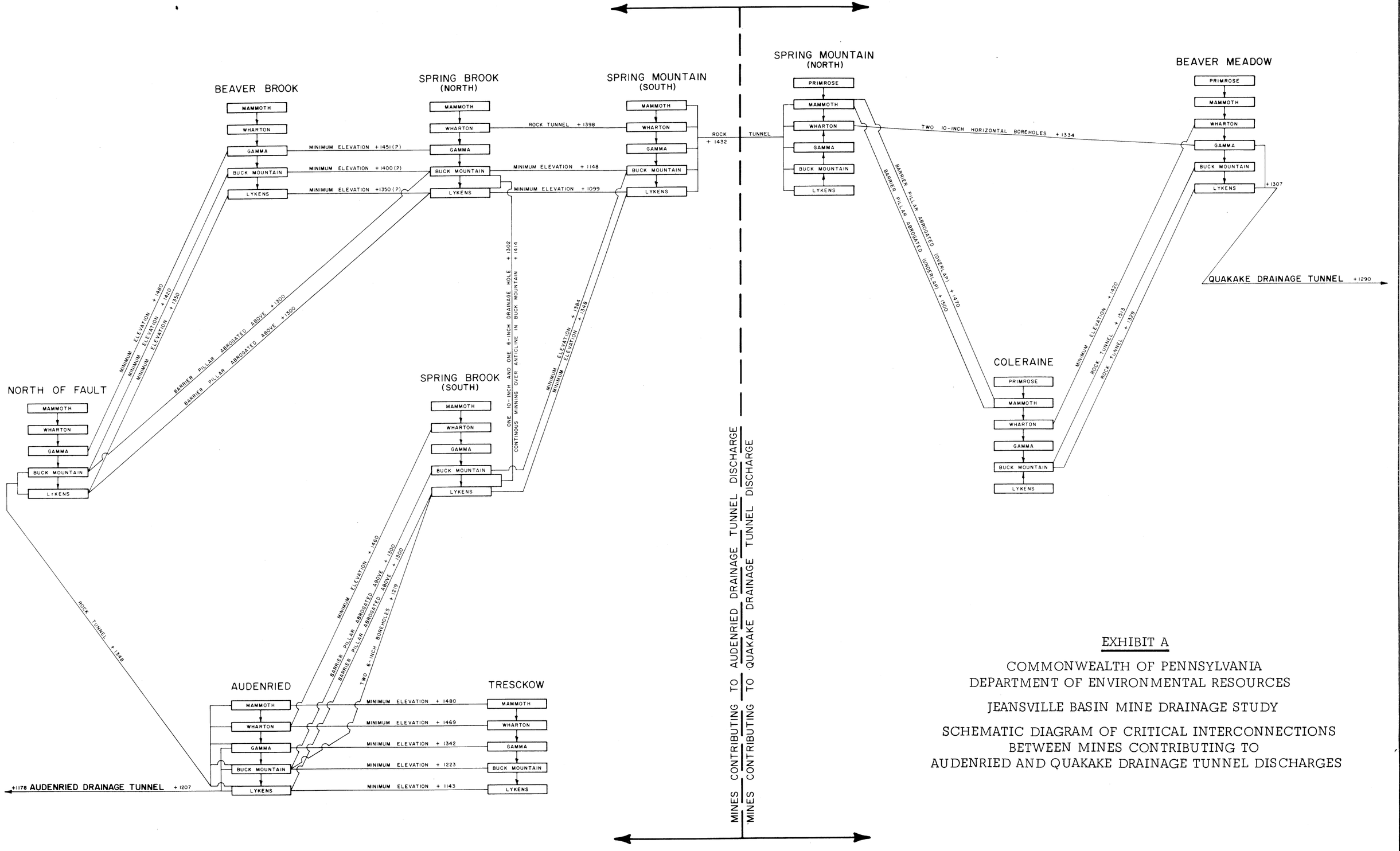

EXHIBIT A

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE STUDY

SCHEMATIC DIAGRAM OF CRITICAL INTERCONNECTIONS
BETWEEN MINES CONTRIBUTING TO
AUDENRIED AND QUAKAKE DRAINAGE TUNNEL DISCHARGES

EXHIBIT B

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

CONTROLLING INTERCONNECTIONS BETWEEN MINES DRAINED BY AUDENRIED DRAINAGE TUNNEL

Interconnected Mines	Type Of Interconnection	Elevation (1)
Audenried Tunnel	-	+1178
Audenried - North of Fault	Rock tunnel	+1348
Audenried - Tresckow	Continuous mining across boundary in:	
	(a) Mammoth vein	(a) +1480 (3)
	(b) Wharton vein	(b) +1469 (3)
	(c) Gamma vein	(c) +1342 (3)
	(d) Buck Mountain vein	(d) +1223 (3)
	(e) Lykens vein	(e) +1143 (3)
Audenried - Spring Brook	Continuous mining across boundary in Wharton vein	-
	Two 6-inch horizontal boreholes drilled from Buck Mountain vein in Audenried Mine to Lykens vein in Spring Brook Mine (2)	+1219
	Barrier pillar in Buck Mountain and Lykens Overlap and Underlap veins abrogated	+1300 (3)

Exhibit B
Jeansville Basin
Sheet 2 of 2

Interconnected Mines	Type Of Interconnection	Elevation (1)
North of Fault - Spring Brook	Barrier pillar in Buck Mountain and Lykens Overlap and Underlap veins abrogated	+1300 (3)
North of Fault - Beaver Brook	Continuous mining across boundary in:	
	(a) Gamma vein	(a) +1480 (3)
	(b) Buck Mountain vein	(b) +1420 (3)
	(c) Lykens vein	(c) +1350 (3)
Beaver Brook - Spring Brook	Continuous mining across boundary in:	(4)
	(a) Gamma vein	
	(b) Buck Mountain vein	
	(c) Lykens vein	
Spring Brook - Spring Mountain	Rock tunnel connecting Wharton vein workings	+1398
	Continuous mining across boundary in:	
	(a) Buck Mountain vein	(a) +1148 (3)
	(b) Lykens vein	(b) +1099 (3)

(1) Coal company based elevations.

(2) Buck Mountain vein was subsequently gobbed in this location; this may cause a severe restriction in flow.

(3) Minimum elevation at boundary.

(4) Available mine maps show no interconnections; cross section maps of Spring Brook and Beaver Brook indicate continuous mining.

EXHIBIT C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

CONTROLLING INTERCONNECTIONS BETWEEN MINES DRAINED BY QUAKAKE DRAINAGE TUNNEL

Interconnected Mines	Type Of Interconnection	Elevation (1)
Quakake Tunnel	-	+1290
Spring Mountain - Coleraine	Barrier pillar abrogated in Mammoth Overlap vein	+1470 (2)
	Barrier pillar abrogated in Mammoth Underlap vein	+1500 (2)
	Continuous mining across boundary in Wharton vein	+1580 (2)
Spring Mountain - Beaver Meadow	Two 10-inch horizontal holes in dam constructed across gangway connecting Wharton vein in Spring Mountain to Gamma vein in Beaver Meadow	+1334
Coleraine - Beaver Meadow	Rock tunnel from Buck Mountain vein in Coleraine to Lykens Valley Shaft in Beaver Meadow	+1329
	Continuous mining across boundary in Wharton vein	+1420 (2)
	Rock tunnel in Buck Mountain vein	+1513

(1) Coal company based elevations.

(2) Minimum elevation at boundary.

EXHIBIT D

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

MINE DRAINAGE VOLUMES, CONSTITUENTS, AND CHARACTERISTICS
MEASURED AT AUDENRIED AND QUAKAKE TUNNELS
DURING GAGING, SAMPLING, AND ANALYTICAL PROGRAM

Location	Date	Volume (mgd)	pH	Alkalinity (mg/l)	Alkalinity (lbs/day)	Acidity (as $CaCO_3$) (mg/l)	Acidity (as $CaCO_3$) (lbs/day)	Total Iron (mg/l)	Total Iron (lbs/day)	Aluminum (mg/l)	Manganese (mg/l)	Sulfates (mg/l)	Total Solids (mg/l)
Audenried Tunnel	11-25-69	8.9	3.3	0	0	432	32,100	5.4	402	-	-	660	-
	12-12-69	14.1	3.2	0	0	420	49,500	4.5	530	-	8.1	500	979 (1)
	2-24-70	24.6	3.4	0	0	300	61,700	3.9	802	-	-	480	-
	3-2-70	25.8	-	-	-	-	-	-	-	-	-	-	-
	3-10-70	17.9	-	-	-	-	-	-	-	-	-	-	-
	4-2-70	18.4	-	-	-	-	-	-	-	-	-	-	-
	4-9-70	44.6	3.5	0	0	256	95,600	0.9	336	-	-	366	-
	4-16-70	28.7	-	-	-	-	-	-	-	-	-	-	-
	4-24-70	27.7	-	-	-	-	-	-	-	-	-	-	-
	5-1-70	22.8	-	-	-	-	-	-	-	-	-	-	-
	5-8-70	22.2	-	-	-	-	-	-	-	-	-	-	-
	5-15-70	18.9	3.4	0	0	320	50,600	3.3	521	-	-	488	-
	5-21-70	20.7	-	-	-	-	-	-	-	-	-	-	-
	5-27-70	17.9	-	-	-	-	-	-	-	-	-	-	-

Location	Date	Volume (mgd)	pH	Alkalinity (mg/l)	Alkalinity (lbs/day)	Acidity (as $CaCO_3$) (mg/l)	Acidity (as $CaCO_3$) (lbs/day)	Total Iron (mg/l)	Total Iron (lbs/day)	Aluminum (mg/l)	Manganese (mg/l)	Sulfates (mg/l)	Total Solids (mg/l)
Audenried Tunnel (Cont'd.)	6-4-70	16.3	-	-	-	-	-	-	-	-	-	-	-
	6-11-70	11.3	3.3	0	0	344	32,500	3.9	368	17.9	6.7	454	828
	7-9-70	7.3	3.3	0	0	344	20,900	6.8	417	-	-	550	-
	8-5-70	16.1	3.4	0	0	372	50,100	3.4	458	-	-	548	-
	9-11-70 (2)	9.0	3.2	0	0	348	26,100	8.2	618	-	-	500	-
	9-11-70 (3)	9.3	3.2	0	0	352	27,300	7.8	608	-	-	490	-
Quakake Tunnel	11-25-69	7.3	3.2	0	0	340	20,700	5.4	329	-	-	480	-
	12-11-69	10.7	3.4	0	0	236	21,100	1.6	143	-	4.2	380	520 (1)
	2-24-70	16.0	3.5	0	0	228	30,500	2.5	344	-	-	390	-
	3-2-70	15.7	-	-	-	-	-	-	-	-	-	-	-
	3-10-70	13.6	-	-	-	-	-	-	-	-	-	-	-
	4-2-70	33.6	-	-	-	-	-	-	-	-	-	-	-
	4-9-70	40.6	3.6	-	-	160	54,300	0.7	238	-	-	230	-
	4-16-70	27.9	-	-	-	-	-	-	-	-	-	-	-
	4-24-70	22.3	-	-	-	-	-	-	-	-	-	-	-
	5-1-70	26.6	-	-	-	-	-	-	-	-	-	-	-
	5-8-70	20.0	-	-	-	-	-	-	-	-	-	-	-
	5-15-70	20.9	3.4	0	0	192	33,500	2.0	350	-	-	312	-

Exhibit D
Jeansville Basin
Sheet 2 of 3

Location	Date	Volume (mgd)	pH	Alkalinity (mg/l)	Alkalinity (lbs/day)	Acidity (as $CaCO_3$) (mg/l)	Acidity (as $CaCO_3$) (lbs/day)	Total Iron (mg/l)	Total Iron (lbs/day)	Aluminum (mg/l)	Manganese (mg/l)	Sulfates (mg/l)	Total Solids (mg/l)
Quakake Tunnel (Cont'd.)	5-21-70	14.7	-	-	-	-	-	-	-	-	-	-	-
	5-27-70	16.1	-	-	-	-	-	-	-	-	-	-	-
	6-4-70	15.1	-	-	-	-	-	-	-	-	-	-	-
	6-11-70	13.7	3.3	0	0	264	30,200	5.4	619	11.8	4.9	356	622
	7-9-70	9.8	3.4	0	0	204	16,700	4.9	401	-	-	300	-
	8-5-70	17.0	3.4	0	0	220	31,300	2.0	284	-	-	312	-
	9-11-70 (4)	8.9	3.3	0	0	252	18,700	6.4	476	-	-	420	-
	9-11-70 (5)	9.2	3.3	0	0	260	20,000	5.7	438	-	-	410	-

(1) Analyzed for dissolved solids only.

(2) Sample collected at 7:00 A.M.

(3) Sample collected at 2:00 P.M.

(4) Sample collected at 8:00 A.M.

(5) Sample collected at 1:00 P.M.

Exhibit D
Jeansville Basin
Sheet 3 of 3

EXHIBIT E

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

MINE DRAINAGE VOLUMES, CONSTITUENTS, AND CHARACTERISTICS
MEASURED AT AUDENRIED AND QUAKAKE TUNNELS DURING
LOW, AVERAGE, AND HIGH GROUNDWATER CONDITIONS

Groundwater Conditions	Audenried Tunnel	Quakake Tunnel
Low		
Volume (mgd)	9.1	8.5
pH Range	3.2-3.4	3.2-3.3
Total Iron		
mg/l	7.1	5.8
tons/day	0.27	0.21
Acid (as $CaCO_3$)		
mg/l	380.	284.
tons/day	14.4	10.1
Average		
Volume (mgd)	16.6	15.0
pH Range	3.2-3.5	3.2-3.6
Total Iron		
mg/l	4.6	3.6
tons/day	0.32	0.23
Acid (as $CaCO_3$)		
mg/l	345.	235.
tons/day	23.8	14.7
High		
Volume (mgd)	22.6	18.1
pH Range	3.2-3.5	3.4-3.6
Total Iron		
mg/l	3.1	1.6
tons/day	0.29	0.12
Acid (as $CaCO_3$)		
mg/l	329.	208.
tons/day	31.	15.7

EXHIBIT F

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

ASSUMPTIONS AND CALCULATIONS USED TO ESTABLISH DESIGN MINE DRAINAGE VOLUMES AT AUDENRIED AND QUAKAKE TUNNELS

Design Average Mine Drainage Volume

Estimated total average precipitation in the Basin (1)	49.51 inches
Estimated total precipitation in the Basin from October 1969 through September 1970 (2)	44.32 inches
Precipitation deficiency	10.6 percent
Average mine drainage volume based on gaging, sampling, and analytical program from November 1969 through September 1970	
Audenried Tunnel	16.6 mgd
Quakake Tunnel	15.0 mgd
Design average mine drainage volume	
Audenried Tunnel	18.4 mgd
Quakake Tunnel	16.6 mgd

Design Wet-Weather Mine Drainage Volume

Estimated total average precipitation from December through April over period of record (1)	18.33 inches
Estimated total average precipitation from December 1969 through April 1970 (2)	16.79 inches
Precipitation deficiency	8.4 percent

Average mine drainage volume based on gaging, sampling, and analytical program from December 1969 through April 1970	
Audenried Tunnel	22.6 mgd
Quakake Tunnel	18.1 mgd
Design wet-weather mine drainage volume	
Audenried Tunnel	24.5 mgd
Quakake Tunnel	19.6 mgd

Design Maximum Mine Drainage Volume

Estimated total 24-hour accumulation of rainfall that will occur no more frequently than once every 10 years	4.59 inches
Estimated acreage contributing ground and surface water to Basin mine drainage discharges	
Audenried Tunnel	4,856 acres
Quakake Tunnel	4,582 acres
Estimated acreage contributing only groundwater to Basin mine drainage discharges	
Audenried Tunnel	788 acres
Quakake Tunnel	-
Fifty percent of the total rainfall on the Basin assumed lost to the atmosphere by evaporation and transpiration	
Estimated runoff coefficient for areas contributing only groundwater to Basin mine drainage discharges	0.35

Mine drainage volume based on acreage contributing surface water and groundwater

Audenried Tunnel
Total available rainfall

$\frac{4.59 \text{ in.}}{\text{day}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \times 4{,}856 \text{ acres} \times 43{,}560 \frac{\text{sq.ft.}}{\text{acre}} \times 7.48 \frac{\text{gal.}}{\text{cu.ft.}}$ = 605 mgd

Evaporation - transpiration losses

$\frac{50}{100} \times 605 \text{ mgd}$ = 303 mgd

Mine drainage volume from acreage contributing surface water and groundwater = 302 mgd

Quakake Tunnel
Total available rainfall

$\frac{4.59 \text{ in.}}{\text{day}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \times 4{,}582 \text{ acres} \times 43{,}560 \frac{\text{sq.ft.}}{\text{acre}} \times 7.48 \frac{\text{gal.}}{\text{cu.ft.}}$ = 571 mgd

Evaporation - transpiration losses

$\frac{50}{100} \times 571 \text{ mgd}$ = 286 mgd

Mine drainage volume from acreage contributing surface water and groundwater = 285 mgd

Mine drainage volume based on acreage contributing groundwater only

Audenried Tunnel

Total available rainfall

$$\frac{4.59 \text{ in.}}{\text{day}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \times 788 \text{ acres} \times 43{,}560 \frac{\text{sq.ft.}}{\text{acre}} \times 7.48 \frac{\text{gal.}}{\text{cu.ft.}} = 98.2 \text{ mgd}$$

Losses

Evaporation - transpiration

$$\frac{50}{100} \times 98.2 \text{ mgd} = 49.1 \text{ mgd}$$

Surface water runoff to streams

$$0.35 \times \frac{4.59 \text{ in.}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr.}} \times 788 \text{ acres} \times 0.646 \frac{\text{mgd}}{\text{cfs}} = 34.1 \text{ mgd}$$

Mine drainage volume from acreage contributing groundwater only — 15.0 mgd

Total design maximum mine drainage volume

Audenried Tunnel	317 mgd
Quakake Tunnel	285 mgd

(1) Based on 37 years of data from U. S. Weather Bureau Station at Tamaqua 4 North Dam.

(2) Based on precipitation recorded at U. S. Weather Bureau Station at Tamaqua 4 North Dam.

EXHIBIT G

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

RECOMMENDED CORE DRILLING PROGRAM
OVER AUDENRIED TUNNEL

Station Location (1)	Surface Elevation	Tunnel Elevation	Depth Of Hole (2)
5,300 Feet	+1,860	+1,200	760 Feet
7,300 Feet	+1,860	+1,200	760 Feet
9,300 Feet	+1,830	+1,200	730 Feet

(1) Based on inside distances from the mouth of Audenried Tunnel.

(2) Holes to be drilled to a depth of 100 feet below tunnel elevation.

EXHIBIT H

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

JEANSVILLE BASIN MINE DRAINAGE ABATEMENT STUDY

PERTINENT DESIGN AND COST DATA FOR
RECOMMENDED ALTERNATIVE ABATEMENT PLANS

Preventive Measures (1)	Estimated Mine Drainage Reduction			Project Cost	Average Annual Cost						Cost For 300 Years	
					First Thirty Years			Next 270 Years				
	Volume (mgd)	Iron (tons/day)	Acid (tons/day)		Fixed (2)	Operation And Maintenance	Per Ton Of Acid Removed (3)	Fixed (2)	Operation And Maintenance	Per Ton Of Acid Removed (3)	Total	Per Ton Of Acid Removed (3)
Abatement Plan I Construct 7,200 feet of lined channel and 4,200 feet of unlined channel, construct 14 transition structures to accommodate point sources of water, and excavate and backfill surface areas to proper gradient.	2.09	0.04	3.05	$244,600	$17,800	$2,600	$18.30	$2,400	$2,600	$4.50	$1,972,000	$5.90
Abatement Plan III Clear debris for a maximum of 8,000 linear feet within Audenried Tunnel; construct impermeable reinforced concrete seals with acid-resistant liners and emergency relief valves in both Audenried and Quakake Tunnels.	0.00	+0.10 (4)	37.00	$937,000 (5)	$68,100	$1,200	$ 5.13	-	$1,200	$0.09	$2,403,000	$0.59

(1) See Plate III for locations of preventive measures.
(2) Based on 30-year amortization at 6 percent.
(3) Calculations based on design average conditions.
(4) Reflects 16.6 percent increase in iron loading.
(5) Does not include cost of core drilling program.