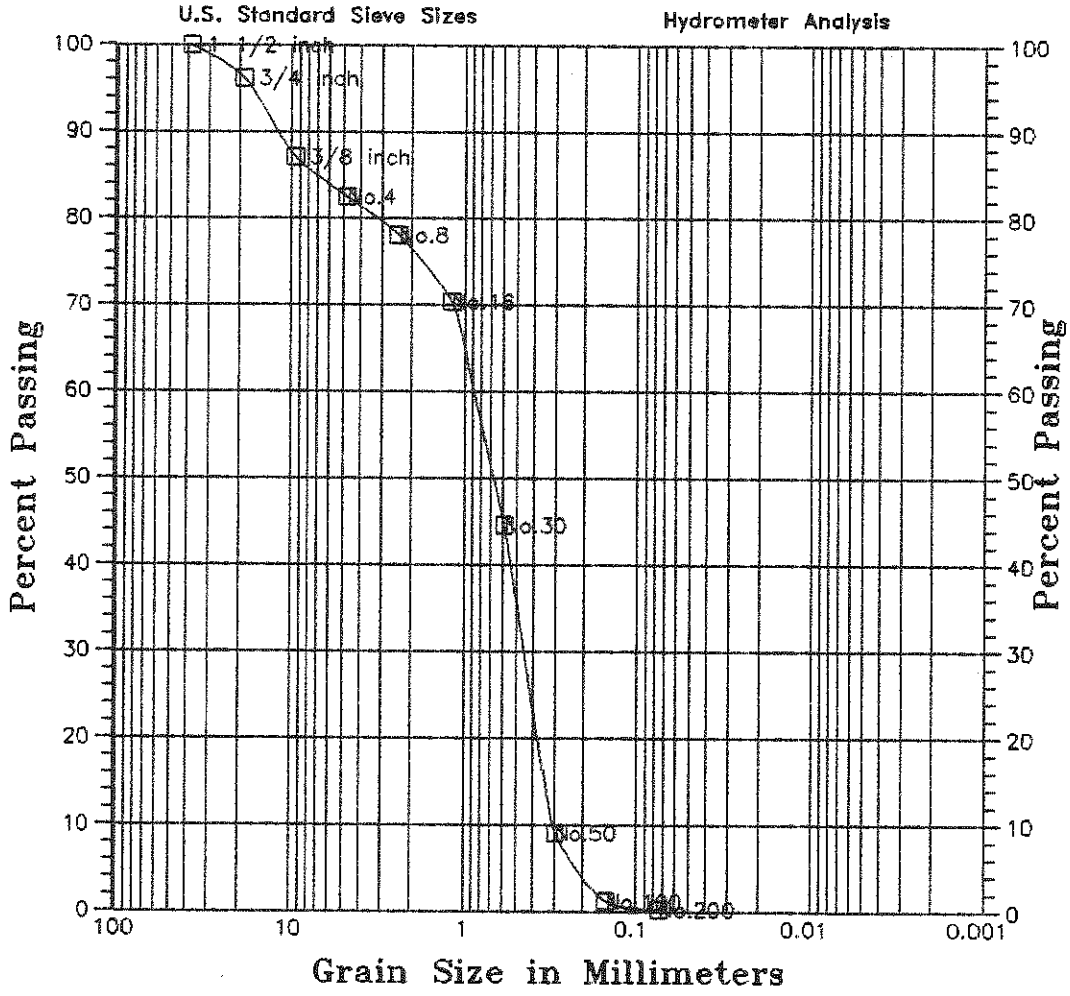
Description: Sand With Silt USCS: SM

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK (U.S.), Inc.	LAB NO. L-392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 8 DEPTH 6-8 ft	SAMPLE NO. 13.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



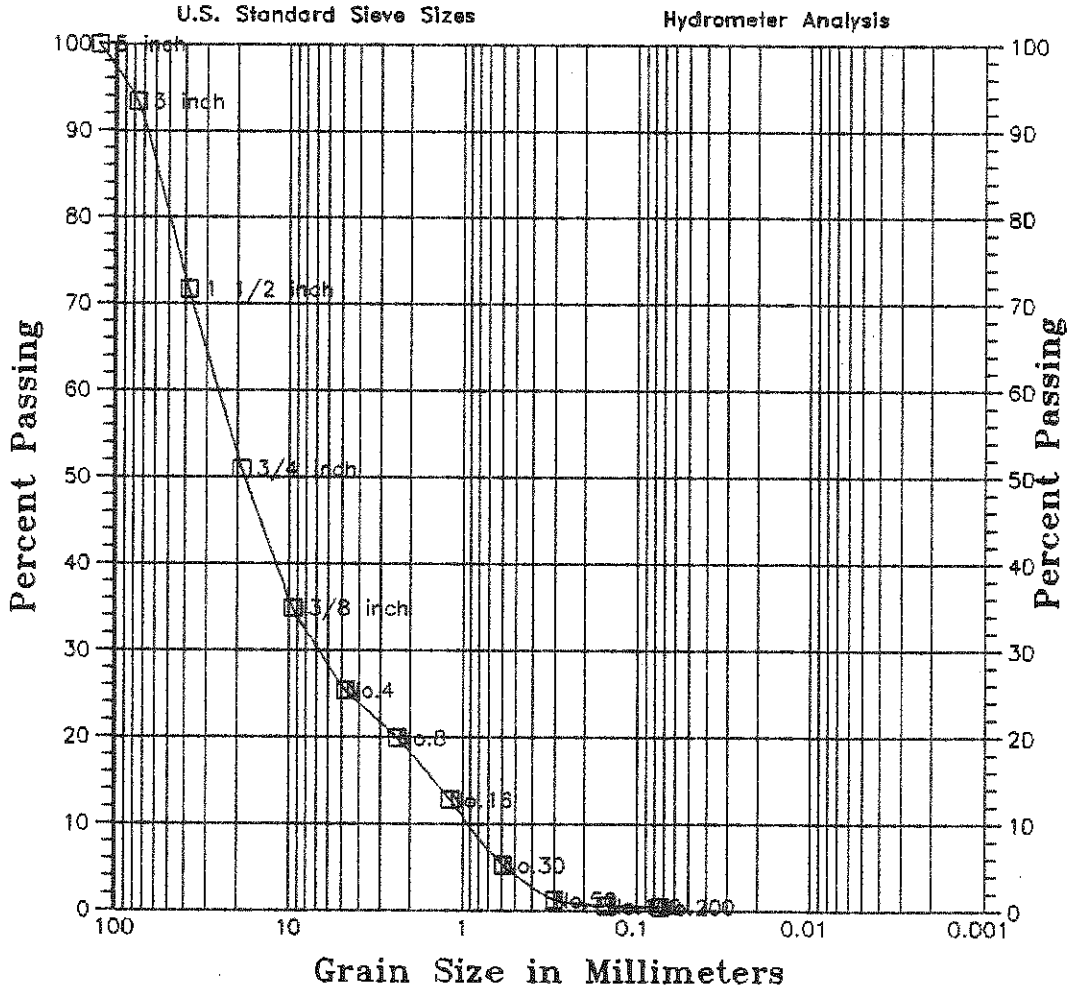
Description: Sand With Gravel USCS: SP

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	4	DEPTH	4-7 ft
SAMPLE NO.	14.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



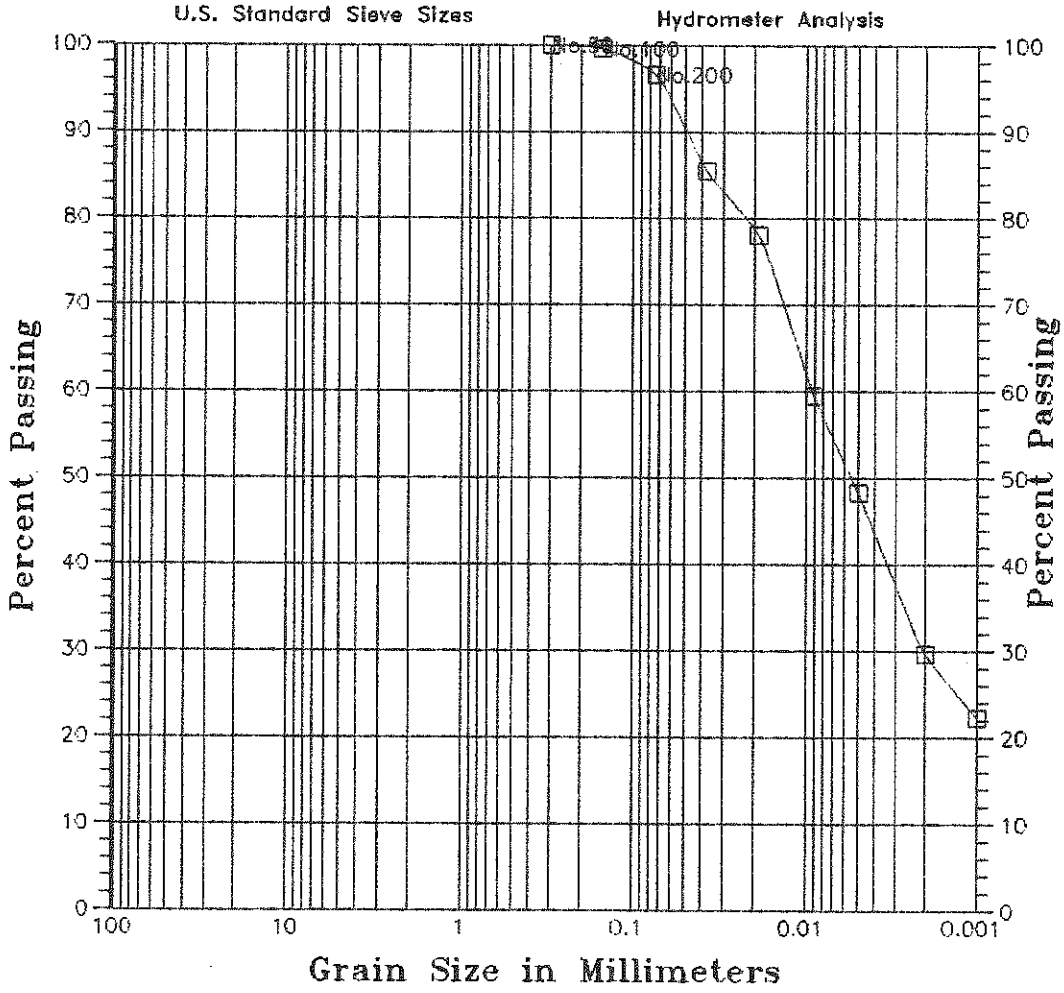
Description: Well graded gravel with sand USCS: GW

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK (U.S.), Inc.	LAB NO. L-392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 11 DEPTH 2.5-7 ft	SAMPLE NO. 16.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



Plasticity Index: 9

Liquid Limit: 29

Description: Lean clay

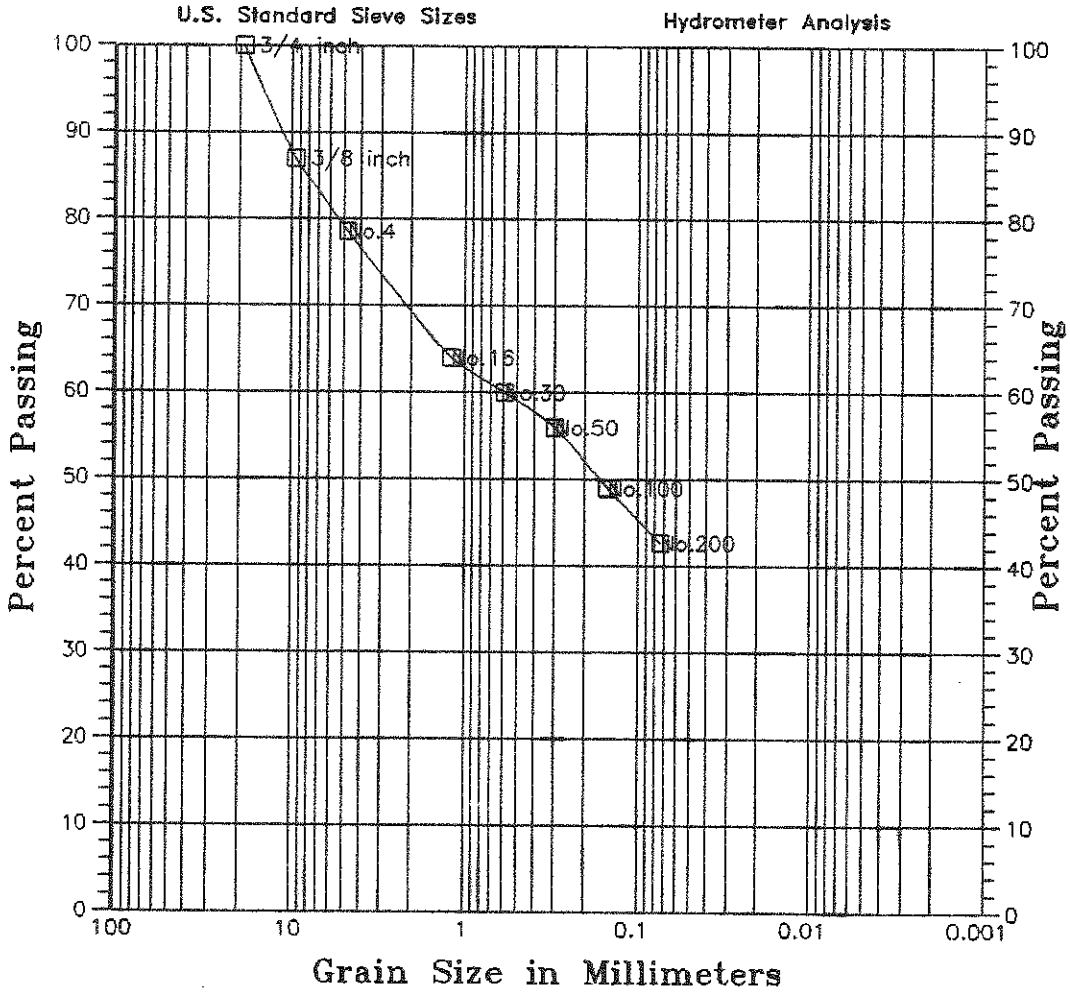
USCS: CL

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	17	DEPTH	2.5-3.5 ft
SAMPLE NO.	17.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



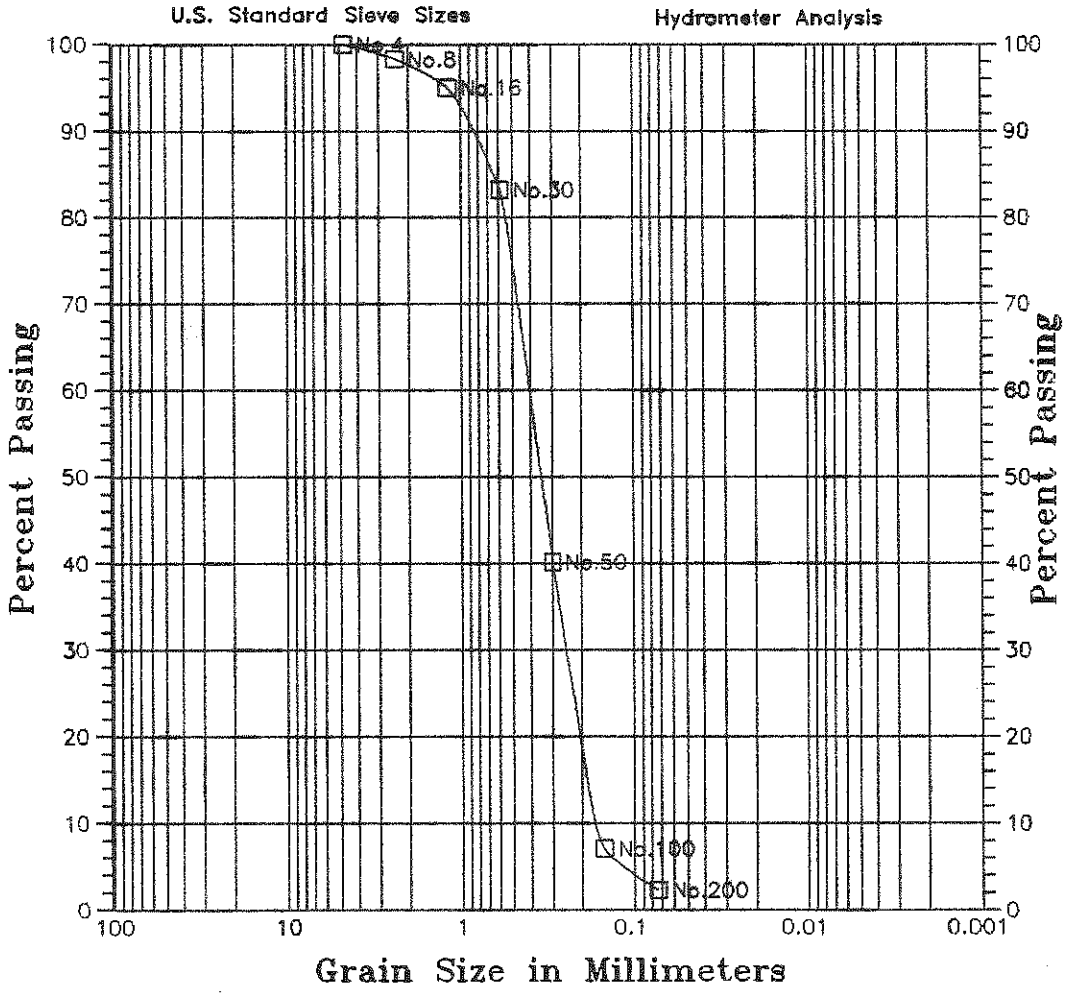
Description: Sand With Gravel and Fines USCS: SM-SC

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO. 15	DEPTH 3.5-4.5 ft	SAMPLE NO. 19.0	DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



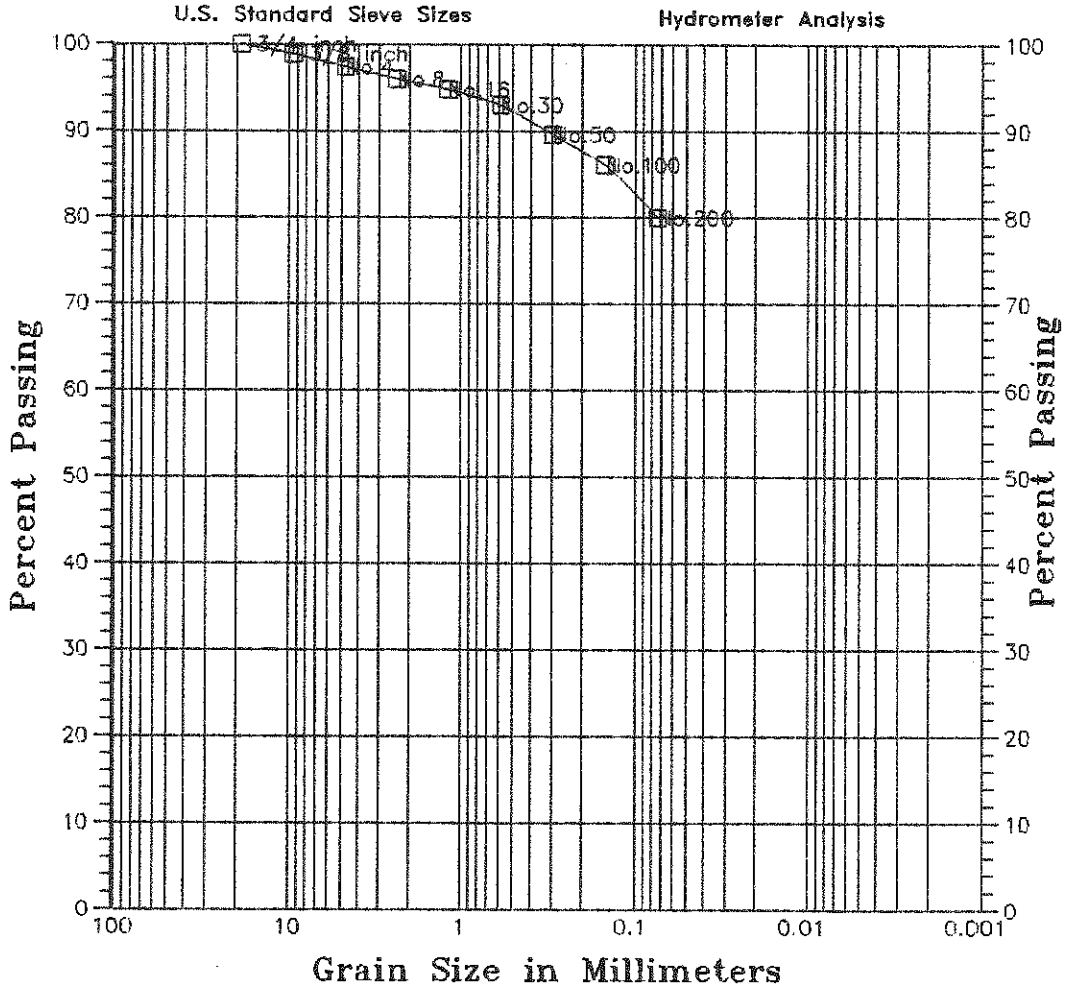
Description: Poorly Graded Sand USCS: SP

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	5	DEPTH	1-3 ft
SAMPLE NO.	24.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



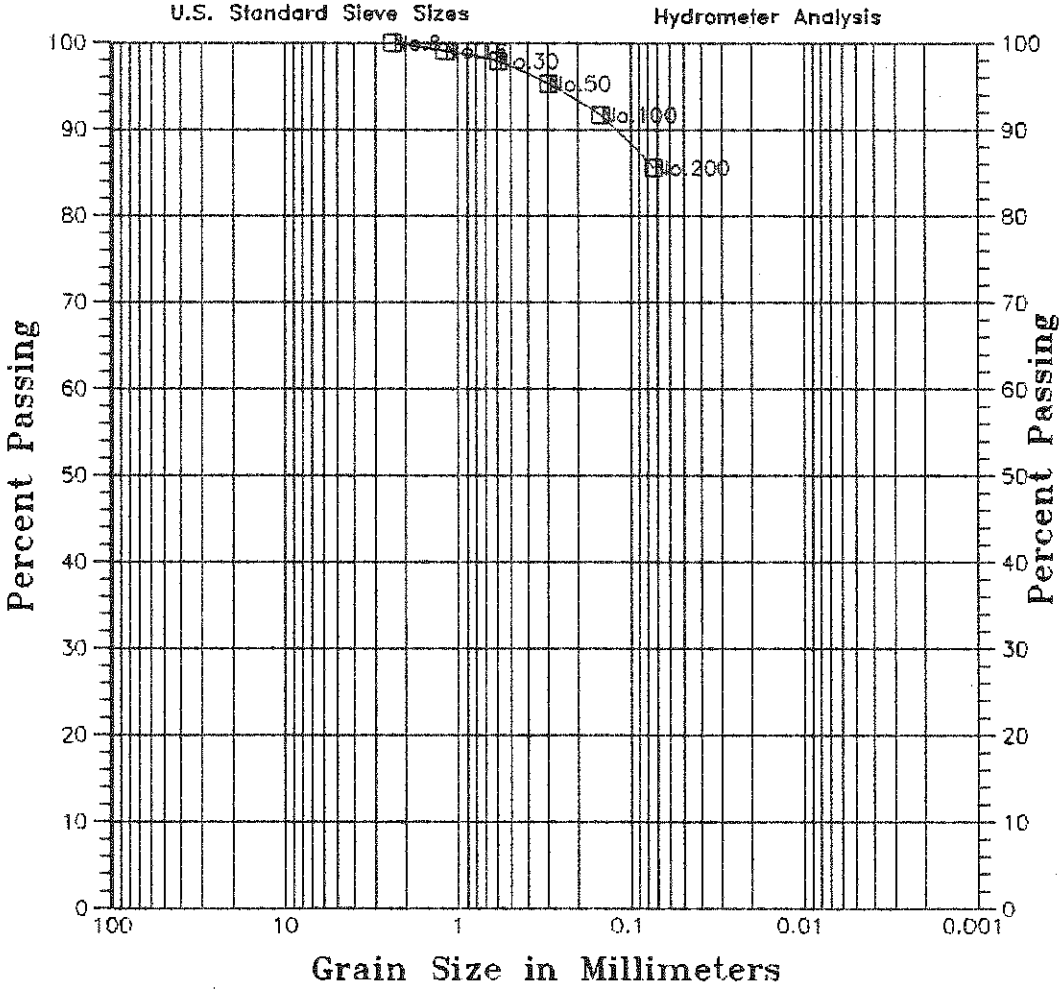
Description: Silt With Sand USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	4	DEPTH	1.5-2 ft
SAMPLE NO.	26.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



Plasticity Index: Non-Plastic

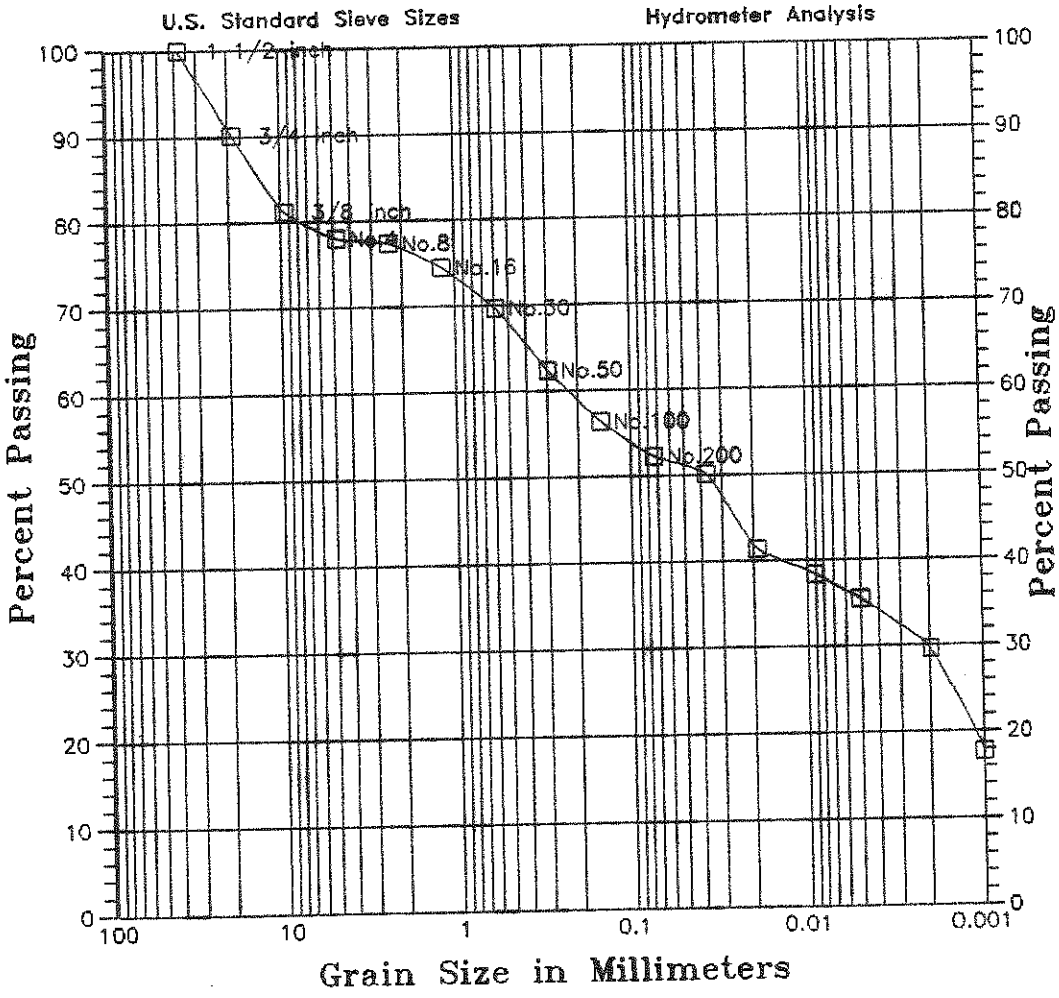
Description: Silt with sand USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK (U.S.), Inc.	LAB NO. L-392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 1 DEPTH 2-3 ft	SAMPLE NO. 28.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



Plasticity Index: 7 Liquid Limit: 31

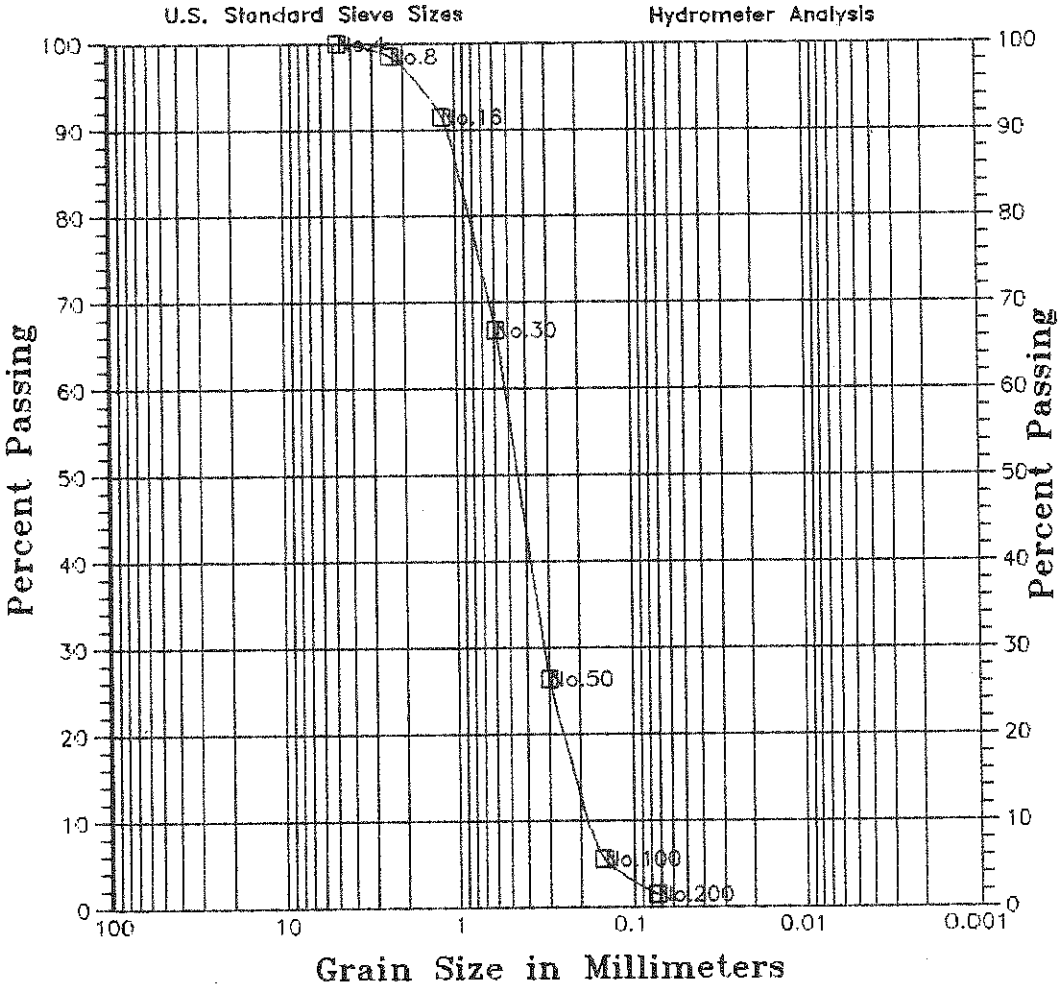
Description: Sandy Clayey Silt With Gravel USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
BOREHOLE OR TEST PIT NO.	2	DEPTH	2.5-3.5 ft
SAMPLE NO.	30.0	DATE TESTED	7-25-89

GRAIN SIZE ANALYSIS



Description: Poorly Graded Sand USCS: SP

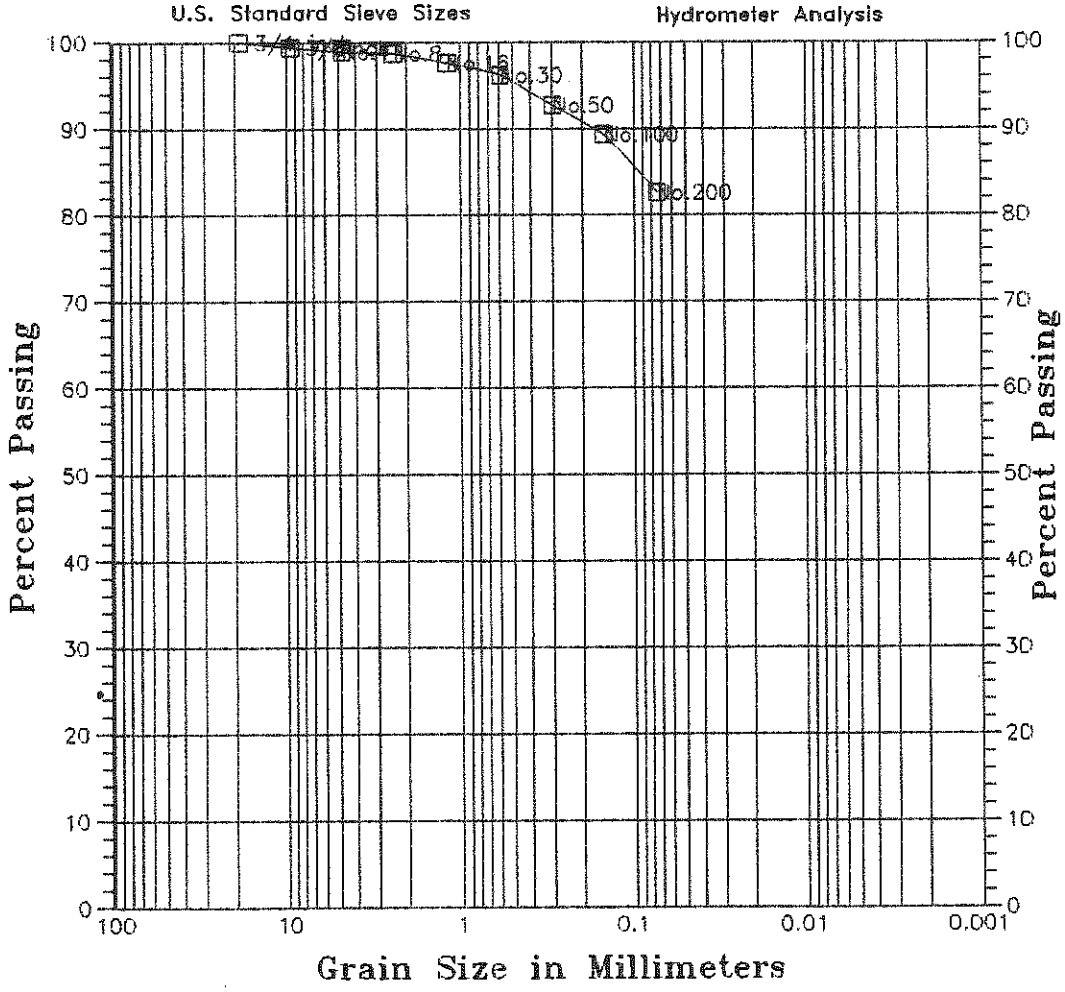
STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB	SRK (U.S.), Inc.	LAB NO.	L-392.0
CLIENT	McKinley Mining	PROJECT	Wishbone Hill
FEATURE	Project Area Subsoils	PROJECT NO.	17202
SAMPLE NO.	35.0	DATE TESTED	7-25-89

BOREHOLE OR TEST PIT NO. 14 DEPTH 2-4.5 ft

GRAIN SIZE ANALYSIS



Plasticity Index: Non-Plastic

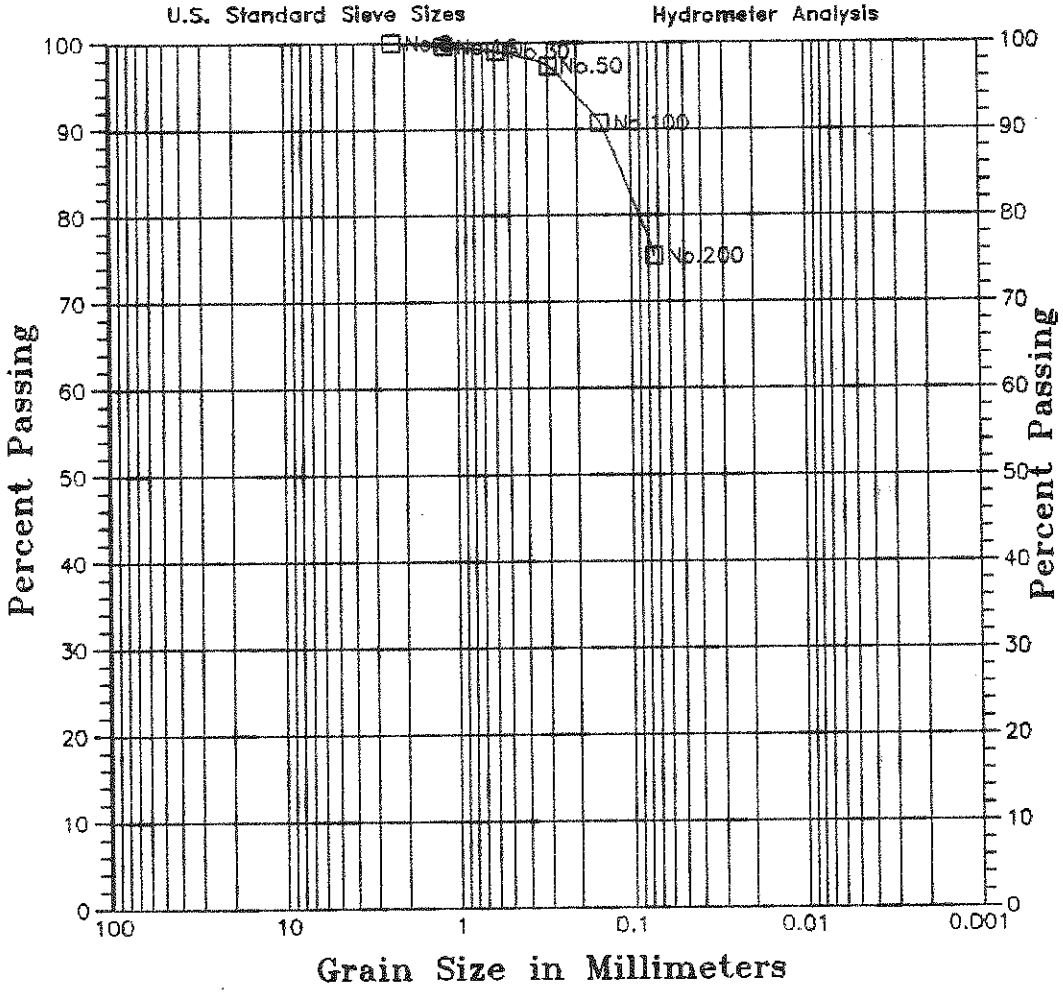
Description: Sandy silt USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK (U.S.), Inc.	LAB NO. L-392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 19 DEPTH 2.5-3.5 ft	SAMPLE NO. 39.0 DATE TESTED 7-25-89

GRAIN SIZE ANALYSIS



Description: Silt with sand

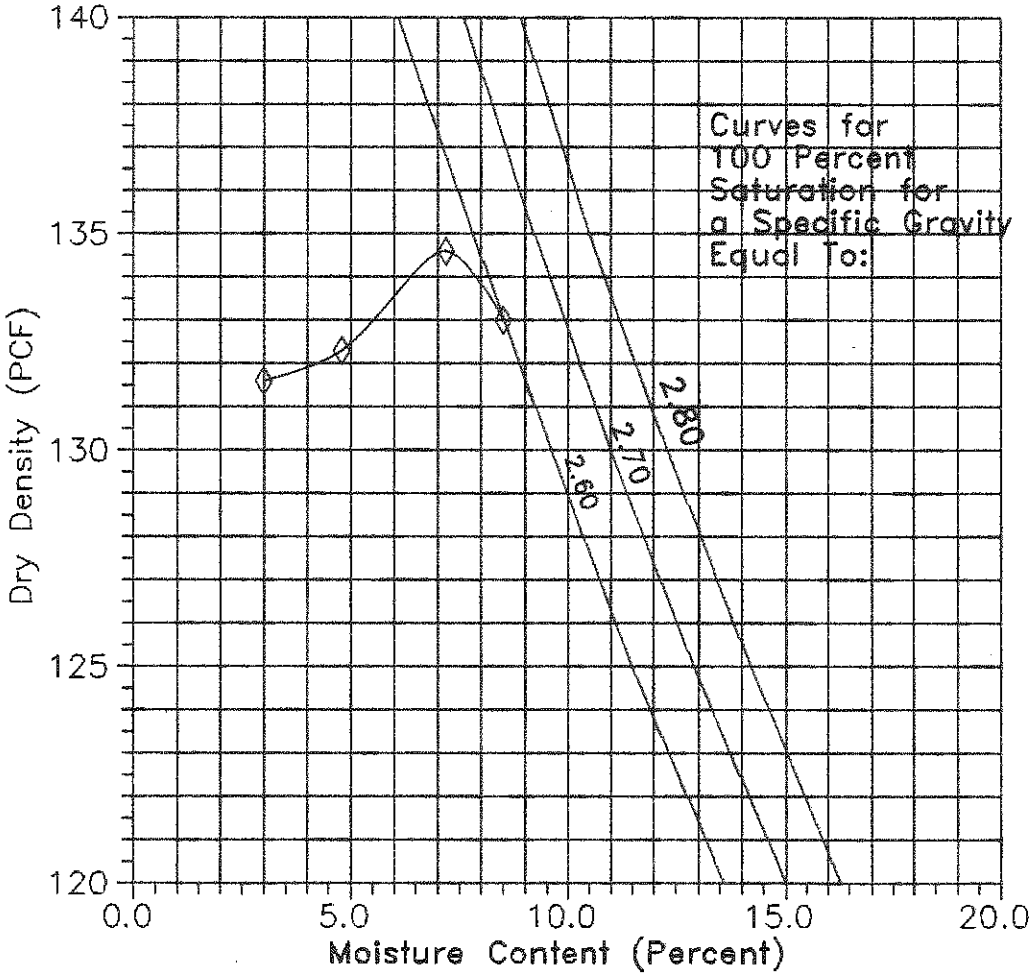
USCS: ML

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 5 DEPTH 3.5-5 ft	SAMPLE NO. 1.0 DATE TESTED 7-18-89

PROCTOR COMPACTION TEST



ASTM D 698-78 Method C

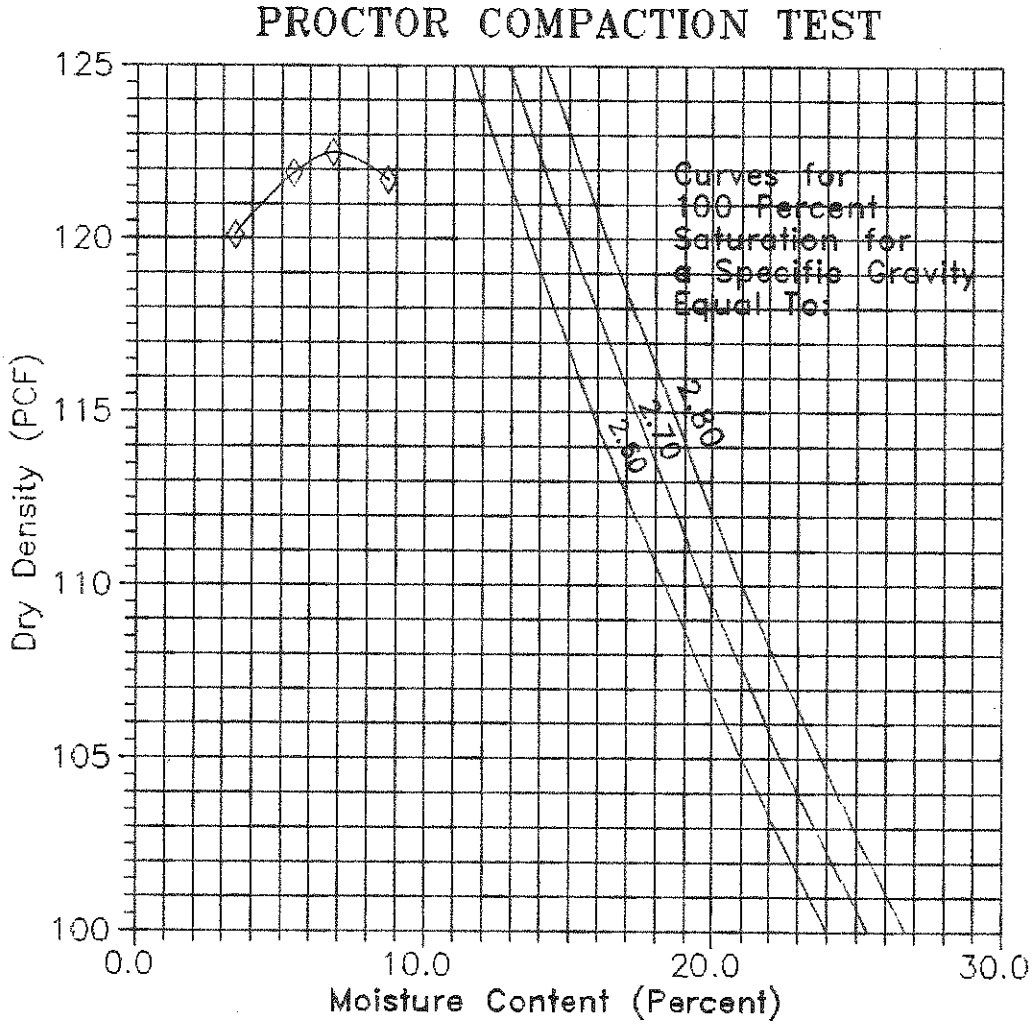
Maximum Dry Density = 134.6 pcf

Optimum Moisture Content = 7.2%

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK-US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 18 DEPTH 3-5 ft	SAMPLE NO. 2.0 DATE TESTED 7-18-89



ASTM D698-78 Method C

Maximum Dry Density = 122.5 pcf

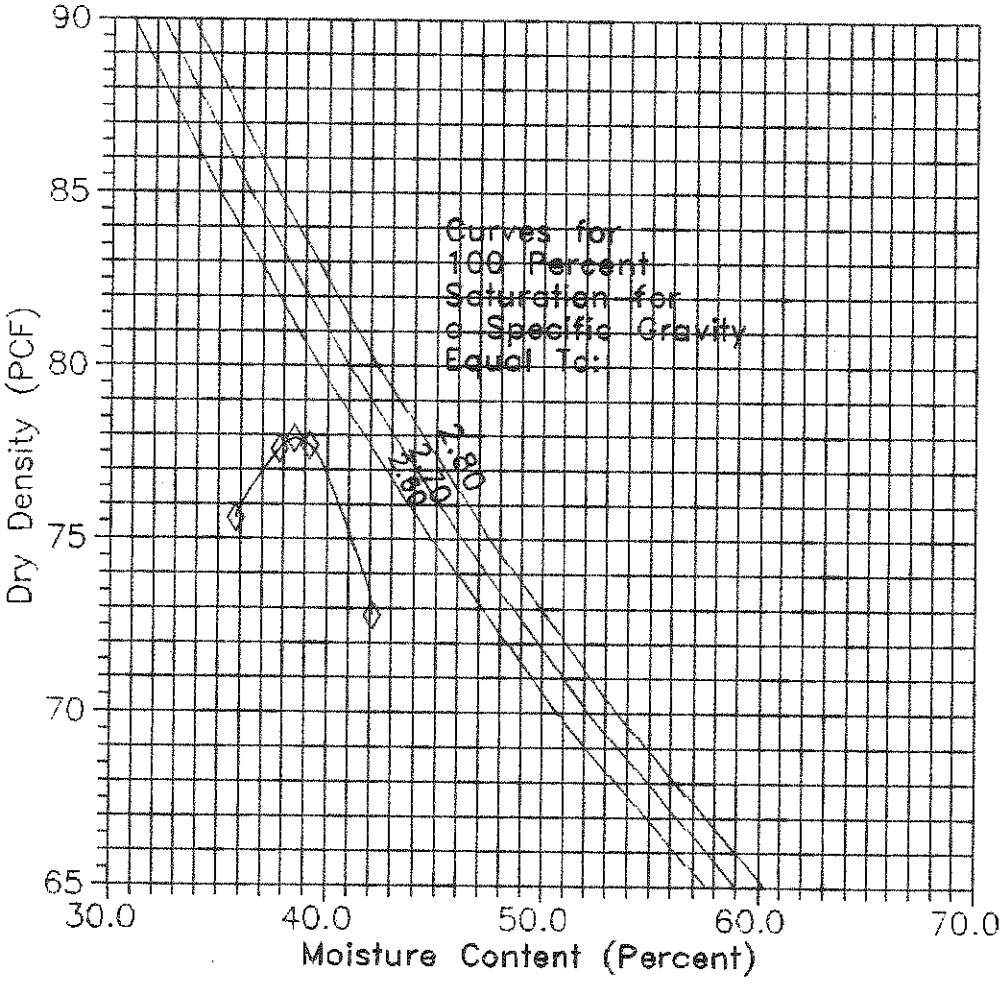
Optimum Moisture Content = 6.8%

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. 1392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 7 DEPTH 2.0-3.0 ft	SAMPLE NO. 5.0 DATE TESTED 7/17/89

PROCTOR COMPACTION TEST



ASTM D 698-78 Method B

Maximum Dry Density = 77.9 pcf

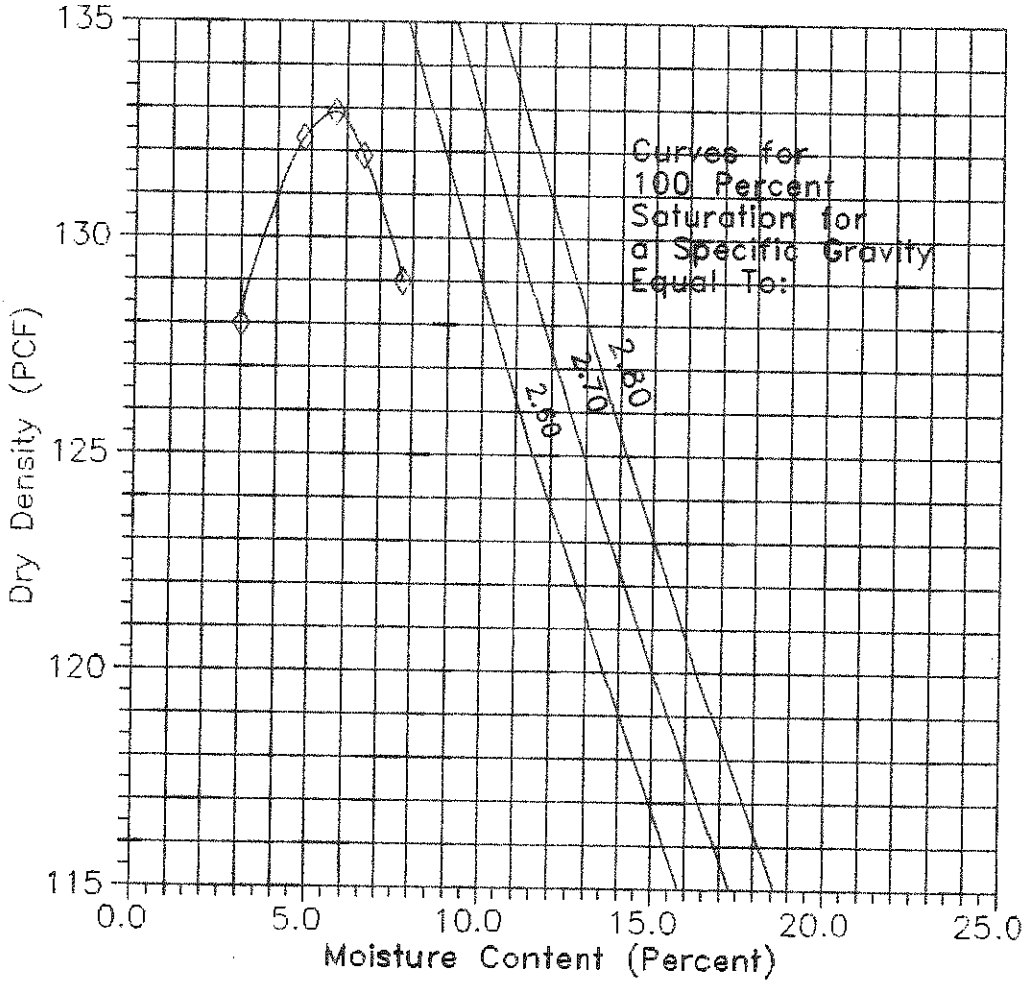
Optimum Moisture Content = 38.5%

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 1 DEPTH 3.0-8.0 ft	SAMPLE NO. 6.0 DATE TESTED 7-18-89

PROCTOR COMPACTION TEST



ASTM = D 698 - 78 Method B

Maximum Dry Density = 132.9

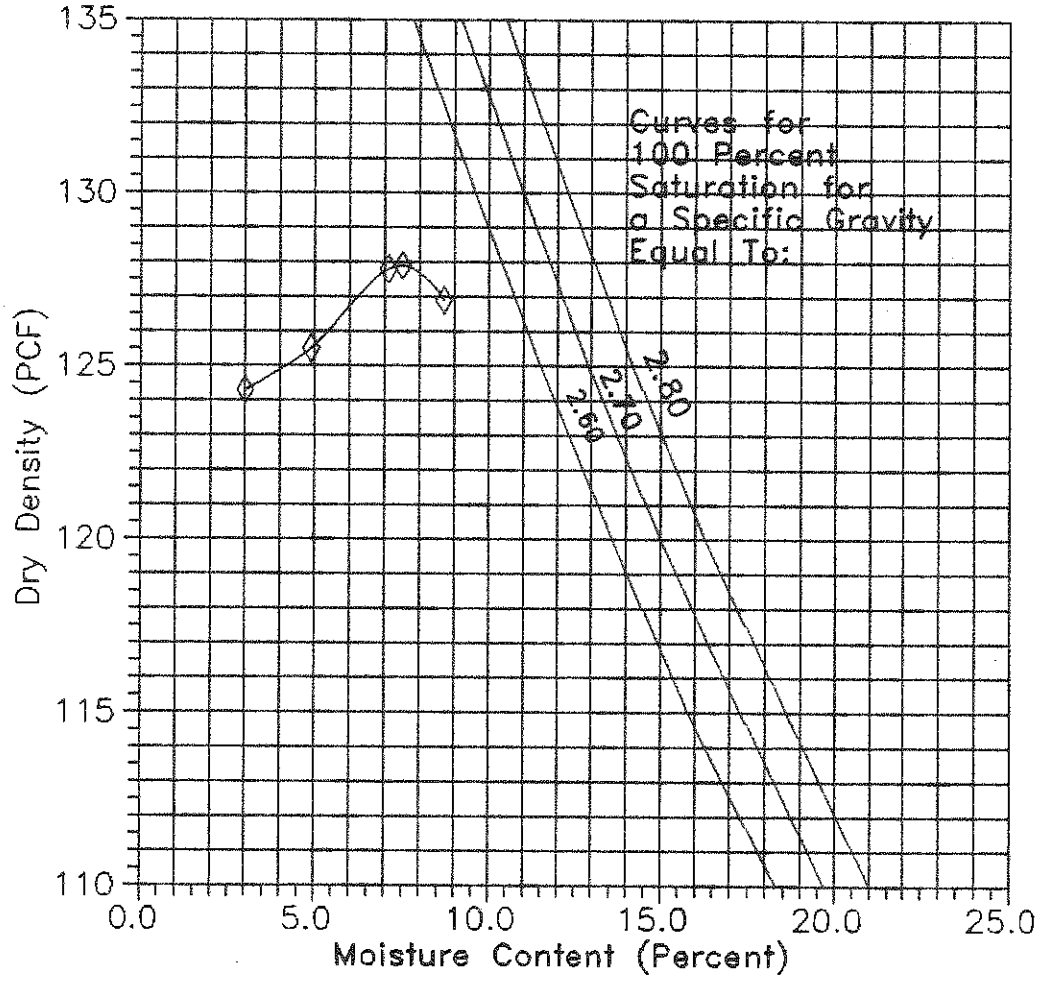
Optimum Moisture content = 5.7%

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. 1392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 15 DEPTH 2.0-3.0 ft	SAMPLE NO. 9.0
	DATE TESTED 7-19-89

PROCTOR COMPACTION TEST



ASTM D 698 - 78 Method B

Maximum Dry Density = 127.9 pcf

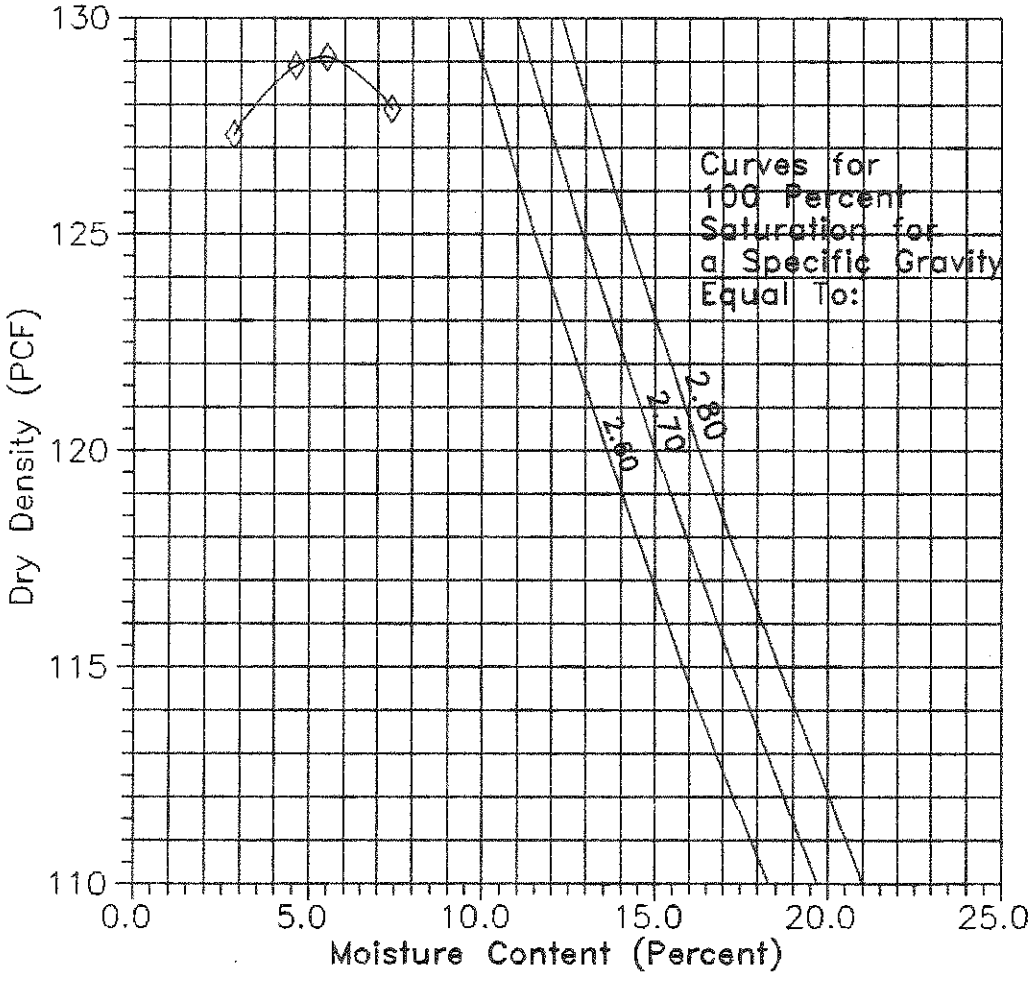
Optimum Moisture Content = 7.5%

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

LAB SRK - US	LAB NO. L392.0
CLIENT McKinley Mining	PROJECT Wishbone Hill
FEATURE Project Area Subsoils	PROJECT NO. 17202
BOREHOLE OR TEST PIT NO. 4 DEPTH 4.0-7.0ft	SAMPLE NO. 4.0 DATE TESTED 7/19/89

PROCTOR COMPACTION TEST



ASTM D 698-78 Method C
Maximum Dry Density = 129.1 pcf

Optimum Moisture Content = 5.5%

APPENDIX K

LABORATORY TESTING OF COAL SLURRY

APPENDIX K - GEOTECHNICAL LAB TEST RESULTS

This appendix contains the geotechnical lab test results produced for the coal fines which will be disposed in the slurry pond. Test results are included for gradational analysis, column settling tests and consolidation testing. These results were used in the design and sizing of the slurry impoundment. Based on the results of this testing program, a consolidated density of 63 pcf was selected for use in sizing of the slurry pond.

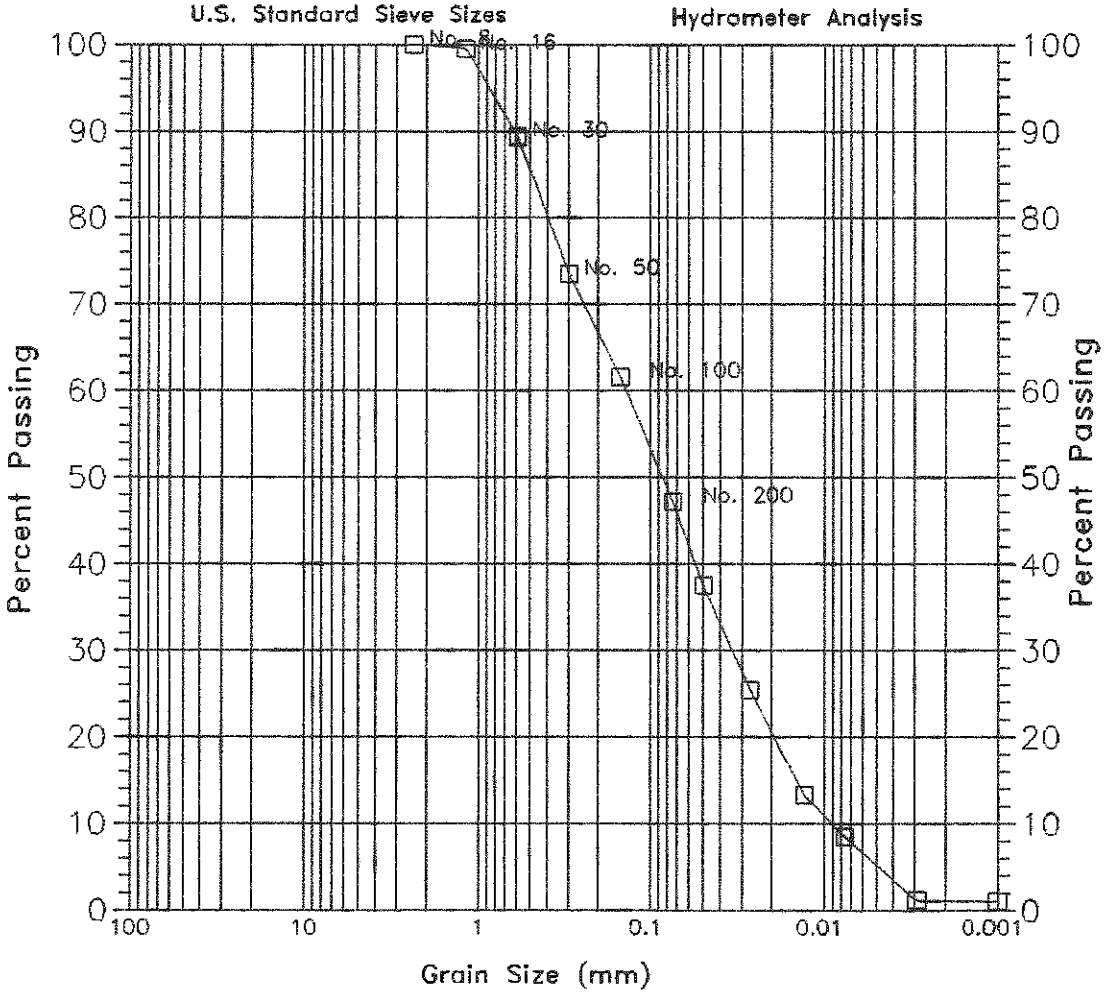
STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

BOREHOLE OR TEST PIT NO. _____ DEPTH _____

LAB	SRK - U.S.	LAB NO.	L388.0
CLIENT	McKinley Mining Co.	PROJECT	Wishbone Hill
FEATURE	Coal Tailings	PROJECT NO.	17202
SAMPLE NO.	1.0	DATE TESTED	05/15/89

GRAIN SIZE ANALYSIS



COLUMN SETTLED DENSITY / PERMEABILITY

Project	WISHBONE HILL	Project No 17202	Lab No.	L388.0	Column No. 51
Lab	SRK - US	Feature COAL TAILINGS	Date	05/15/89	Bottom Drainage YES
Sample No.	1	Specimen No.	3		Lift No. 1

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.60 g	M/C % (initial) =	11.60 %	WT. OF DRY SOLIDS =	432.44 g
WT. OF WATER =	50.16 g	WT. OF ADDED WATER =	1,166.76 g	TOTAL WATER =	1,216.92 g
TOTAL WT. OF SLURRY=	1,599.20 g	M/C % (SLURRY) =	281.41 %	SOLIDS CONTENT =	26.2 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm	HEIGHT =	12.07 cm
VOLUME (t) =	1,469.39 cc	VOLUME (s) =	252.89 cc	VOLUME (v) =	1,216.50 cc
e =	4.810	n % =	82.8 %	So =	100.0 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	941.10 g	RETAINED WATER =	275.82 g	RETAINED M/C % =	63.8 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	52.00 %	Sf =	87.43 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Total Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test: Constant	Falling	(Ft./Yr.)	(cm/sec)	Gradient (i)
05/15/89	15.68										
05/15/89	15.70	1.0	1,469.4	4.810	18.4	281.3					
05/15/89	15.72	2.0	1,453.6	4.748	18.6	277.7					
05/15/89	15.73	3.0	1,447.5	4.724	18.7	276.2					
05/15/89	15.77	5.0	1,361.0	4.382	19.8	256.3					
05/15/89	15.83	9.0	1,267.3	4.011	21.3	234.6					
05/15/89	15.95	16.0	525.9	1.080	51.3	63.1	X		859.1	8.3E-04	2.2
05/15/89	16.20	31.0	525.9	1.080	51.3	63.1	X		1,308.3	1.3E-03	1.7
05/15/89	16.70	61.0	525.9	1.080	51.3	63.1	X		1,113.2	1.1E-03	1.1
05/15/89	16.80	67.0	525.9	1.080	51.3	63.1	X		1,043.2	1.0E-03	1.0
05/16/89	9.95	1,096.0	510.1	1.017	52.9	59.5					
05/16/89	16.97	1,517.0	510.1	1.017	52.9	59.5					
05/17/89	8.57	2,453.0	510.1	1.017	52.9	59.5					
05/17/89	13.50	2,749.0	510.1	1.017	52.9	59.5					
05/17/89	13.77	2,765.0	510.1	1.017	52.9	59.5					

COLUMN SETTLED DENSITY / PERMEABILITY

Project	WISHBONE HILL	Project No	17202	Lab No.	L388.0
Lab	SRK - US	Feature	COAL TAILINGS	Date	05/17/89
Sample No.	1	Specimen No.	3		

Column No.	51
Bottom Drainage	YES
Lift No.	2

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.70 g	M/C % (initial) =	11.20 %	WT. OF DRY SOLIDS =	434.08 g
WT. OF WATER =	48.62 g	WT. OF ADDED WATER =	1,138.40 g	TOTAL WATER =	1,187.02 g
TOTAL WT. OF SLURRY=	1,572.48 g	M/C % (SLURRY) =	273.45 %	SOLIDS CONTENT =	26.8 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm		
HEIGHT of 1st LIFT =	4.19 cm	HEIGHT of 2nd LIFT =	15.24 cm	HEIGHT =	11.05 cm
VOLUME (t) =	1,345.21 cc	VOLUME (s) =	253.85 cc	VOLUME (v) =	1,091.36 cc
e =	4.299	n % =	81.1 %	So =	108.8 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	938.00 g	RETAINED WATER =	249.02 g	RETAINED M/C % =	57.4 %
RECOVERED WATER 1&2	1,879.10	RETAINED WATER 1&2	524.84 g	RETAINED M/C% 1&2	60.6 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	52.00 %	Sf =	107.50 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test: Constant	Falling	(Ft./Yr.)	(cm/sec)	Gradient (i)	Lift Nos. 1&2: Total Volume	Total Void Ratio (e)	Total Dry Density (PCF)	Total Saturated Moisture Content %
05/17/89	13.70		1,345.21	4.299	20.1	251.4						1,855.3	2.661	29.2	155.6
05/17/89	13.72	0.6	1,345.21	4.299	20.1	251.4	X					1,855.3	2.661	29.2	155.6
05/17/89	13.73	1.2	1,329.39	4.237	20.4	247.8	X					1,839.5	2.630	29.4	153.8
05/17/89	13.77	2.4	989.74	2.899	27.4	169.5	X					1,499.8	1.960	36.1	114.6
05/17/89	13.83	4.8	819.30	2.228	33.1	130.3	X					1,329.4	1.623	40.7	94.9
05/17/89	13.95	9.0	504.00	0.985	53.8	57.6	X					1,014.1	1.001	53.3	58.5
05/17/89	14.20	42.0	479.65	0.890	56.5	52.0	X	561.7	5.4E-04		1.4	989.7	0.953	54.7	55.7
05/17/89	14.53	54.0	479.65	0.890	56.5	52.0	X	1,852.0	1.8E-03		1.2	989.7	0.953	54.7	55.7
05/17/89	14.70	60.0	479.65	0.890	56.5	52.0	X	2,073.4	2.0E-03		1.1	989.7	0.953	54.7	55.7
05/17/89	14.85	65.4	479.65	0.890	56.5	52.0	X	1,263.8	1.2E-03		1.1	989.7	0.953	54.7	55.7
05/17/89	14.88	66.6	479.65	0.890	56.5	52.0	X	5,694.2	5.5E-03		1.0	989.7	0.953	54.7	55.7
05/17/89	14.92	67.8	463.82	0.827	58.4	48.4	X	2,549.2	2.5E-03		1.0	973.9	0.922	55.5	53.9
05/17/89	15.05	96.6	463.82	0.827	58.4	48.4						973.9	0.922	55.5	53.9
05/17/89	17.05	216.6	463.82	0.827	58.4	48.4						973.9	0.922	55.5	53.9
05/18/89	9.33	1,186.8	463.82	0.827	58.4	48.4						973.9	0.922	55.5	53.9
05/18/89	14.08	1,477.8	463.82	0.827	58.4	48.4						973.9	0.922	55.5	53.9

COLUMN SETTLED DENSITY / PERMEABILITY

Project	SAN LUIS	Project No	17202	Lab No.	L388.0
Lab	SRK - US	Feature	COAL TAILINGS	Date	05/17/89
Sample No.	1	Specimen No.	3		

Column No.	51
Bottom Drainage	YES
Lift No.	3

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.70 g	M/C % (initial) =	11.20 %	WT. OF DRY SOLIDS =	434.08 g
WT. OF WATER =	48.62 g	WT. OF ADDED WATER =	1,138.40 g	TOTAL WATER =	1,187.02 g
TOTAL WT. OF SLURRY=	1,572.48 g	M/C % (SLURRY) =	273.45 %	SOLIDS CONTENT =	26.8 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm		
HEIGHT of 2nd LIFT =	8.00 cm	HEIGHT of 3rd LIFT =	19.55 cm	HEIGHT =	11.55 cm
VOLUME (t) =	1,406.08 cc	VOLUME (s) =	253.85 cc	VOLUME (v) =	1,152.23 cc
e =	4.539	n % =	81.9 %	So =	103.0 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	950.80 g	RETAINED WATER =	236.22 g	RETAINED M/C % =	54.4 %
RECOVERED H2O 1,2&3	2,829.90	RETAINED H2O 1,2&3	761.06 g	RETAINED M/C% 1,2&3	58.5 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	52.00 %	Sf =	93.42 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test: Constant	Falling	(Ft./Yr.)	(cm/sec)	Gradient (i)	Lift Nos. 1,2&3: Total Volume	Total Void Ratio (e)	Total Dry Density (PCF)	Total Saturated Moisture Content %
05/18/89	14.08		1,406.08	4.539	19.3	265.4									
05/18/89	14.10	1.0	1,391.47	4.481	19.5	262.1						2,380.0	2.129	34.1	124.5
05/18/89	14.12	2.0	1,361.04	4.362	19.9	255.1						2,365.4	2.110	34.3	123.4
05/18/89	14.15	4.0	1,339.13	4.275	20.2	250.0						2,334.9	2.070	34.8	121.0
05/18/89	14.22	8.0	1,268.52	3.997	21.4	233.7						2,313.0	2.041	35.1	119.4
05/18/89	14.33	15.0	510.09	1.009	53.1	59.0						2,242.4	1.948	36.2	113.9
05/18/89	14.48	24.0	495.48	0.952	54.7	55.7						1,484.0	0.951	54.7	55.6
05/18/89	14.58	30.0	495.48	0.952	54.7	55.7		X	1,014.4	9.8E-04	1.4	1,469.4	0.932	55.3	54.5
05/18/89	14.68	36.0	495.48	0.952	54.7	55.7		X	1,314.2	1.3E-03	1.3	1,469.4	0.932	55.3	54.5
05/18/89	14.78	42.0	495.48	0.952	54.7	55.7		X	1,211.6	1.2E-03	1.3	1,469.4	0.932	55.3	54.5
05/18/89	14.88	48.0	495.48	0.952	54.7	55.7		X	1,324.2	1.3E-03	1.3	1,469.4	0.932	55.3	54.5
05/18/89	14.98	54.0	495.48	0.952	54.7	55.7		X	1,472.3	1.4E-03	1.2	1,469.4	0.932	55.3	54.5
05/18/89	15.08	60.0	495.48	0.952	54.7	55.7		X	1,239.6	1.2E-03	1.2	1,469.4	0.932	55.3	54.5
05/18/89	15.18	66.0	495.48	0.952	54.7	55.7		X	1,285.7	1.2E-03	1.1	1,469.4	0.932	55.3	54.5
05/18/89	15.28	72.0	495.48	0.952	54.7	55.7		X	1,335.4	1.3E-03	1.1	1,469.4	0.932	55.3	54.5
05/18/89	15.37	77.0	495.48	0.952	54.7	55.7		X	1,222.7	1.2E-03	1.0	1,469.4	0.932	55.3	54.5
05/18/89	16.65	154.0	479.65	0.890	56.5	52.0		X	1,452.2	1.4E-03	1.0	1,469.4	0.932	55.3	54.5
05/19/89	9.82	1,184.0	479.65	0.890	56.5	52.0		X	0.0	0.0E+00	1.0	1,453.6	0.911	55.9	53.3
05/19/89	10.83	1,245.0	479.65	0.890	56.5	52.0		X	0.0	0.0E+00	1.0	1,453.6	0.911	55.9	53.3
05/19/89	10.85	1,246.0	479.65	0.890	56.5	52.0		Recharged Column with water and ran a permeability test							
05/19/89	10.93	1,251.0	479.65	0.890	56.5	52.0		X	663.8	6.4E-04	2.1	1,453.6	0.911	55.9	53.3
05/19/89	11.02	1,256.0	479.65	0.890	56.5	52.0		X	518.5	5.0E-04	2.0	1,453.6	0.911	55.9	53.3
05/19/89	11.10	1,261.0	479.65	0.890	56.5	52.0		X	644.7	6.3E-04	2.0	1,453.6	0.911	55.9	53.3
05/19/89	11.18	1,266.0	479.65	0.890	56.5	52.0		X	602.9	5.8E-04	2.0	1,453.6	0.911	55.9	53.3
05/19/89	11.27	1,271.0	479.65	0.890	56.5	52.0		X	541.5	5.3E-04	2.0	1,453.6	0.911	55.9	53.3
05/19/89	11.35	1,276.0	479.65	0.890	56.5	52.0		X	620.1	6.0E-04	1.9	1,453.6	0.911	55.9	53.3
05/19/89	11.52	1,286.0	479.65	0.890	56.5	52.0		X	684.0	6.6E-04	1.9	1,453.6	0.911	55.9	53.3
05/19/89	11.68	1,296.0	479.65	0.890	56.5	52.0		X	607.9	5.9E-04	1.8	1,453.6	0.911	55.9	53.3
05/19/89	11.85	1,306.0	479.65	0.890	56.5	52.0		X	781.2	7.6E-04	1.8	1,453.6	0.911	55.9	53.3
05/19/89	12.02	1,316.0	479.65	0.890	56.5	52.0		X	751.6	7.3E-04	1.7	1,453.6	0.911	55.9	53.3
05/19/89	12.18	1,326.0	479.65	0.890	56.5	52.0		X	790.7	7.7E-04	1.6	1,453.6	0.911	55.9	53.3
05/19/89	12.68	1,356.0	479.65	0.890	56.5	52.0		X	887.9	8.6E-04	1.6	1,453.6	0.911	55.9	53.3
05/19/89	13.18	1,386.0	479.65	0.890	56.5	52.0		X	1,015.6	9.9E-04	1.4	1,453.6	0.911	55.9	53.3
05/19/89	13.42	1,400.0	479.65	0.890	56.5	52.0		X	1,243.6	1.2E-03	1.1	1,453.6	0.911	55.9	53.3
								X	1,389.3	1.3E-03	1.0	1,453.6	0.911	55.9	53.3

COLUMN SETTLED DENSITY / PERMEABILITY

Project	WISHBONE HILL	Project No 17202	Lab No.	L388.0	Column No. 52
Lab	SRK - US	Feature COAL TAILINGS	Date	05/16/89	Bottom Drainage NO
Sample No.	1	Specimen No.	4		Lift No. 1

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.60 g	M/C % (initial) =	11.20 %	WT. OF DRY SOLIDS =	433.99 g
WT. OF WATER =	48.61 g	WT. OF ADDED WATER =	1,142.80 g	TOTAL WATER =	1,191.41 g
TOTAL WT. OF SLURRY=	1,576.79 g	M/C % (SLURRY) =	274.52 %	SOLIDS CONTENT =	26.7 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm	HEIGHT =	11.77 cm
VOLUME (t) =	1,432.86 cc	VOLUME (s) =	253.80 cc	VOLUME (v) =	1,179.07 cc
e =	4.646	n % =	82.3 %	So =	101.0 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	830.00 g	RETAINED WATER =	361.41 g	RETAINED M/C % =	83.3 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	51.3 %	Sf =	57.2 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Total Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test Constant	Permeability Test Falling	Permeability Test (Ft./Yr.)	Permeability Test (cm/sec)	Gradient (i)
05/16/89	14.15										
05/16/89	14.17	1.0	1,432.9	4.646	18.9	271.7					
05/16/89	14.20	3.0	1,432.9	4.646	18.9	271.7					
05/16/89	14.28	8.0	1,432.9	4.646	18.9	271.7					
05/16/89	14.40	15.0	742.6	1.926	36.5	112.6					
05/16/89	14.42	16.0	726.8	1.864	37.3	109.0					
05/16/89	14.43	17.0	704.9	1.777	38.4	103.9					
05/16/89	14.47	19.0	685.4	1.701	39.5	99.4					
05/16/89	14.53	23.0	674.4	1.657	40.2	96.9					
05/16/89	14.65	30.0	648.9	1.557	41.8	91.0					
05/16/89	14.90	45.0	642.8	1.533	42.2	89.6					
05/16/89	15.40	75.0	630.6	1.485	43.0	86.8					
05/16/89	16.40	135.0	630.6	1.485	43.0	86.8					
05/17/89	8.58	1,106.0	602.6	1.374	45.0	80.4					
05/17/89	14.25	1,446.0	602.6	1.374	45.0	80.4					

COLUMN SETTLED DENSITY / PERMEABILITY

Project	WISHBONE HILL	Project No	17202	Lab No.	L388.0
Lab	SRK - US	Feature	COAL TAILINGS	Date	05/16/89
Column No.	52	Bottom Drainage	NO		
Sample No.	1	Specimen No.	4	Lift No.	2

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.60 g	M/C % (initial) =	10.90 %	WT. OF DRY SOLIDS =	435.17 g
WT. OF WATER =	47.43 g	WT. OF ADDED WATER =	1,162.40 g	TOTAL WATER =	1,209.83 g
TOTAL WT. OF SLURRY=	1,597.57 g	M/C % (SLURRY) =	278.02 %	SOLIDS CONTENT =	26.5 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm		
HEIGHT of 1st Lift =	11.77 cm	HEIGHT of 2nd Lift =	23.70 cm	HEIGHT =	11.93 cm
VOLUME (t) =	1,452.34 cc	VOLUME (s) =	254.48 cc	VOLUME (v) =	1,197.86 cc
e =	4.707	n % =	82.5 %	So =	101.0 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	926.40 g	RETAINED WATER =	283.43 g	RETAINED M/C % =	65.1 %
RECOVERED WATER 1&2	1,756.40 g	RETAINED WATER 1&2	644.84 g	RETAINED M/C% 1&2	74.2 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	51.30 %	Sf =	82.25 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test Constant (Ft./Yr.)	Permeability Test Falling (Ft./Yr.)	Permeability Test (cm/sec)	Gradient (i)	Lift Nos. 1&2 Total Volume	Lift Nos. 1&2 Total Void Ratio (e)	Lift Nos. 1&2 Total Dry Density (PCF)	Lift Nos. 1&2 Total Saturated Moisture Content %
05/17/89	14.32		2,282.60	7.970	11.9	466.1					2,885.2	4.676	18.8	273.5
05/17/89	14.33	1	2,282.60	7.970	11.9	466.1					2,885.2	4.676	18.8	273.5
05/17/89	14.35	2	2,282.60	7.970	11.9	466.1					2,885.2	4.676	18.8	273.5
05/17/89	14.38	4	2,282.60	7.970	11.9	466.1					2,885.2	4.676	18.8	273.5
05/17/89	14.45	8	1,716.52	5.745	15.8	336.0					2,319.1	3.563	23.4	208.3
05/17/89	14.57	15	1,222.26	3.803	22.2	222.4					1,824.9	2.590	29.7	151.5
05/17/89	14.82	30	634.26	1.492	42.8	87.3					1,236.9	1.433	43.9	83.8
05/17/89	15.32	60	581.91	1.287	46.7	75.2					1,184.5	1.330	45.8	77.8
05/17/89	16.32	120	557.56	1.191	48.7	69.6					1,160.2	1.283	46.8	75.0
05/17/89	17.32	180	550.26	1.162	49.4	68.0					1,152.9	1.268	47.1	74.2
05/18/89	9.25	1,136	525.91	1.067	51.7	62.4					1,128.5	1.220	48.1	71.4
05/18/89	16.12	1,548	525.91	1.067	51.7	62.4					1,128.5	1.220	48.1	71.4

COLUMN SETTLED DENSITY / PERMEABILITY

Project	SAN LUIS	Project No	17202	Lab No.	L388.0	Column No.	52
Lab	SRK - US	Feature	COAL TAILINGS	Date	05/16/89	Bottom Drainage	NO
Sample No.	1	Specimen No.	4			Lift No.	3

INITIAL SPECIMEN CONDITIONS

WET WT. OF SOLIDS =	482.70 g	M/C % (initial) =	11.00 %	WT. OF DRY SOLIDS =	434.86 g
WT. OF WATER =	47.84 g	WT. OF ADDED WATER =	1,141.10 g	TOTAL WATER =	1,188.94 g
TOTAL WT. OF SLURRY=	1,575.96 g	M/C % (SLURRY) =	273.40 %	SOLIDS CONTENT =	26.8 %
DIAMETER =	12.45 cm	AREA =	121.74 sq cm		
HEIGHT of 2nd Lift =	23.70 cm	HEIGHT of 3rd Lift =	35.47 cm	HEIGHT =	11.77 cm
VOLUME (t) =	1,432.86 cc	VOLUME (s) =	254.31 cc	VOLUME (v) =	1,178.56 cc
e =	4.634	n % =	82.3 %	So =	100.9 %

AFTER SETTLEMENT AND DRAINAGE SPECIMEN CONDITION

RECOVERED WATER =	953.80 g	RETAINED WATER =	235.14 g	RETAINED M/C % =	54.1 %
RECOVERED H2O 1,2&3	2,710.20	RETAINED H2O 1,2&3	879.98 g	RETAINED M/C% 1,2&3	67.5 %

END OF TEST SPECIMEN CONDITION

M/C % (final) =	51.30 %	Sf =	82.14 %

SETTLEMENT DATA

Date M D Y 00/00/00	Time (Hrs.)	Total Elapsed Time (Min.)	Volume Total (cc)	Void Ratio (e)	Dry Density (PCF)	Saturated Moisture Content %	Permeability Test: Constant (Ft./Yr.)	Permeability Test: Falling (Ft./Yr.)	Permeability Test: (cm/sec)	Gradient (i)	Total Volume	Lift Nos. 1,2&3: Total Void Ratio (e)	Lift Nos. 1,2&3: Total Dry Density (PCF)	Lift Nos. 1,2&3: Total Saturated Moisture Content %
05/18/89	16.12		2,056.17	7.085	13.2	414.3					3,184.7	3.176	25.6	185.7
05/18/89	16.13	1.0	2,025.73	6.966	13.4	407.4					3,154.2	3.136	25.8	183.4
05/18/89	16.15	2.0	1,994.08	6.841	13.6	400.1					3,122.6	3.095	26.1	181.0
05/18/89	16.18	4.0	1,963.64	6.722	13.8	393.1					3,092.2	3.055	26.3	178.6
05/18/89	16.25	8.0	1,654.43	5.506	16.4	322.0					2,782.9	2.649	29.3	154.9
05/18/89	16.37	15.0	865.56	2.404	31.4	140.6					1,994.1	1.615	40.8	94.4
05/18/89	16.38	16.0	835.13	2.284	32.5	133.6					1,963.6	1.575	41.5	92.1
05/18/89	16.40	17.0	804.69	2.164	33.7	126.6					1,933.2	1.535	42.1	89.8
05/18/89	16.43	19.0	742.61	1.920	36.6	112.3					1,871.1	1.454	43.5	85.0
05/18/89	16.50	23.0	658.61	1.590	41.2	93.0					1,787.1	1.344	45.6	78.6
05/18/89	16.62	30.0	572.17	1.250	47.4	73.1					1,700.7	1.230	47.9	71.9
05/18/89	16.87	45.0	525.91	1.068	51.6	62.5					1,654.4	1.169	49.2	68.4
05/18/89	17.95	110.0	495.48	0.948	54.8	55.5					1,624.0	1.130	50.1	66.1
05/19/89	9.87	1,065.0	479.65	0.886	56.6	51.8					1,608.2	1.109	50.6	64.8

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PROJECT:	Wishbone Hill	SAMPLE NO.:	1.0
PROJECT NO.:	22401	SPECIMEN	
LAB NO.:	L3880		
FEATURE:	COAL SPOILS		

CONSOLIDATION TEST
SPECIMEN DATA

Moisture Content and Initial Conditions

Consolidometer No.	Units	Before Test Specimen	Before Test Trimmings	After Test Specimen
Tare No.			Cottonwood	C220
Tare Plus Wet Soil	grams	300.5	296.8	324.1
Tare Plus Dry Soil	grams	294.8	289.2	298.7
Moisture	grams	5.8	7.6	25.4
Tare	grams	220.1	190.3	229.4
Dry Soil	grams	74.7	98.9	69.3
Moisture Content	%	7.7	7.7	36.7

Initial Specimen Conditions

	Units			Units	
Initial Height	cm	2.54	Volume of Solids	cm3	43.65
Diameter of Specimen	cm	7.04	Void Ratio	e	1.262
Area of Specimen	cm2	38.88	Saturation	%	10.4
Volume of Specimen	cm3	98.74	Dry Density	PCF	47.2
Specific Gravity	--	1.71			

CONSOLIDATION TEST
Time - Consolidation Readings

Load Placed	Date	Time (Hours, Minutes)	Time (Hrs.)	Total Elapsed Time	Load Elapsed Time	Square Rt Elapsed Time	Log Elapsed Time	Dial Reading	Dial Reading Correction	Corrected Dial Reading	Load Dial Reading	Height of Specimen	Total Volume	Void Ratio	Dry Density (PCF)
Seating Load	07/17/89	10.23	10.38					0.0000							
1.1 Psi	07/17/89	10.23	10.39	0.1	0.1	0.32		0.0000	0.0350			2.54	98.74	1.262	47.2
	07/17/89	10.23	10.39	0.3	0.3	0.50		0.1400	0.0350	0.1050		2.53	98.34	1.253	47.4
	07/17/89	10.24	10.39	0.5	0.5	0.71		0.1450	0.0350	0.1100	0.0050	2.53	98.32	1.252	47.4
	07/17/89	10.24	10.40	1.0	1.0	1.00	0.00	0.1525	0.0350	0.1175	0.0125	2.53	98.29	1.251	47.4
	07/17/89	10.25	10.42	2.0	2.0	1.41	0.30	0.1575	0.0350	0.1225	0.0175	2.53	98.27	1.251	47.4
	07/17/89	10.27	10.45	4.0	4.0	2.00	0.60	0.1625	0.0350	0.1275	0.0225	2.53	98.25	1.251	47.4
	07/17/89	10.31	10.52	8.0	8.0	2.83	0.90	0.1650	0.0350	0.1300	0.0250	2.53	98.24	1.250	47.4
	07/17/89	10.38	10.63	15.0	15.0	3.87	1.18	0.1700	0.0350	0.1350	0.0300	2.53	98.22	1.250	47.4
	07/17/89	10.53	10.88	30.0	30.0	5.48	1.48	0.1725	0.0350	0.1375	0.0325	2.53	98.21	1.250	47.5
	07/17/89	11.23	11.38	60.0	60.0	7.75	1.78	0.1750	0.0350	0.1400	0.0350	2.53	98.20	1.249	47.5
	07/17/89	12.23	12.38	120.0	120.0	10.95	2.08	0.2000	0.0350	0.1650	0.0600	2.52	98.10	1.247	47.5
	07/17/89	14.23	14.38	240.0	240.0	15.49	2.38	0.2100	0.0350	0.1750	0.0700	2.52	98.06	1.246	47.5
Water Added	07/17/89	14.33	14.55	250.0	250.0	15.81	2.40	0.2100	0.0350	0.1750		2.52	98.06	1.246	47.5
	07/17/89	14.33	14.55	250.1	0.1	0.32		1.50	0.0350	1.4650	1.3600	2.39	93.05	1.131	50.1
	07/17/89	14.33	14.55	250.3	0.2	0.50		2.0575	0.0350	2.0225	1.9175	2.34	90.88	1.082	51.3
	07/17/89	14.34	14.56	250.5	0.5	0.71		4.8075	0.0350	4.7725	4.6675	2.06	80.19	0.837	58.1
	07/17/89	14.34	14.57	251.0	1.0	1.00	0.00	5.0700	0.0350	5.0350	4.9300	2.04	79.17	0.814	58.9
	07/17/89	14.35	14.58	252.0	2.0	1.41	0.30	5.0875	0.0350	5.0525	4.9475	2.03	79.10	0.812	58.9
	07/17/89	14.37	14.62	254.0	4.0	2.00	0.60	5.0950	0.0350	5.0600	4.9550	2.03	79.07	0.811	58.9
	07/17/89	14.41	14.68	258.0	8.0	2.83	0.90	5.1000	0.0350	5.0650	4.9600	2.03	79.05	0.811	59.0
	07/17/89	14.48	14.80	265.0	15.0	3.87	1.18	5.1175	0.0350	5.0825	4.9775	2.03	78.99	0.809	59.0
	07/17/89	15.03	15.05	280.0	30.0	5.48	1.48	5.1225	0.0350	5.0875	4.9825	2.03	78.97	0.809	59.0
	07/17/89	15.33	15.55	310.0	60.0	7.75	1.78	5.1275	0.0350	5.0925	4.9875	2.03	78.95	0.808	59.0
	07/17/89	16.33	16.55	370.0	120.0	10.95	2.08	5.1425	0.0350	5.1075	5.0025	2.03	78.89	0.807	59.1
2.15 Psi	07/18/89	6.45	6.75	1,222.0	972.0	31.18	2.99	5.2975	0.0575	5.2400	5.1350	2.02	78.37	0.795	59.5
	07/18/89	6.45	6.75	1,222.1	0.1	0.32		6.1550	0.0575	6.0975	5.9925	1.93	75.04	0.719	62.1
	07/18/89	6.45	6.75	1,222.3	0.3	0.50		6.1725	0.0575	6.1150	6.0100	1.93	74.97	0.717	62.2
	07/18/89	6.46	6.76	1,222.5	0.5	0.71		6.1800	0.0575	6.1225	6.0175	1.93	74.94	0.717	62.2
	07/18/89	6.46	6.77	1,223.0	1.0	1.00	0.00	6.1875	0.0575	6.1300	6.0250	1.93	74.91	0.716	62.2
	07/18/89	6.47	6.78	1,224.0	2.0	1.41	0.30	6.2325	0.0575	6.1750	6.0700	1.92	74.74	0.712	62.4
	07/18/89	6.49	6.82	1,226.0	4.0	2.00	0.60	6.2350	0.0575	6.1775	6.0725	1.92	74.73	0.712	62.4
	07/18/89	6.53	6.88	1,230.0	8.0	2.83	0.90	6.2375	0.0575	6.1800	6.0750	1.92	74.72	0.712	62.4
	07/18/89	7.00	7.00	1,237.0	15.0	3.87	1.18	6.2550	0.0575	6.1975	6.0925	1.92	74.65	0.710	62.4
	07/18/89	7.15	7.25	1,252.0	30.0	5.48	1.48	6.2700	0.0575	6.2125	6.1075	1.92	74.59	0.709	62.5
	07/18/89	7.45	7.75	1,282.0	60.0	7.75	1.78	6.2825	0.0575	6.2250	6.1200	1.92	74.54	0.708	62.5
	07/18/89	8.45	8.75	1,342.0	120.0	10.95	2.08	6.3025	0.0575	6.2450	6.1400	1.92	74.47	0.706	62.6
	07/18/89	10.45	10.75	1,462.0	240.0	15.49	2.38	6.3050	0.0575	6.2475	6.1425	1.92	74.46	0.706	62.6
	07/18/89	14.45	14.75	1,702.0	480.0	21.91	2.68	6.3075	0.0575	6.2500	6.1450	1.92	74.45	0.705	62.6
	07/19/89	10.50	10.83	2,907.0	1,685.0	41.05	3.23	6.3425	0.0575	6.2850	6.1800	1.91	74.31	0.702	62.7

4.3 Psi	07/19/89	10.50	10.84	2,907.1	0.1	0.32		6.7225	0.0900	6.6325	6.5275	1.88	72.96	0.671	63.9
	07/19/89	10.50	10.84	2,907.3	0.2	0.50		6.7500	0.0900	6.6600	6.5550	1.87	72.85	0.669	64.0
	07/19/89	10.51	10.84	2,907.5	0.5	0.71		6.7550	0.0900	6.6650	6.5600	1.87	72.83	0.668	64.0
	07/19/89	10.51	10.85	2,908.0	1.0	1.00	0.00	6.7675	0.0900	6.6775	6.5725	1.87	72.79	0.667	64.0
	07/19/89	10.52	10.87	2,909.0	2.0	1.41	0.30	6.7800	0.0900	6.6900	6.5850	1.87	72.74	0.666	64.1
	07/19/89	10.54	10.90	2,911.0	4.0	2.00	0.60	6.8350	0.0900	6.7450	6.6400	1.87	72.52	0.661	64.3
	07/19/89	10.58	10.97	2,915.0	8.0	2.83	0.90	6.8375	0.0900	6.7475	6.6425	1.87	72.51	0.661	64.3
	07/19/89	11.05	11.08	2,922.0	15.0	3.87	1.18	6.8525	0.0900	6.7625	6.6575	1.86	72.45	0.660	64.3
	07/19/89	11.20	11.33	2,937.0	30.0	5.48	1.48	6.8550	0.0900	6.7650	6.6600	1.86	72.45	0.659	64.3
	07/19/89	11.50	11.83	2,967.0	60.0	7.75	1.78	6.8700	0.0900	6.7800	6.6750	1.86	72.39	0.658	64.4
	07/19/89	12.50	12.83	3,027.0	120.0	10.95	2.08	6.8750	0.0900	6.7850	6.6800	1.86	72.37	0.658	64.4
	07/19/89	14.50	14.83	3,147.0	240.0	15.49	2.38	6.8825	0.0900	6.7925	6.6875	1.86	72.34	0.657	64.4
	07/19/89	18.50	18.83	3,387.0	480.0	21.91	2.68	6.8825	0.0900	6.7925		1.86	72.34	0.657	64.4
	07/20/89	8.55	8.92	4,232.0	1,325.0	36.40	3.12	6.8875	0.0900	6.7975	6.6925	1.86	72.32	0.657	64.4
8.6 Psi	07/20/89	9.02	9.03	4,239.0	1,332.0	36.50	3.12	6.8875	0.1450	6.7425		1.87	72.53	0.661	64.3
	07/20/89	9.02	9.04	4,239.1	0.1	0.32		7.2925	0.1450	7.1475	7.0425	1.83	70.96	0.625	65.7
	07/20/89	9.02	9.04	4,239.3	0.2	0.50		7.3175	0.1450	7.1725	7.0675	1.82	70.86	0.623	65.8
	07/20/89	9.03	9.04	4,239.5	0.5	0.71		7.3250	0.1450	7.1800	7.0750	1.82	70.83	0.623	65.8
	07/20/89	9.03	9.05	4,240.0	1.0	1.00	0.00	7.3450	0.1450	7.2000	7.0950	1.82	70.75	0.621	65.9
	07/20/89	9.04	9.07	4,241.0	2.0	1.41	0.30	7.3575	0.1450	7.2125	7.1075	1.82	70.71	0.620	65.9
	07/20/89	9.06	9.10	4,243.0	4.0	2.00	0.60	7.3625	0.1450	7.2175	7.1125	1.82	70.69	0.619	65.9
	07/20/89	9.10	9.17	4,247.0	8.0	2.83	0.90	7.3725	0.1450	7.2275	7.1225	1.82	70.65	0.618	66.0
	07/20/89	9.17	9.28	4,254.0	15.0	3.87	1.18	7.3850	0.1450	7.2400	7.1350	1.82	70.60	0.617	66.0
	07/20/89	9.32	9.53	4,269.0	30.0	5.48	1.48	7.3925	0.1450	7.2475	7.1425	1.82	70.57	0.617	66.0
	07/20/89	10.02	10.03	4,299.0	60.0	7.75	1.78	7.4025	0.1450	7.2575	7.1525	1.81	70.53	0.616	66.1
	07/20/89	11.02	11.03	4,359.0	120.0	10.95	2.08	7.4100	0.1450	7.2650	7.1600	1.81	70.50	0.615	66.1
	07/20/89	13.02	13.03	4,479.0	240.0	15.49	2.38	7.4150	0.1450	7.2700	7.1650	1.81	70.48	0.615	66.1
	07/20/89	17.02	17.03	4,719.0	480.0	21.91	2.68	7.4225	0.1450	7.2775	7.1725	1.81	70.45	0.614	66.1
	07/21/89	9.02	9.03	5,679.0	1,440.0	37.95	3.16	7.4325	0.1450	7.2875	7.1825	1.81	70.41	0.613	66.2
17.2 Psi	07/21/89	9.16	9.27	5,693.0	1,454.0	38.13	3.16	7.7900	0.2000	7.5900	7.4850	1.78	69.24	0.586	67.3
	07/21/89	9.16	9.27	5,693.1	0.1	0.32		7.8225	0.2000	7.6225	7.5175	1.78	69.11	0.583	67.4
	07/21/89	9.16	9.27	5,693.3	0.3	0.50		7.8275	0.2000	7.6275	7.5225	1.78	69.09	0.583	67.4
	07/21/89	9.17	9.28	5,693.5	0.5	0.71		7.8375	0.2000	7.6375	7.5325	1.78	69.05	0.582	67.5
	07/21/89	9.18	9.30	5,695.0	2.0	1.41	0.30	7.8625	0.2000	7.6625	7.5575	1.77	68.96	0.580	67.6
	07/21/89	9.20	9.33	5,697.0	4.0	2.00	0.60	7.9075	0.2000	7.7075	7.6025	1.77	68.78	0.576	67.8
	07/21/89	9.24	9.40	5,701.0	8.0	2.83	0.90	7.9150	0.2000	7.7150	7.6100	1.77	68.75	0.575	67.8
	07/21/89	9.31	9.52	5,708.0	15.0	3.87	1.18	7.9225	0.2000	7.7225	7.6175	1.77	68.72	0.574	67.8
	07/21/89	9.46	9.77	5,723.0	30.0	5.48	1.48	7.9275	0.2000	7.7275	7.6225	1.77	68.70	0.574	67.8
	07/21/89	10.16	10.27	5,753.0	60.0	7.75	1.78	7.9325	0.2000	7.7325	7.6275	1.77	68.68	0.573	67.9
	07/21/89	11.16	11.27	5,813.0	120.0	10.95	2.08	7.9375	0.2000	7.7375	7.6325	1.77	68.66	0.573	67.9
	07/21/89	13.16	13.27	5,933.0	240.0	15.49	2.38	7.9425	0.2000	7.7425	7.6375	1.77	68.65	0.572	67.9
	07/21/89	17.16	17.27	6,173.0	480.0	21.91	2.68	7.9500	0.2000	7.7500	7.6450	1.77	68.62	0.572	67.9
	07/22/89	13.36	13.60	7,393.0	1,700.0	41.23	3.23	7.9600	0.2000	7.7600	7.6550	1.76	68.58	0.571	68.0
34.4 Psi	07/22/89	13.38	13.63	7,395.0	1,702.0	41.26	3.23	7.9600	0.2700	7.6900		1.77	68.85	0.577	67.7
	07/22/89	13.38	13.64	7,395.1	0.1	0.32		8.0625	0.2700	7.7925	7.6875	1.76	68.45	0.568	68.1
	07/22/89	13.38	13.64	7,395.3	0.2	0.50		8.0675	0.2700	7.7975	7.6925	1.76	68.43	0.568	68.1
	07/22/89	13.39	13.64	7,395.5	0.5	0.71		8.0900	0.2700	7.8200	7.7150	1.76	68.34	0.566	68.2
	07/22/89	13.39	13.65	7,396.0	1.0	1.00	0.00	8.1000	0.2700	7.8300	7.7250	1.76	68.30	0.565	68.2
	07/22/89	13.40	13.67	7,397.0	2.0	1.41	0.30	8.1050	0.2700	7.8350	7.7300	1.76	68.29	0.564	68.2
	07/22/89	13.42	13.70	7,399.0	4.0	2.00	0.60	8.1075	0.2700	7.8375	7.7325	1.76	68.28	0.564	68.3
	07/22/89	13.46	13.77	7,403.0	8.0	2.83	0.90	8.1075	0.2700	7.8375		1.76	68.28	0.564	68.3
	07/22/89	13.53	13.88	7,410.0	15.0	3.87	1.18	8.1100	0.2700	7.8400	7.7350	1.76	68.27	0.564	68.3
	07/22/89	14.08	14.13	7,425.0	30.0	5.48	1.48	8.1100	0.2700	7.8400		1.76	68.27	0.564	68.3
	07/22/89	14.38	14.63	7,455.0	60.0	7.75	1.78	8.1125	0.2700	7.8425	7.7375	1.76	68.26	0.564	68.3
	07/22/89	15.38	15.63	7,515.0	120.0	10.95	2.08	8.1150	0.2700	7.8450	7.7400	1.76	68.25	0.563	68.3
	07/22/89	17.38	17.63	7,635.0	240.0	15.49	2.38	8.1175	0.2700	7.8475	7.7425	1.76	68.24	0.563	68.3
	07/22/89	17.38	17.63	7,635.0	240.0	15.49	2.38	8.1225	0.2700	7.8525	7.7475	1.75	68.22	0.563	68.3
	07/24/89	8.32	8.53	9,969.0	2,574.0	50.73	3.41	8.5750	0.2700	8.3050	8.2000	1.71	66.46	0.522	70.1

APPENDIX L
INFLOW ANALYSIS

APPENDIX L.1

TRANSIENT 1-DIMENSIONAL ANALYSIS OF INFLOW

1. Summary Tables of Computed Inflows
2. Program Output
3. Program Listing

RESULTS OF TRANSIENT 1-D FLOW ANALYSIS
ESTIMATED INFLOWS (GPM) TO MINE AREA 1

END OF YEAR	PIT 1			PIT 2 DEEPEN PITS 1&2						PIT 3			MINE AREA I TOTAL (GPM)
	FLAT	GLAC	TOTAL	FLAT	DIP	FLAT	DIP	GLAC	TOTAL	FLAT	GLAC	TOTAL	
YEAR 1	0.51	15.82	16.33										16.33
	0.90	28.18	29.08										29.08
	1.61	50.02	51.63										51.63
YEAR 2	0.36	11.18	11.54	0.85	0.27	0.07	0.05	15.82	17.06				28.60
	0.64	19.93	20.57	1.51	0.49	0.12	0.10	28.18	30.40				50.97
	1.14	35.37	36.51	2.68	0.87	0.21	0.17	50.02	53.95				90.46
YEAR 3	0.29	9.13	9.42	0.60	0.19	0.05	0.04	11.18	12.06	0.37	15.82	16.19	37.67
	0.52	16.27	16.79	1.07	0.35	0.08	0.07	19.93	21.50	0.66	28.18	28.84	67.13
	0.93	28.88	29.81	1.90	0.61	0.15	0.12	35.37	38.15	1.18	50.02	51.20	119.16
YEAR 4	0.25	7.91	8.16	0.49	0.16	0.04	0.03	9.13	9.85	0.26	11.18	11.44	29.45
	0.45	14.09	14.54	0.87	0.28	0.07	0.06	16.27	17.55	0.47	19.93	20.40	52.49
	0.80	25.01	25.81	1.55	0.50	0.12	0.10	28.88	31.15	0.84	35.37	36.21	93.17

Notes:

Column Headings:
FLAT = flat-lying bedrock
DIP = dipping bedrock
GLAC = glacial deposits

The three entries for each year refer to low, mid and high values for hydraulic conductivity discussed in text.

RESULTS OF TRANSIENT 1-D FLOW ANALYSIS
ESTIMATED INFLOWS (GPM) TO MINE AREA 2

END OF YEAR	PITS 4-7			PITS 8 - 10			PITS 12 & 13			PIT 16			MINE AREA I TOTAL
	DIP	GLAC	TOTAL	DIP	GLAC	TOTAL	DIP	GLAC	TOTAL	DIP	GLAC	TOTAL	
YEAR 3	3.70	35.32	39.02										39.02
	6.57	62.94	69.51										69.51
	11.70	111.70	123.40										123.40
YEAR 4	2.62	24.98	27.60										27.60
	4.65	44.50	49.15										49.15
	8.27	78.99	87.26										87.26
YEAR 5	2.14	20.39	22.53										22.53
	3.80	36.34	40.14										40.14
	6.75	64.49	71.24										71.24
YEAR 6	1.85	17.66	19.51	2.51	20.03	22.54							42.05
	3.29	31.47	34.76	4.45	35.70	40.15							74.91
	5.85	55.85	61.70	7.92	63.35	71.27							132.97
YEAR 7	1.65	15.80	17.45	1.77	14.17	15.94							33.39
	2.94	28.15	31.09	3.15	25.24	28.39							59.48
	5.23	49.95	55.18	5.60	44.80	50.40							105.58
YEAR 8	1.51	14.42	15.93	1.45	11.57	13.02							28.95
	2.68	25.69	28.37	2.57	20.61	23.18							51.55
	4.78	45.60	50.38	4.57	36.58	64.33							114.71
YEAR 9	1.40	13.35	14.75	1.25	10.02	11.27	2.67	13.96	16.63				42.65
	2.48	23.79	26.27	2.23	17.85	20.08	4.75	24.87	29.62				75.97
	4.42	42.22	46.64	3.96	31.68	35.64	8.46	44.14	52.60				134.88
YEAR 10	1.31	12.49	13.80	1.12	8.96	10.08	1.89	9.87	11.76	1.16	8.09	9.25	44.89
	2.32	22.25	24.57	1.99	15.96	17.95	3.36	17.59	20.95	2.05	14.41	16.46	79.93
	4.14	39.49	43.63	3.54	28.33	31.87	5.98	31.21	37.19	3.65	25.57	29.22	141.91
YEAR 11	1.23	11.77	13.00	1.02	8.18	9.20	1.54	8.06	9.60	0.82	5.72	6.54	38.34
	2.19	20.98	23.17	1.82	14.57	16.39	2.74	14.36	17.10	1.45	10.19	11.64	68.30
	3.90	37.23	41.13	3.23	25.86	29.09	4.88	25.48	30.36	2.58	18.08	20.66	121.24

Column headings: DIP = dipping bedrock
GLAC = glacial deposits

The three entries for each year refer to low, mid, and high values for hydraulic conductivity discussed in text.

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 1 FLAT STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0076
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3400
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00015	0.51
2.0	0.00011	0.36
3.0	0.00009	0.29
4.0	0.00007	0.25

***** PIT 1 FLAT STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0240
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3400
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00027	0.90
2.0	0.00019	0.64
3.0	0.00015	0.52
4.0	0.00013	0.45

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 1 FLAT STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0760
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3400
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00047	1.61
2.0	0.00033	1.14
3.0	0.00027	0.93
4.0	0.00024	0.80

***** PIT 2 FLAT STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0076
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2800
Drawdown (ft) = 180
Aquifer thick (ft) = 230

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00030	0.85
2.0	0.00021	0.60
3.0	0.00018	0.49
4.0	0.00015	0.42

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 2 FLAT STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0240
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2800
Drawdown (ft) = 180
Aquifer thick (ft) = 230

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00054	1.51
2.0	0.00038	1.07
3.0	0.00031	0.87
4.0	0.00027	0.75

***** PIT 2 FLAT STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0760
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2800
Drawdown (ft) = 180
Aquifer thick (ft) = 230

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00096	2.68
2.0	0.00068	1.90
3.0	0.00055	1.55
4.0	0.00048	1.34

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 4 - 7 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 6500
Drawdown (ft) = 370
Aquifer thick (ft) = 420

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00057	3.70
2.0	0.00040	2.62
3.0	0.00033	2.14
4.0	0.00028	1.85
5.0	0.00025	1.65
6.0	0.00023	1.51
7.0	0.00022	1.40
8.0	0.00020	1.31
9.0	0.00019	1.23

***** PITS 4 - 7 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 6500
Drawdown (ft) = 370
Aquifer thick (ft) = 420

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00101	6.57
2.0	0.00072	4.65
3.0	0.00058	3.80
4.0	0.00051	3.29
5.0	0.00045	2.94
6.0	0.00041	2.68
7.0	0.00038	2.48
8.0	0.00036	2.32
9.0	0.00034	2.19

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 4 - 7 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 6500
Drawdown (ft) = 370
Aquifer thick (ft) = 420

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00180	11.70
2.0	0.00127	8.27
3.0	0.00104	6.75
4.0	0.00090	5.85
5.0	0.00080	5.23
6.0	0.00073	4.78
7.0	0.00068	4.42
8.0	0.00064	4.14
9.0	0.00060	3.90

***** PITS 4 - 7 GLACIAL DEPOSITS, LOW K *****

Hydraulic cond (ft/day) = 0.1260
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 6700
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00527	35.32
2.0	0.00373	24.98
3.0	0.00304	20.39
4.0	0.00264	17.66
5.0	0.00236	15.80
6.0	0.00215	14.42
7.0	0.00199	13.35
8.0	0.00186	12.49
9.0	0.00176	11.77

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 1 - 3 GLACIAL DEPOSITS, HIGH K *****

Hydraulic cond (ft/day) = 1.2600
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3000
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.01667	50.02
2.0	0.01179	35.37
3.0	0.00963	28.88
4.0	0.00834	25.01

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 1 - 3 GLACIAL DEPOSITS, LOW K *****

Hydraulic cond (ft/day) = 0.1260
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3000
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00527	15.82
2.0	0.00373	11.18
3.0	0.00304	9.13
4.0	0.00264	7.91

***** PITS 1 - 3 GLACIAL DEPOSITS, MID K *****

Hydraulic cond (ft/day) = 0.4000
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3000
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00939	28.18
2.0	0.00664	19.93
3.0	0.00542	16.27
4.0	0.00470	14.09

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 3 FLAT STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0240
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00027	0.66
2.0	0.00019	0.47
3.0	0.00015	0.38
4.0	0.00013	0.33

***** PIT 3 FLAT STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0760
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00047	1.18
2.0	0.00033	0.84
3.0	0.00027	0.68
4.0	0.00024	0.59

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 1 & 2 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 100
Aquifer thick (ft) = 150

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00017	0.17
2.0	0.00012	0.12
3.0	0.00010	0.10
4.0	0.00009	0.09

***** PIT 3 FLAT STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0076
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 120
Aquifer thick (ft) = 170

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00015	0.37
2.0	0.00011	0.26
3.0	0.00009	0.22
4.0	0.00007	0.19

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 1 & 2 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 100
Aquifer thick (ft) = 150

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00005	0.05
2.0	0.00004	0.04
3.0	0.00003	0.03
4.0	0.00003	0.03

***** PITS 1 & 2 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 100
Aquifer thick (ft) = 150

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00010	0.10
2.0	0.00007	0.07
3.0	0.00006	0.06
4.0	0.00005	0.05

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 1 & 2 FLAT STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0240
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 40
Aquifer thick (ft) = 90

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00005	0.12
2.0	0.00003	0.08
3.0	0.00003	0.07
4.0	0.00002	0.06

***** PITS 1 & 2 FLAT STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0760
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 40
Aquifer thick (ft) = 90

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00008	0.21
2.0	0.00006	0.15
3.0	0.00005	0.12
4.0	0.00004	0.10

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 2 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 250
Aquifer thick (ft) = 300

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00087	0.87
2.0	0.00061	0.61
3.0	0.00050	0.50
4.0	0.00043	0.43

***** PITS 1 & 2 FLAT STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0076
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 2500
Drawdown (ft) = 40
Aquifer thick (ft) = 90

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00003	0.07
2.0	0.00002	0.05
3.0	0.00002	0.04
4.0	0.00001	0.03

MINE AREA 1: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 2 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 250
Aquifer thick (ft) = 300

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00027	0.27
2.0	0.00019	0.19
3.0	0.00016	0.16
4.0	0.00014	0.14

***** PIT 2 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 1000
Drawdown (ft) = 250
Aquifer thick (ft) = 300

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00049	0.49
2.0	0.00035	0.35
3.0	0.00028	0.28
4.0	0.00024	0.24

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 4 - 7 GLACIAL DEPOSITS, MID K *****

Hydraulic cond (ft/day) = 0.4000
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 6700
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00939	62.94
2.0	0.00664	44.50
3.0	0.00542	36.34
4.0	0.00470	31.47
5.0	0.00420	28.15
6.0	0.00383	25.69
7.0	0.00355	23.79
8.0	0.00332	22.25
9.0	0.00313	20.98

***** PITS 4 - 7 GLACIAL DEPOSITS, HIGH K *****

Hydraulic cond (ft/day) = 1.2600
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 6700
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.01667	111.70
2.0	0.01179	78.99
3.0	0.00963	64.49
4.0	0.00834	55.85
5.0	0.00746	49.95
6.0	0.00681	45.60
7.0	0.00630	42.22
8.0	0.00589	39.49
9.0	0.00556	37.23

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 8 - 10 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3800
Drawdown (ft) = 400
Aquifer thick (ft) = 450

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00066	2.51
2.0	0.00047	1.77
3.0	0.00038	1.45
4.0	0.00033	1.25
5.0	0.00029	1.12
6.0	0.00027	1.02
7.0	0.00025	0.95
8.0	0.00023	0.89
9.0	0.00022	0.84

***** PITS 8 - 10 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3800
Drawdown (ft) = 400
Aquifer thick (ft) = 450

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00117	4.45
2.0	0.00083	3.15
3.0	0.00068	2.57
4.0	0.00059	2.23
5.0	0.00052	1.99
6.0	0.00048	1.82
7.0	0.00044	1.68
8.0	0.00041	1.57
9.0	0.00039	1.48

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 8 - 10 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3800
Drawdown (ft) = 400
Aquifer thick (ft) = 450

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00208	7.92
2.0	0.00147	5.60
3.0	0.00120	4.57
4.0	0.00104	3.96
5.0	0.00093	3.54
6.0	0.00085	3.23
7.0	0.00079	2.99
8.0	0.00074	2.80
9.0	0.00069	2.64

***** PITS 8 - 10 GLACIAL DEPOSITS, LOW K *****

Hydraulic cond (ft/day) = 0.1260
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3800
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00527	20.03
2.0	0.00373	14.17
3.0	0.00304	11.57
4.0	0.00264	10.02
5.0	0.00236	8.96
6.0	0.00215	8.18
7.0	0.00199	7.57
8.0	0.00186	7.08
9.0	0.00176	6.68

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 8 - 10 GLACIAL DEPOSITS, MID K *****

Hydraulic cond (ft/day) = 0.4000
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3800
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00939	35.70
2.0	0.00664	25.24
3.0	0.00542	20.61
4.0	0.00470	17.85
5.0	0.00420	15.96
6.0	0.00383	14.57
7.0	0.00355	13.49
8.0	0.00332	12.62
9.0	0.00313	11.90

***** PITS 8 - 10 GLACIAL DEPOSITS, HIGH K *****

Hydraulic cond (ft/day) = 1.2600
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3800
Drawdown (ft) = 50
Aquifer thick (ft) = 25

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.01667	63.35
2.0	0.01179	44.80
3.0	0.00963	36.58
4.0	0.00834	31.68
5.0	0.00746	28.33
6.0	0.00681	25.86
7.0	0.00630	23.95
8.0	0.00589	22.40
9.0	0.00556	21.12

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 12 & 13 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3700
Drawdown (ft) = 420
Aquifer thick (ft) = 470

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00072	2.67
2.0	0.00051	1.89
3.0	0.00042	1.54
4.0	0.00036	1.34
5.0	0.00032	1.20
6.0	0.00030	1.09
7.0	0.00027	1.01
8.0	0.00026	0.95
9.0	0.00024	0.89

***** PITS 12 & 13 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3700
Drawdown (ft) = 420
Aquifer thick (ft) = 470

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00128	4.75
2.0	0.00091	3.36
3.0	0.00074	2.74
4.0	0.00064	2.38
5.0	0.00057	2.13
6.0	0.00052	1.94
7.0	0.00049	1.80
8.0	0.00045	1.68
9.0	0.00043	1.58

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 12 & 13 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3700
Drawdown (ft) = 420
Aquifer thick (ft) = 470

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00229	8.46
2.0	0.00162	5.98
3.0	0.00132	4.88
4.0	0.00114	4.23
5.0	0.00102	3.78
6.0	0.00093	3.45
7.0	0.00086	3.20
8.0	0.00081	2.99
9.0	0.00076	2.82

***** PITS 12 & 13 GLACIAL DEPOSITS, LOW K *****

Hydraulic cond (ft/day) = 0.1260
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3700
Drawdown (ft) = 40
Aquifer thick (ft) = 20

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00377	13.96
2.0	0.00267	9.87
3.0	0.00218	8.06
4.0	0.00189	6.98
5.0	0.00169	6.24

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PITS 12 & 13 GLACIAL DEPOSITS, MID K *****

Hydraulic cond (ft/day) = 0.4000
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3700
Drawdown (ft) = 40
Aquifer thick (ft) = 20

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00672	24.87
2.0	0.00475	17.59
3.0	0.00388	14.36
4.0	0.00336	12.43
5.0	0.00301	11.12

***** PITS 12 & 13 GLACIAL DEPOSITS, HIGH K *****

Hydraulic cond (ft/day) = 1.2600
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3700
Drawdown (ft) = 40
Aquifer thick (ft) = 20

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.01193	44.14
2.0	0.00844	31.21
3.0	0.00689	25.48
4.0	0.00596	22.07
5.0	0.00534	19.74

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 16 DIPPING STRATA, LOW K *****

Hydraulic cond (ft/day) = 0.0019
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3200
Drawdown (ft) = 290
Aquifer thick (ft) = 340

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00036	1.16
2.0	0.00026	0.82
3.0	0.00021	0.67
4.0	0.00018	0.58
5.0	0.00016	0.52

***** PIT 16 DIPPING STRATA, MID K *****

Hydraulic cond (ft/day) = 0.0060
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3200
Drawdown (ft) = 290
Aquifer thick (ft) = 340

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00064	2.05
2.0	0.00045	1.45
3.0	0.00037	1.19
4.0	0.00032	1.03
5.0	0.00029	0.92

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 16 DIPPING STRATA, HIGH K *****

Hydraulic cond (ft/day) = 0.0190
Storage (1/ft) = 3.00E-07
Pit wall length (ft) = 3200
Drawdown (ft) = 290
Aquifer thick (ft) = 340

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00114	3.65
2.0	0.00081	2.58
3.0	0.00066	2.11
4.0	0.00057	1.83
5.0	0.00051	1.63

***** PIT 16 GLACIAL DEPOSITS, LOW K *****

Hydraulic cond (ft/day) = 0.1260
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3300
Drawdown (ft) = 30
Aquifer thick (ft) = 15

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00245	8.09
2.0	0.00173	5.72
3.0	0.00141	4.67
4.0	0.00123	4.04
5.0	0.00110	3.62

MINE AREA 2: 1-D TRANSIENT STATE INFLOW RESULTS

***** PIT 16 GLACIAL DEPOSITS, MID K *****

Hydraulic cond (ft/day) = 0.4000
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3300
Drawdown (ft) = 30
Aquifer thick (ft) = 15

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00437	14.41
2.0	0.00309	10.19
3.0	0.00252	8.32
4.0	0.00218	7.20
5.0	0.00195	6.44

***** PIT 16 GLACIAL DEPOSITS, HIGH K *****

Hydraulic cond (ft/day) = 1.2600
Storage (Sya) = 1.50E-01
Pit wall length (ft) = 3300
Drawdown (ft) = 30
Aquifer thick (ft) = 15

YEAR	UNIT INFLOW Gpm/ft	TOT. WALL INFLOW Gpm
1.0	0.00775	25.57
2.0	0.00548	18.08
3.0	0.00447	14.76
4.0	0.00387	12.78
5.0	0.00347	11.44

```
'PROGRAM PLANEQUE
'ONE-DIMENSIONAL SOLUTIONS TO GROUNDWATER FLOW

WRITTEN BY L. COPE, GOLDER ASSOCIATES, 1989.

'THE EQUATION FOR DISCHARGE (OPTION 9 IN THE MENU) IS THE
'BANK STORAGE EQUATION GIVEN ON PAGE 74 OF "TRANSIENT GROUNDWATER
'HYDRAULICS" BY R.E. GLOVER, 1974.


Defdbl C-H,J-Z: defstr A,B: DEFINT I
SZERO=200:K=.0019:THIC=150:STOR=.05:TIM=365:LENG=1000
NSTEP=10.:ATIT="OUTPUT TABLE":AFLAG="SCREEN"
50 CLS:PRINT "     1-D SOLUTIONS FOR FLOW IN A VERTICAL PLANE"
PRINT "    ***********************************************"
PRINT "    0   TITLE FOR OUTPUT:     ";ATIT
PRINT "    1   DRAWDOWN (So) IN FEET                     ";SZERO
PRINT USING "    2   HYDRAULIC CONDUCTIVITY (K) IN FEET/DAY:#####.####";K
PRINT USING "    3   STORAGE PARAMETER (S/Sya):              #####.####";STOR
PRINT "    4   AVERAGE AQUIFER THICKNESS (b) IN FEET:    ";THIC
PRINT "    5   NUMBER OF TIME STEP (print times):        ";NSTEP
PRINT "    6   NUMBER OF DAYS PER TIME STEPS (t):        ";TIM
PRINT "    7   LENGTH OF PIT WALL (LENG) IN FEET:        ";LENG:PRINT
PRINT "        =======  TRANSIENT STATE SOLUTION ======="
PRINT "    8   SOLVE EQUATION FOR DRWDWN DISTANCE FROM WALL (feet)"
PRINT "    9   SOLVE EQUATION FOR WALL DISCHARGE":PRINT
PRINT "        =======   STEADY STATE SOLUTION   ========"
PRINT "    10  SOLVE FOR INFILTRATION GIVEN (L) AND (H)"
PRINT "    ***********************************************"
PRINT "    11  ACTIVATE OUTPUT TO DISK FILE  =======>   ";AFLAG
PRINT "    12  OUTPUT FILE NAME ====>   ";AFNAM
PRINT "    13  QUIT PROGRAM
PRINT:INPUT "Enter selection:";IN
  IF IN=0 THEN
    input "      Title for output listing";ATIT
  ELSEIF IN=1 THEN
    input "      Drawdown (feet)";SZERO
  ELSEIF IN=2 THEN
    input "      Hydraulic Conductivity (feet/day)";K
  ELSEIF IN=3 THEN
    input "      Storage parameter";STOR
  ELSEIF IN=4 THEN
    input "      Average aquifer thickness (feet)";THIC
  ELSEIF IN=5 THEN
    input "      number of time steps";NSTEP
  ELSEIF IN=6 THEN
    input "      Days per timestep";TIM
  ELSEIF IN=7 THEN
    input "      Length of pit wall (feet)";LENG
  ELSEIF IN=8 THEN :CLS
    PRINT "                ";ATIT:PRINT:PRINT
    input " Enter integral value (From Tab.8, Glover,74)";ERFVAL
    TSALFA=K*SZERO/2/STOR
```

```
      PRINT:PRINT " s = ";SZERO,"K = ";k:PRINT USING "     ALPHA= ###.##";TSALFA
      PRINT:PRINT "  YEAR     DIST (ft.) "
      PRINT "            FROM WALL "
      PRINT " ======================="
      FOR I=1 TO NSTEP
        DAY= I*TIM : YEAR=DAY/365.25
        L= (ERFVAL)*((4*TSALFA*DAY)^.5)
        PRINT USING "####.##   #####,.#";YEAR,L
      NEXT I
      GOTO 40
    ELSEIF IN=9 THEN
      goto 100
    ELSEIF IN=10 THEN
      CLS:PRINT:PRINT:PRINT "                ";ATIT:PRINT
      PRINT:INPUT "  Average annual precipitation";precip
      PRINT:INPUT "  Distance that infiltration is caught by pit";L
      PRINT:PRINT "  Thickness Ho is assumed to be 50 feet.  Enter"
      INPUT "  the saturated thickness plus 50 feet (H1) ";H1
      PRINT:PRINT:PRINT:PRINT
      W=((K*365.25)*(H1^2 - 2500))/L^2
      WIN=W*12.
      PCNT=WIN/PRECIP*100.
      PRINT USING "    HYDRAULIC CONDUCTIVITY (ft/day)= ##.###";K
      PRINT "    ANNUAL PRECIP. (Inches)        = ";PRECIP
      PRINT USING "    ANNUAL INFILTRATION (Inches)   = ##.##";WIN
      PRINT USING "    INFILT/PRECIP (Percent)        = ###.##";PCNT;
      PRINT:PRINT:PRINT
      IF PCNT>100. THEN PRINT "WARNING: INFILTRATION EXCEEDS PRECIPITATION.
      GOTO 40
    ELSEIF IN=11 THEN
     AFLAG="FILE"
    ELSEIF IN=12 THEN
      print:input "   New name of output file  ";AFNAM
    ELSEIF IN=13 THEN
      goto 200
    END IF
  GOTO 50
  100 PI=3.1416 : T=K*THIC
  CLS:PRINT "        *****  ";ATIT;"  *****":PRINT
  PRINT USING "          Hydraulic cond = #.####";K
  PRINT USING "          Storage coef   = #.####";STOR
  PRINT "          Pit wall length=";leng
  PRINT "          Drawdown       =";szero
  PRINT "          Aquifer thick. =";thic:print
  PRINT "                UNIT       TOT. WALL
  PRINT "      YEAR     INFLOW       INFLOW"
  PRINT "                Gpm/ft       Gpm
  PRINT "   ================================="
  IF AFLAG="SCREEN" GOTO 60
  OPEN AFNAM FOR APPEND AS #1
  PRINT #1,:PRINT #1,:PRINT #1,:PRINT #1,:PRINT #1, "          *****   ";ATIT;
  *****":PRINT #1,
  PRINT #1, USING "          Hydraulic cond = #.####";K
  PRINT #1, USING "          Storage coef   = #.####";STOR
```

```
PRINT #1, "          Pit wall length =";leng
PRINT #1, "          Drawdown        =";szero
PRINT #1, "          Aquifer thick.  =";thic:
PRINT #1,
PRINT #1, "                 UNIT       TOT. WALL
PRINT #1, "      YEAR      INFLOW       INFLOW"
PRINT #1, "                 Gpm/ft       Gpm
PRINT #1, "     ==============================="
60 FOR I=1 TO NSTEP
    DAY=I*TIM:YEAR=DAY/365.25
    Q=SZERO*T/((PI*(T/STOR)*DAY)^.5)
    QGPM=(Q*7.48)/1440
    TOTQ=QGPM*LENG
    PRINT USING "########.#    ##.#####   #####.##";YEAR,QGPM,TOTQ
    IF AFLAG="SCREEN" GOTO 70
    PRINT #1, USING "########.#    ##.#####   #####.##";YEAR,QGPM,TOTQ
70 NEXT I
CLOSE #1
40 PRINT:INPUT "        press enter for menu";B
AFLAG="SCREEN"
GOTO 50
200 CLS:END^Z
```

APPENDIX L.2

STEADY-STATE 1-DIMENSIONAL ANALYSIS OF INFLOW

Golder Associates	Subject 1-D STEADY STATE	Made by LEC	Job No. 893-2145
		Checked by	Date 8/11/89
		Approved by	Sheet No. 1/4

CALCULATIONS

USING 1-D STEADY STATE SOLN

ASSUMPTIONS

- NO RECHARGE FROM PRECIPITATION OR SURFACE WATER
- NO LEAKAGE FROM THE GLACIAL DEPOSITS TO THE BEDROCK
- A CONSTANT HEAD BOUNDARY IS ASSUMED AT SOME DISTANCE FROM THE PITS. DISTANCE TO THE BOUNDARY IS CONTROLLED BY SURFACE TOPOGRAPHY AND BY DISTANCE TO SURFACE WATER.

ESTIMATED DISTANCES (L) ARE:

L = 1000 ft. for mine area 1
L = 1500 ft. for mine area 2

THE EQUATION USED:

$$Q = \frac{K}{2L}\left(h_L^2 - h_o^2\right)$$

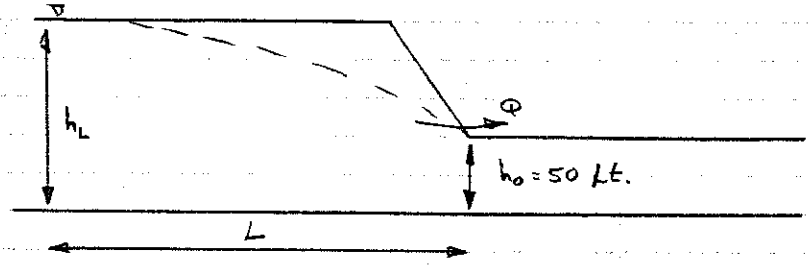
unconfined - steady state, as presented by Sunada & McWhorter, 1977, Groundwater hydrology and hydraulics, pg 147.

L = distance to constant head
h_L = Saturated thickness at distance L
h_o = Saturated thickness at toe of pit wall

Golder Associates	Subject: 1-D STEADY STATE	Made by: LEC	Job No. 893-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 2/4

BEDROCK

physical model:



MINE AREA 1

$K = 0.0076,\ 0.024,\ 0.076$ ft/day
$L = 1000$ ft.
$h_L = 250$ ft.

$$Q = \frac{(0.0076)}{2(1000)}(250^2 - 50^2) = 0.228 \text{ ft}^3/\text{day}/\text{ft.}$$

$$Q = \frac{(0.024)}{2(1000)}(250^2 - 50^2) = 0.720 \text{ ft}^3/\text{day}/\text{ft.}$$

$$Q = \frac{(0.076)}{2(1000)}(250^2 - 50^2) = 2.280 \text{ ft}^3/\text{day}/\text{ft.}$$

MINE AREA 2

$K = 0.0019,\ 0.006,\ 0.019$ ft/day
$L = 1500$ ft
$h_L = 450$ ft

$$Q = \frac{(0.0019)}{2(1500)}(450^2 - 50^2) = 0.127 \text{ ft}^3/\text{day}/\text{ft}$$

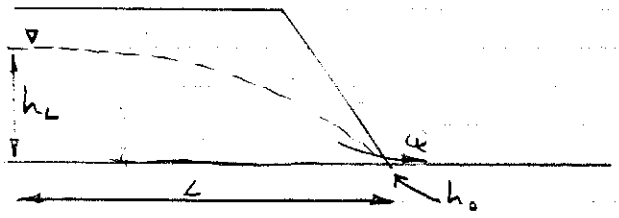
$$Q = \frac{(0.006)}{2(1500)}(450^2 - 50^2) = 0.40 \text{ ft}^3/\text{day}/\text{ft}$$

$$Q = \frac{(0.019)}{2(1500)}(450^2 - 50^2) = 1.27 \text{ ft}^3/\text{day}/\text{ft}$$

Golder Associates	Subject 1-D STEADY STATE	Made by LEC	Job No. 883-2145
		Checked by	Date 8/11/89
		Approved by	Sheet No. 3/4

GLACIAL DEPOSITS

physical model:



MINE AREA 1

$K = 0.126,\ 0.40,\ 1.26$ ft/day
$L = 1000$ ft
$h_L = 50$ ft

$$Q = \frac{(0.126)}{2(1000)}(50^2 - 0^2) = 0.158 \text{ ft}^3/\text{day}/\text{ft}$$

$$Q = \frac{(0.40)}{2(1000)}(50^2 - 0^2) = 0.500 \text{ ft}^3/\text{day}/\text{ft}$$

$$Q = \frac{(1.26)}{2(1000)}(50^2 - 0^2) = 1.58 \text{ ft}^3/\text{day}/\text{ft}$$

MINE AREA 2

$$Q = \frac{(0.126)}{2(1500)}(50^2 - 0^2) = 0.105 \text{ ft}^3/\text{day}/\text{ft}$$

$$Q = \frac{(0.40)}{2(1500)}(50^2 - 0^2) = 0.33 \text{ ft}^3/\text{day}/\text{ft}$$

$$Q = \frac{(1.26)}{2(1500)}(50^2 - 0^2) = 1.05 \text{ ft}^3/\text{day}/\text{ft}$$

Golder Associates	Subject: 1-D Steady State	Made by: LEC	Job No. 883-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 4/9

— Summary of Results —

for

1-D steady-state mine Inflow

	K	INFLOW (GPM) Bedrock gpm	Glacial Deposits gpm	Total gpm
MINE AREA I (Q x 8,100)	LO	9.6	6.6	16.2
	MID	30.3	21.0	51.3
	HI	95.9	66.2	162.1
MINE AREA II (Q x 15,400)	LO	10.2	8.4	18.6
	MID	32.0	26.7	58.7
	HI	101.6	84.0	185.6

APPENDIX L.3
TRANSIENT RADIAL
ANALYSIS OF INFLOW

Golder Associates	Subject: RADIAL TRANSIENT STATE WISHBONE HILL MINE INFLOW	Made by: LEC	Job No. 883-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 1/4

CALCULATION OF MINE INFLOW
USING RADIAL TRANSIENT STATE
SOL'N

ASSUMPTIONS

- NO RECHARGE FROM PRECIPITATION, SURFACE WATER, OR INTO BEDROCK FROM GLACIAL DEPOSITS
- A LARGE OPEN PIT BEHAVES HYDRAULICALLY LIKE A LARGE DIAMETER WELL.
- THE USUAL THEIS ASSUMPTIONS OF HORIZONTAL RADIAL FLOW IN AN INFINITE AQUIFER ARE VALID AT THE SITE.
- VALUES FOR (u) ARE ≤ 10.
  SINCE:

$$u = \frac{r^2 S}{4Kt},$$

THE CONDITION FOR $u \leq 10$ IS TRUE WHEN (r) IS THE LARGE RADIUS OF AN OPEN-PIT MINE ONLY IF:

STORAGE (S) IS VERY SMALL $\Rightarrow$ CONFINED
and/or HYD. COND. (K) IS VERY LARGE
and/or time (t) IS VERY LARGE

OVER THE LIFE OF THE MINE ($t \leq 10$ YEARS), AND WITH THE GIVEN VALUES OF (r) AND (K), SPECIFIC YIELD VALUES OF 0.05 - 0.20 PRODUCE $u \gg 10$.

CONSEQUENTLY, THE SOLUTION IS ONLY VALID FOR CONFINED FLOW HAVING LOW STORAGE (S_S BEDROCK $\approx 10^{-7}/ft$).

- EQUIVALENT MINE AREA RADII ARE CHOSEN THAT CORRESPOND TO ACTUAL MINE OPEN AREAS:

$$A = \pi r^2 \Rightarrow r = (\pi/A)^{1/2}$$

Golder Associates	Subject: RADIAL TRANSIENT STATE WISHBONE HILL MINE INFLOW	Made by: LEC	Job No. 883-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 2/4

FOR:

MINE AREA 1, $r = 950$ ft

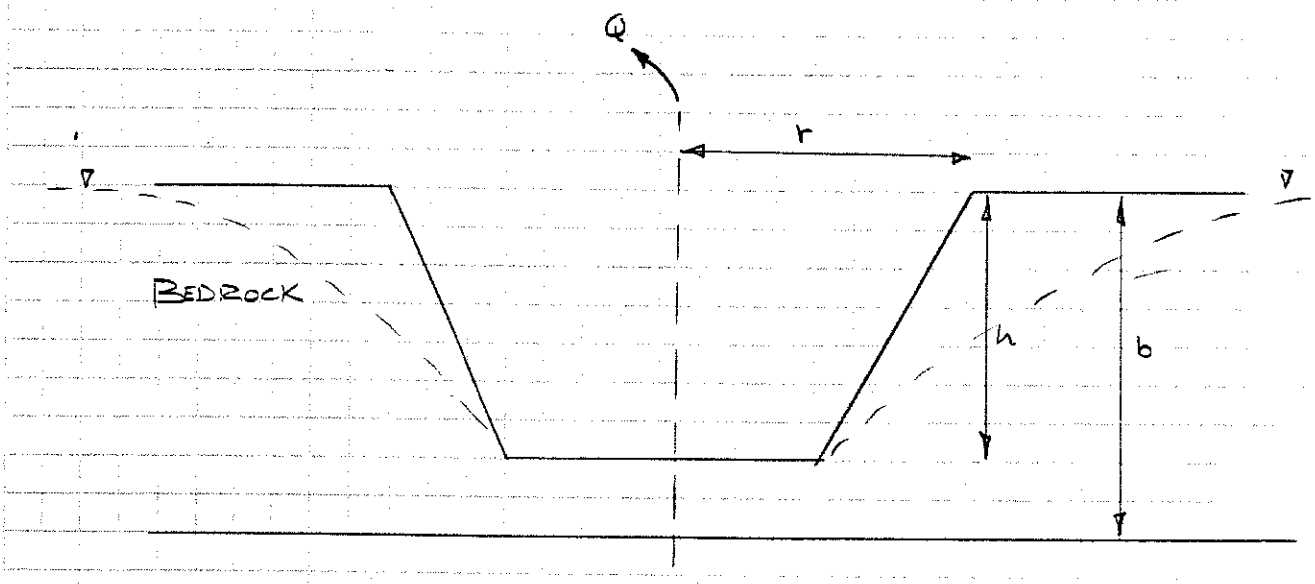
MINE AREA 2, $r = 1700$ ft.

- VALUES FOR MINE INFLOW ARE CALCULATED BY THE THEIS EQUATION:

$$u = \frac{r^2 S}{4Kt}$$

$(u) \Longrightarrow W(u)$ from well function tables

$$Q = \frac{4\pi K b h}{W(u)}$$



Golder Associates	Subject: RADIAL TRANSIENT STATE WISHBONE HILL MINE INFLOW	Made by: LEC	Job No. 883-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 3/4

MINE AREA 1

$r = 950$ ft
$K = 0.0076,\ 0.024,\ 0.076$ ft/day
$S_s = 3 \times 10^{-7}$ / ft

$h = 200$
$b = 250$
$t = 1 \rightarrow 3$ YEARS

	K	u	W(u)	Q (gpm)
YEAR 1	LO	2.44×10^{-2}	3.15	7.85
	MID	7.72×10^{-2}	4.3	18.2
	HI	2.44×10^{-3}	5.44	45.58
YEAR 2	LO	1.22×10^{-2}	3.86	6.46
	MID	3.86×10^{-3}	4.98	15.72
	HI	1.22×10^{-3}	6.13	40.44
YEAR 3	LO	8.13×10^{-3}	4.25	5.85
	MID	2.57×10^{-3}	5.40	14.54
	HI	8.13×10^{-4}	6.54	37.94
YEAR 4	LO	6.1×10^{-3}	4.53	5.48
	MID	1.93×10^{-3}	5.67	13.80
	HI	6.1×10^{-4}	6.83	36.34

Golder Associates	Subject: RADIAL TRANSIENT STATE WISHBONE HILL MINE INFLOW	Made by: LEC	Job No. 883-2145
		Checked by:	Date: 8/11/89
		Approved by:	Sheet No. 4/4

MINE AREA 2

	K	(u)	w(u)	Q (gpm)
YEAR 3	LO	3.12×10^{-1}	0.88	25.48
	MID	9.89×10^{-2}	1.83	38.52
	HI	3.12×10^{-2}	2.90	76.98
YEAR 4	LO	1.56×10^{-1}	1.43	15.61
	MID	4.95×10^{-2}	2.48	28.43
	HI	1.56×10^{-2}	3.6	62.01
YEAR 5	LO	1.04×10^{-1}	1.78	12.5
	MID	3.3×10^{-2}	2.87	24.56
	HI	1.04×10^{-2}	4.03	55.40
YEAR 6	LO	7.81×10^{-2}	2.05	10.89
	MID	2.47×10^{-2}	3.14	22.45
	HI	7.81×10^{-3}	4.28	52.12
YEAR 7	LO	6.25×10^{-2}	2.26	9.89
	MID	1.98×10^{-2}	3.35	21.04
	HI	6.25×10^{3}	4.49	49.56
YEAR 8	LO	5.21×10^{-2}	2.43	9.19
	MID	1.65×10^{-2}	3.53	19.97
	HI	5.21×10^{-3}	4.69	47.60
YEAR 9	LO	4.46×10^{-2}	2.58	8.66
	MID	1.41×10^{-2}	3.70	19.05
	HI	4.46×10^{-3}	4.84	46.12
YEAR 10	LO	3.90×10^{-2}	2.70	8.25
	MID	1.24×10^{-2}	3.80	18.55
	HI	3.90×10^{-3}	4.97	44.92
YEAR 11	LO	3.47×10^{-2}	2.82	7.92
	MID	1.10×10^{-2}	3.94	17.89
	HI	3.47×10^{-3}	5.10	43.77

$r = 1700$ ft
$K = 0.0019$
0.006
0.019 ft/day
$S = 3 \times 10^{-7}$/ft
$h = 400$ ft
$b = 450$ ft
$t = 1 \rightarrow 9$ years
(3 → 11 mine years)

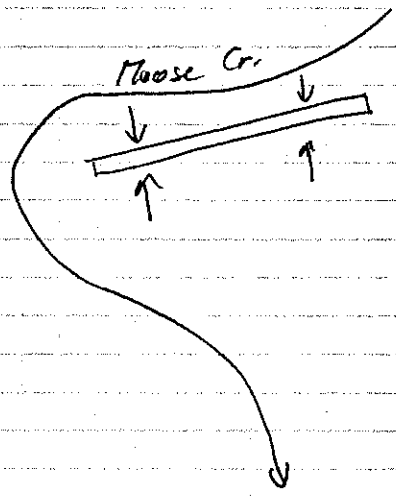
APPENDIX L.4

ANALYSIS OF WATER LEVEL DRAWDOWNS

Golder Associates	Subject: Wishbone Hill Coal - WL Impacts	Made by: [illegible]	Job No. 883-2145.003
		Checked by:	Date: 1/27/96
		Approved by:	Sheet No. 1

<u>Objective</u>: Estimate the distance from the open pits that water level drawdowns caused by pit inflow will occur.

<u>Approach</u>: Idealize open pits as a long trench or slot with axis running NE-SW and 9,000 feet long based on Fig 4-1 from Chap III.



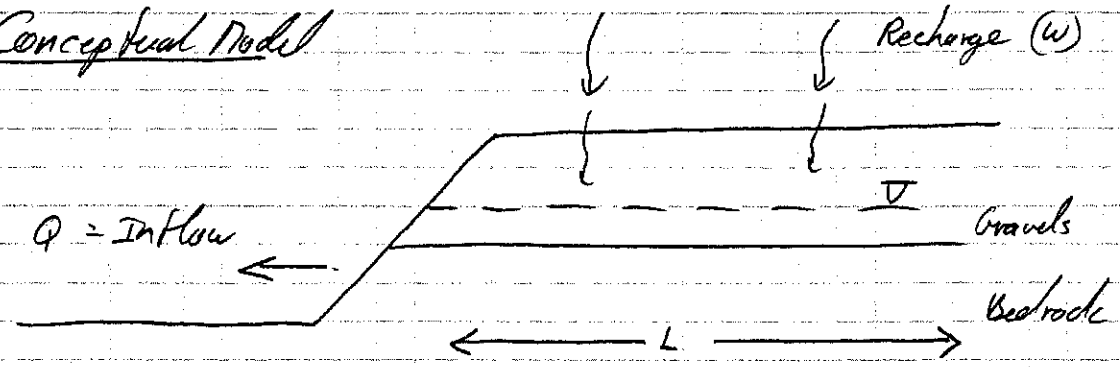
At steady-state, drawdowns will be at maximum around pits. Inflow will be supplied by surface recharge from precipitation + infiltration to water table. Water table aquifer will provide vertical leakage to bedrock.

<u>Estimated Recharge</u>: based on experience, infiltration to groundwater should be 2" per year or greater. Assume 2 values as representative ⇒ 2"/yr = 4.57×10^{-4} ft³/day/ft²

4"/yr = 9.13×10^{-4} ft³/day/ft²

Golder Associates	Subject	Made by	Job No. 883-2245.003
		Checked by	Date 1/27/90
		Approved by	Sheet No. 2

Conceptual Model



Q_{tot} = Total Inflow to pit, based on inflow analysis in Section 2.0 the maximum inflow to the pits is expected to be 200 gpm. Half will come from north (i.e. from area between pits + Moose Creek) and half from South of idealized trench. Inflow per unit length of trench will be

$$Q_{unit} = Q_{tot} / 2 / 9000 \text{ ft}$$

$$Q_{unit} = 200 \text{ gpm} / 18000 = 1.11 \times 10^{-2} \text{ gpm/ft}$$

$$Q_u = 2.14 \text{ ft}^2/\text{day}/\text{ft}$$

At steady state recharge = inflow

$$\text{Recharge} = W \times L$$ where L is perpendicular distance from trench.

$$Q_u = WL \Rightarrow L = Q_u/W$$

for $W = 2''/yr$

$$L = \frac{2.14 \text{ ft}^3/\text{day}/\text{ft}}{4.57 \times 10^{-4} \text{ ft}^3/\text{day}/\text{ft}^2} = 4{,}680 \text{ ft}$$

for $W = 4''/yr$

$$L = \frac{2.14 \text{ ft}^3/\text{day}/\text{ft}}{9.13 \times 10^{-4} \text{ ft}^3/\text{day}/\text{ft}^2} = 2{,}340 \text{ ft}$$

Golder Associates	Subject	Made by J Rowe	Job No. 883-2145.003
		Checked by	Date 1/27/90
		Approved by	Sheet No. 3

Conclusions: Based on steady-state flow the total inflow to the pit from both glacial sediments and bedrock can be sustained by a recharge area from 2,340 to 4,680 ft from the pit. This estimate is conservative since it assumes steady-state conditions (no inflow from aquifer storage) and maximum estimated pit inflows.