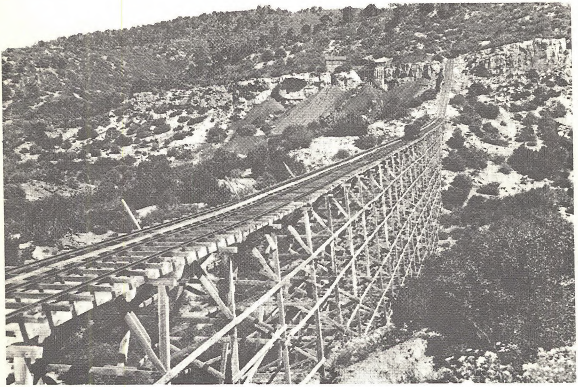
COAL LEASE SALE

APPLICATION C-25079
and Associated Rights-of-Way C-25150

ENVIRONMENTAL ASSESSMENT RECORD
Applicant: Colorado Westmoreland, Inc.



Cowan Mine (now Orchard Valley Mine) and conveyor line, C. 1912
(Photograph, courtesy of North Fork Historical Society)

Montrose District

Bureau of Land Management

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EAR

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ACTIVITY 1211 & 1212

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C65
1977

EAR FACE SHEET

OFFICE: Montrose

FY & REPORT # CO-030-7-79

ACTION: Westmoreland Short-Term Coal Lease Application & Associated Rights-of-Way
(Project Name, Case Type, etc.)

NO. OF PAGES 224

LOCATION: See Proposed Action & Associated Maps in Text

SERIAL NO. C.-25079 (Lease)
C -25150 (R/W's)

REQUIRED BY 43 CFR 23: YES [x] NO [ ]

TEAM SIGNATURES:	TITLE	RESOURCE VALUES ASSIGNED	HOURS
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G.V. "Doug" Douglas	Sociologist	Socio-Economic	80
Robert M. Anderson	Geologist	Team Leader-Technical Review	325
Edward R. Schmidt	Planning & Environmental Coor.	Technical Review	60
James E. Stone	Soil Scientist	Soils & Vegetation	204
James E. Pitchell	Botanist	Vegetation	64
Richard E. Graves	Landscape Architect	Visual and Recreation	264
R. Randy Lewis	Engineering Technician	Engineering	60
Steven M. Hyper	Hydrologist	Water Quality & Hydrology	129
Hugh Reed	Wildlife Biologist	Wildlife	134
Betsy Daniel	Geologist	Air Quality - Noise	100
Douglas D. Scott	Archeologist	Cultural Resources	60
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6/23/77
(Date)

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DISTRICT MANAGER: Marilyn Jones
(Signature)

June 24, 1977
(Date)

CSO 1790-1 (Aug. 1975)

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INTRODUCTION

AND

BACKGROUND

INTRODUCTION AND BACKGROUND

A. Introduction

This Final Environmental Assessment Record (EAR) has been prepared to assess the environmental impacts which may be anticipated if the Bureau of Land Management (BLM) grants applications filed by Colorado Westmoreland, Inc., for a competitive coal lease for federal coal to be mined by underground mining methods and for associated rights-of-way necessary for mining operations. The BLM has responsibility for leasing coal owned by the federal government and the U.S. Geological Survey (USGS) has responsibility for governing the mining of federal coal.

On January 26, 1976, the Secretary of Interior announced a formal end to the federal coal leasing moratorium that had been in effect since 1971. To implement renewed coal leasing the Department of Interior adopted the Energy Minerals Activity Recommendation System (EMARS), and subsequently, on August 4, 1976, Congress passed the Federal Coal Leasing Amendments Act.

The Department of the Interior is now reviewing the existing federal coal leasing policy and may adopt new management policies and procedures. On July 25, 1977, Secretary Andrus proposed new short-term coal leasing criteria for issuing leases for existing and new mines.

The short-term criteria under which CWI filed its application for coal lease sale and associated rights-of-way permitted leasing only:

1. When coal was needed to maintain an existing operation; or

2. When coal was needed as a reserve for production in the near future.

Under Bureau of Land Management procedures, the "need" for coal under these standards was shown if the applicant would begin operations in three years. Westmoreland was in operation, proposed to begin production from federal coal as soon as a lease could be issued, and therefore met the criteria.

The proposed new short-term criteria are as follows:

Operating Mines

The Department may grant short-term lease applications where:

1. Federal coal reserves are needed to give a contiguous mining area of an operating mine a reserve of coal that can meet contracted-for rates of production for the next eight years or expected rates of production for the next eight years whichever is higher; or

2. The federal lease area sought is so small, or so located in relation to an operating mine on adjacent lands that failure to issue a lease will preclude mining of the federal reserve in the foreseeable future.

New Mines

The Department may grant short-term applications for competitive leases for new mines to serve existing power plants or other existing coal users if the new mine can be operated, related facilities constructed, and the coal delivered without the construction of major new transportation facilities.

Leases issued under these criteria shall require the lessee to submit a complying mining and reclamation plan within one year from lease issuance and to begin mine development within six months from the date of approval of the mining plan. A lease would automatically terminate if those conditions were not met.

A lease may be issued for no more than eight years of reserves at contracted-for or expected levels of production, and must form, with lands already controlled by the applicant, an economic mining unit.

Other general provisions of the proposed new short-term criteria are:

1. Except in a bypass situation involving an operating mine, the short-term lease applicant shall have the burden of showing that the additional reserves to satisfy the short-term requirements cannot be supplied from coal reserves which the applicant controls.

2. Expected levels of production means a letter of intent or similar commitment to deliver coal from the short-term applicant to a buyer. If a lease is issued on the basis of expected levels of production, the lease shall be forfeited unless the lessee obtains a contract conforming to the letter of intent within six months after the lease is issued. Integrated coal producers may show need for the coal on the basis of an affidavit from a corporate officer.

3. A contiguous mining area includes all lands controlled by the applicant which can be mined as a unit and which touch or abut the lands in the application.

4. The Department shall comply with NEPA and all other applicable laws prior to issuing all coal leases.

5. An existing power plant or existing coal user means any facility actually operating and any other facility that has received all necessary regulatory approvals on the date the Secretary approves these criteria.

As well as demonstrating that it met the short-term criteria in effect at the time of its application and the proposed new criteria, Westmoreland has been required to submit data to BLM to demonstrate that the tract it seeks to bid on meets the general EMARS tract selection criteria. These selection factors on which data were submitted, include the depth, quality, thickness and extent of the coal resources; the relationship of mining to existing communities, water availability; potential impacts on the social and economic structure of the surrounding area; service and access corridors; aesthetic qualities such as scenic, cultural, wildlife and vegetative values; and rehabilitation potential for disturbed lands. Based on these data, the land use planning process, and on its own analysis, BLM makes a determination whether the tract is appropriate for leasing.

Westmoreland has supplemented additional data to (1) demonstrate compliance with the proposed new criteria, (2) assure that it could mine economically and efficiently within the eight-year limitation of those criteria, if imposed, and measures originally proposed even if it receives a lease limited to eight years production.

New coal leases must comply with the four basic requirements of the Coal Leasing Amendments Act which are reflected in the existing EMARS regulations. These requirements are:

1. The Department must lease coal through a competitive bidding system which prohibits lease issuance unless the Department receives fair market value for the coal resources.

2. The Department may not lease coal unless the issuance of a lease is compatible with a comprehensive land-use plan prepared with public involvement.

3. The Department must consider the effects of lease issuance on impacted communities and other affected areas.

4. All leases must be issued on terms that will ensure the diligent development of the coal resources and prevent speculative holding of federal coal leases.

Section 3(c) of the Amendments Act states, in addition:

> "Prior to issuance of any coal lease, the Secretary shall consider effects which mining of the proposed lease might have on an impacted community or area, including, but not limited to, impacts on the environment, on agricultural and other economic activities, and on public services. Prior to issuance of a lease, the Secretary shall evaluate and compare the effects of recovering coal by deep mining, by surface mining, and by any other method to determine which method or methods or sequence of methods achieves the maximum economic recovery of the coal within the proposed leasing tract. This evaluation and comparison by the Secretary shall be in writing but shall not prohibit the issuance of a lease; however, no mining operating plan shall be approved which is not to achieve the maximum economic recovery of coal within the tract. hearings in the area shall be held by the Secretary prior to the sale."

The tract selection criteria relating to Land Use Planning have been satisfied. A comprehensive land-use plan for the North Fork Unit, of which Westmoreland's lease application and associated rights-of-way areas are a part, was completed and subsequently approved by the State Director on April 26, 1974. Numerous public, auditor-consultant, and interagency meetings were held in the North Fork area concerning the North Fork Planning Unit and the leasing of coal. Their comments and concerns may be found in chapter IX of the analysis.

One multiple-use recommendation for coal made as a result of the land-use plan is as follows:

> "Deal with current coal lease applications under the EMARS system and criteria and as outlined in the next following recommendation except recognize that short-term leasing criteria may be proper for applications covering 480 acres or less adjacent to active, operating leases where new coal is needed for continued operation of a producing mine. Prior to issuing any lease, a resource team will evaluate the proposed lease for physical and socio-economic impacts and will devise stipulations necessary to assure the protection of the environment and which recognize local needs and demands. No short-term criteria leases will be let without an environmental analysis report which has been reviewed by local governments."

The "480 acres or less" discussed above was suggested at a time when it was standard practice to lease all coal seams in a proposed lease tract. It is now an accepted practice to lease coal by individual and/or collective coal seams. This determination is made by the U.S. Geological Survey (USGS) in accordance with standard mining practices and considering maximum economic recovery. Accordingly, 480 acres may not be sufficient in any one lease to satisfy the regulations as set forth in the Department's short-term leasing program and the Federal Coal Leasing Amendments Act of 1976.

The purpose of this environmental assesssment record (EAR) is to address the anticipated impacts of the following actions (should they be authorized) submitted in application form by Colorado Westmoreland, Inc. (CWI):

1. Competitive Coal Lease Application
   Note:
   In accordance with the Secretary's policy, a high bidder must demonstrate that he meets short-term criteria. If the high bidder is other than the applicant, a period of 30 days will be allowed to furnish evidence that he meets the short-term criteria.

2. A right-of-way application to construct, maintain, and operate an overland conveyor system over public lands.

3. A right-of-way application to construct, maintain, and operate water lines and buried power cables over public lands.

4. A right-of-way application to construct, maintain, and operate water drainage diversion structures and waste retention dams over public lands.

In addition to the above items, this EAR also addresses the alternatives of:

1. No leasing.

2. Leasing only as much of the "D" seam as is necessary to satisfy Westmoreland's contract needs with Northern Indiana Public Service Company (NIPSCO).

3. Leasing only as much of the "D" seam as is necessary to satisfy CWI's contracted needs with NIPSCO (700,000 tons per year) for eight years.

4. Leasing the entire "D" seam to be mined in accordance with acceptable mining practices as specified by USGS in order to permit the best conservation and maximum economic recovery of the coal resource.

5. Leasing only as much of the "D" seam as is necessary to meet CWI's anticipated production rate of 1 to 1-1/4 million tons per year for eight years. (CWI's lease application stated it would continue negotiations with coal users to obtain contracts sufficient to increase its production to approximately 1 to 1-1/4 million tons per year.)

The EAR was completed by a resource team selected by the Montrose District, Bureau of Land Management. The team used the interdisciplinary approach to environmental analysis, involving integrated team discussion of the social, economic and environmental impacts associated with the proposed action and reasonable alternatives.

The team members requested and received baseline data from Westmoreland's environmental consulting firm, Thorne Ecological Institute of Boulder, Colorado. Thorne was hired by Westmoreland to complete a comprehensive study on the impacts of mining, associated rights-of-way, and social economic structure. The Thorne Ecological Institute will continue to provide its services until at least October 1977.

BLM must also make a determination based on this Final Environmental Assessment Record whether to prepare an Environmental Statement (ES) prior to any proposed lease sale. If the determination is that the lease sale is not a major federal action or that it will not cause significant impact on the environment, BLM must then conduct a further technical examination and environmental analysis based on the data contained in the lease application and the available materials. The purpose of the technical examination and environmental analysis is to identify any specific reclamation requirements on portions of the tract requiring special environmental consideration, to prepare bonding requirements, and to develop lease stipulations required to minimize impacts on the environment and other resources, land uses or programs if a lease sale is held. This step would also be required after completion of an ES, if one is prepared.

If a determination is made to hold a lease sale, either on the basis of an EAR or an ES, the Department will prepare a coal resource economic evaluation of the tract selected, determine the fair market value of the coal after notice and an opportunity for public comments, consult with the Governor of Colorado, publish notice of the lease sale, and hold the sale. A determination will then be made whether the high bid at the sale meets or exceeds the fair market value established for the coal reserves determined to be offered. No lease will be issued for less than the fair market value of the coal. If the Department determines to issue a lease to the high bidder, the Attorney General of the United States will be notified so that he can determine if issuance of the lease would create or maintain a situation inconsistent with the antitrust laws.

B. Background and History

Numerous large and small coal mines have operated in the North Fork Valley since before the turn of the century. Currently, three mines are in operation approximately 10 miles east of the Orchard Valley Mine in Gunnison County. The Orchard Valley Mine initiated its operations in the uppermost "D" coal seam. Previous mines in this immediate area have operated in the "B", or lowest, and/or "C", next lowest, coal seams in the area. The Black Diamond Mine operated in this same "B" seam, approximately 100 yards east of Orchard Valley Mine from 1909 to 1917. The Converse Mine also operated in the "B" seam, 350 yards to the east of the Orchard Valley Mine, from approximately 1913 to 1935. Just east of the Converse Mine, the Farmer's Mine operated from approximately 1926 to 1961. Approximately one-half mile west of the Orchard Valley Mine the Halley Mine operated prior to the turn of the century. Farther west the Fitzsimmons, Burdick, Newman, Bennett, Owens, another Farmer's Mine, and the Gray Mines have operated at various times since the turn of the century. On the present Westmoreland property the Cowan Mine operated for a short time around 1912. Unique to its operation was a wooden conveyor line which carried coal from the mine to a tipple on what is now Highway 133 (see cover).

On November 25, 1974, the Colorado Consolidated Coal Company filed competitive coal lease application Colorado 22184 for certain lands situated in Delta County, Colorado. In January 1976, Colorado Westmoreland acquired all of the stock and interests of Colorado Consolidated. Among these interests was a small, 120-acre block of private coal (shown in map I-1), on which the old Converse Mine was located. It is from this private coal that Colorado Westmoreland is now mining at its Orchard Valley Mine.

On January 31, 1977, Colorado Westmoreland filed competitive coal lease application Colorado 25079, which amended the previous application of Colorado Consolidated Coal Company (although Colorado Westmoreland's application covers approximately the same lands as previously applied for by Colorado Consolidated). Development of the mine site and portals into the "B" seam was begun 2½ years ago by Colorado Consolidated. When Colorado Westmoreland purchased the property, all development in the "B" seam was halted, and development work of the "D" seam was initiated.

CHAPTER I

Chapter I - Description of the Proposed Action

A. Coal Lease Application

On January 31, 1977, CWI filed short-term coal lease application Colorado 25079 for approximately 2,230 acres described as follows:

T. 13 S., R. 92 W., 6th P.M.

Sec. 1: All -- Private Surface - Federal Coal
Sec. 12: All -- Private Surface - Federal Coal
Sec. 13: All -- Private Surface - Federal Coal
Sec. 24: N½NE¼, NW¼, N½SW¼ -- Federal Surface & Federal Coal

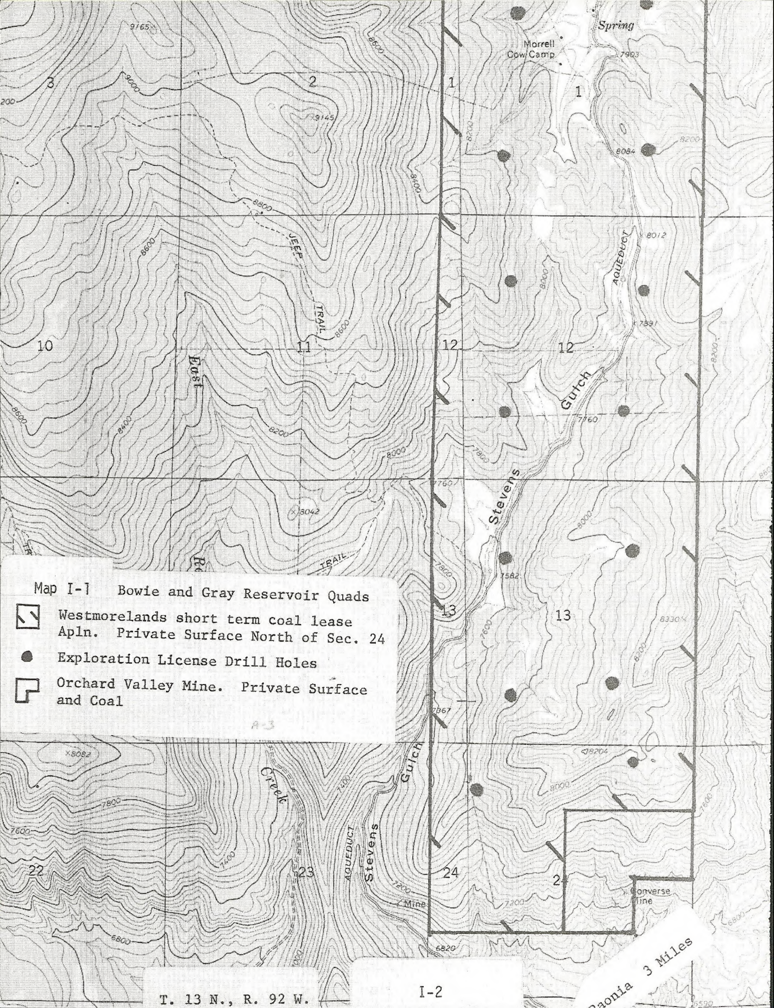
The subject application is located approximately three miles northwest of the town of Paonia, Delta County, Colorado (see maps I-1, I-2, and I-3). The application tract covers approximately 2,230 acres and adjoins the northern side of a private tract containing the Orchard Valley Mine.

Westmoreland's application is supported by data and information which indicate that the applicant and application meet both the original and the proposed new short-term leasing criteria as an operating mine. Even if the application were considered as a new mine, it would satisfy these criteria.

See memorandum from USGS dated May 27, 1977 (appendix K-1), and memorandum from BLM State Director, dated June 1977 (appendix K-2).

The company proposes to mine by underground methods approximately 1,000,000 tons of coal per year from its Orchard Valley Mine. A considerable amount of development work has been completed to date, including sinking of two shafts, construction of a shop, offices, warehouse, changehouse, etc. Capital expenditures as of July 31, 1977, total $35,218,000 with another $2,700,000 committed. Work is nearing completion of the company's coal storage silos and unit-train load-out facilities. Actual coal production began on December 13, 1976, from fee coal leased by the company, and 60,000 tons have been shipped as of August 1977. The company is currently producing about 1,500 tons of coal per day and approximately 126,000 tons have been extracted from the company's fee property as of August 1977. (For description of present development, see appendix A-1 to A-3.)

CWI, presently has a steam coal supply contract with Northern Indiana Public Service Company of Hammond, Indiana, for 700,000 tons of coal annually commencing in July 1977. Proper mine development to meet the demands of this contract require advancing mine working beyond the fee coal boundary by December of 1977; consequently a federal coal lease is required to meet the contract supply requirements to NIPSCO. Fee coal reserves are not adequate to supply this production. CWI does not own or control other coal reserves sufficient to meet this commitment.



Map I-1 Bowie and Gray Reservoir Quads

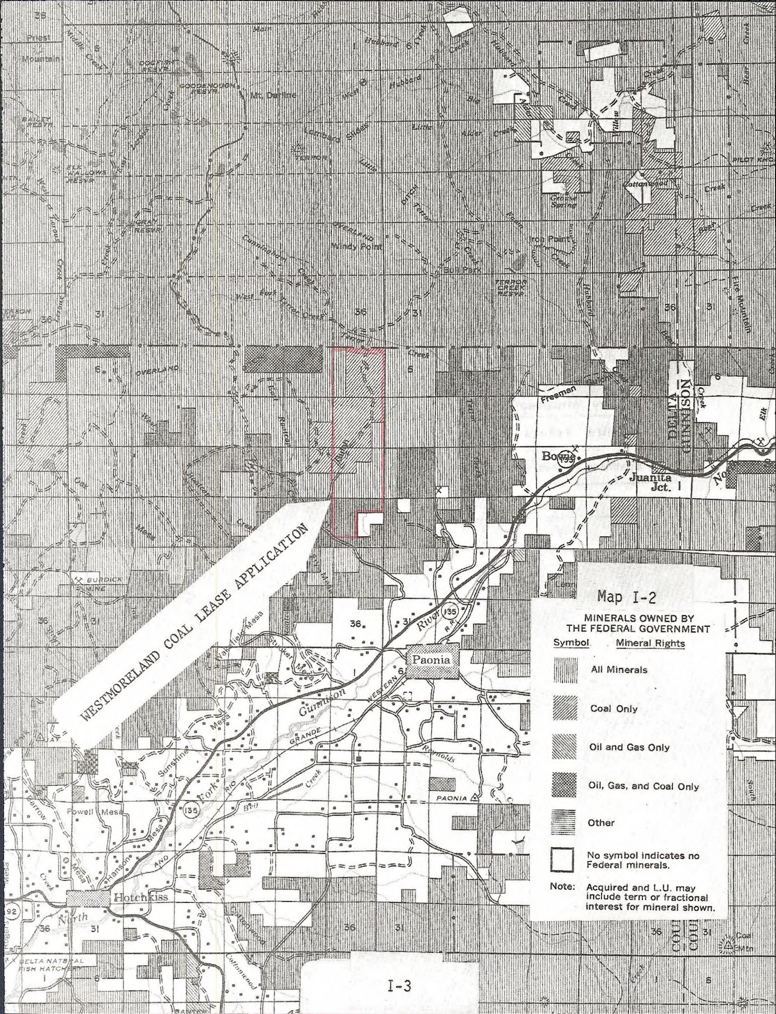
Westmorelands short term coal lease Apln. Private Surface North of Sec. 24

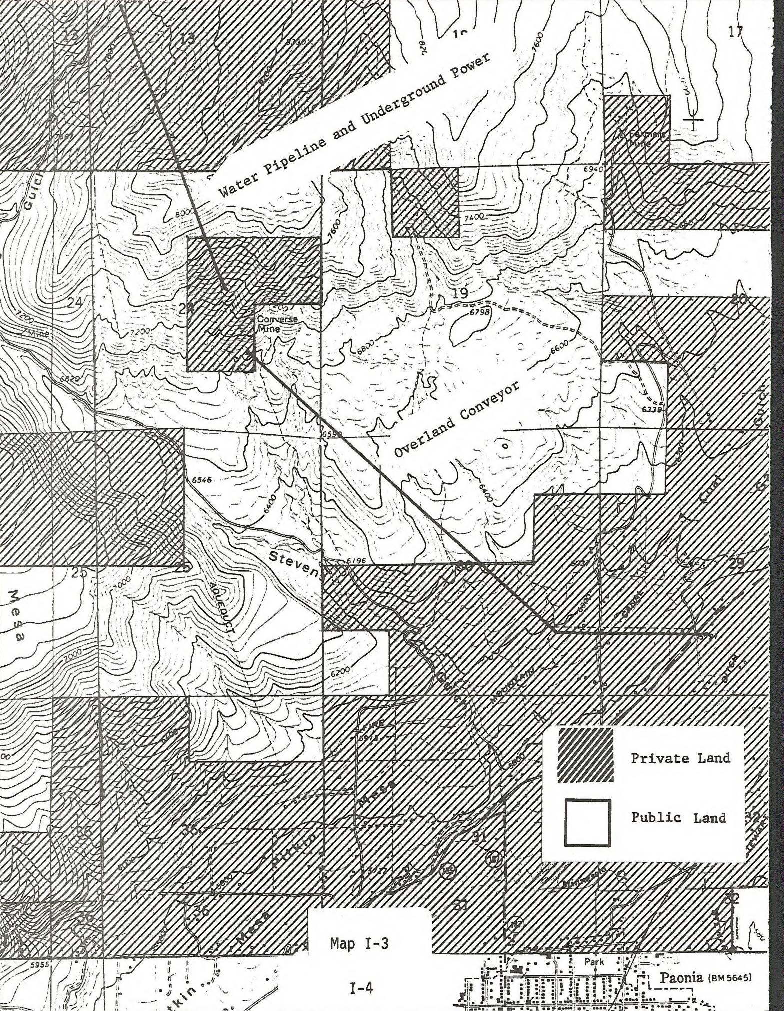
Exploration License Drill Holes

Orchard Valley Mine. Private Surface and Coal

A-3

T. 13 N., R. 92 W.


Map I-2
MINERALS OWNED BY THE FEDERAL GOVERNMENT
Symbol
Mineral Rights
All Minerals
Coal Only
Oil and Gas Only
Oil, Gas, and Coal Only
Other
No symbol indicates no Federal minerals.
Note: Acquired and L.U. may include term or fractional interest for mineral shown.
WESTMORELAND COAL LEASE APPLICATION
Paonia
Hotchkiss
Bowie
Juanita Jct.
DELTA
GUNNISON
Windy Point
Mt. Darline
Priest Mountain
Iron Point
Bull Park
Powell Mesa
BURDICK MINE
DELTA NATURAL FISH HATCHERY
Gunnison
North
Fork


Water Pipeline and Underground Power
Overland Conveyor
Converse Mine
Private Land
Public Land
Paonia (BM 5645)
Park
AQUEDUCT
Stevens
Gulch
Coal
Mesa
Pitkin Mesa

Map I-3

This contract requires tonnage for 1977 to be 300,000 tons, escalating by 1979 to 700,000 each year thereafter for a minimum of 15 years. CWI plans to execute additional coal sales contracts if the lease application is issued and it is the successful bidder. Expected production would then be 1 to 1.25 tons per year. (See Summary of Contract, appendix K-3.)

The lease (if issued under the proposed action) would be for all available coal seams contained on the application lands.

For stages of implementation of coal mine, see appendix A-4.

Although Westmoreland has stated that it does not believe that the revised short-term criteria should limit the scope of its requested lease, BLM will apply the revised short-term criteria in passing on this application. BLM has determined that (1) Westmoreland's Orchard Valley Mine became a coal producing mine on December 13, 1976, and prior to then was engaged in active on-site construction and development work since January 1976 (its predecessor had commenced development about January 1975) and (2) Westmoreland has applied for a contiguous reserve area which is clearly needed to meet contracted-for and expected levels of production. Westmoreland thus qualifies under the criteria for operating mines. Westmoreland would also qualify under the revised short-term criteria if examined as a new mine, in that (1) its lease application is for an economic mining unit, (2) its mine will serve existing coal users, (3) the mine can be operated and the coal delivered without construction of major transportation facilities, and (4) Westmoreland will clearly begin mine development within six months of approval of its mine plan, which will be submitted immediately if it is issued a lease.

The following rights-of-way are associated with the coal lease application and are accordingly made a part of the proposed action. Photo 1 is an aerial photo depicting proposed actions.

1. <u>Overland Coal Conveyor</u>

   The proposed conveyor system would be used to transport coal from the Orchard Valley Mine coal-crushing site, located on private land just south of the mine in the SE¼NW¼SE¼, Section 24, T. 13 S., R. 92W., 6th P.M., to Highway 133, approximately one mile east of Paonia, Colorado (E½SW¼, Section 29, T. 13 S., R. 91 W., 6th P.M.). (See site map 4 for location details.)

   The proposed conveyor is approximately 3 miles long (total length); 6,127.4 feet of the conveyor cross public lands. The public lands crossed by the conveyor is described as the NE¼SE¼, SE¼SE¼, Section 24, T. 13 S., R. 92 W.; SW¼SW¼, Section 19, T. 13 S., R. 91 W.; and NW¼NW¼, NE¼NW¼, SE¼NW¼, SE¼NE¼, Section 30, T. 13 S., R. 91 W., 6th P.M.

Photo #1 North Fork Valley - Orchard Valley Mine Area & Proposed Facilities

Key to reference numbers:

1. Stevens Gulch
2. Stevens Gulch Road
3. Orchard Valley Mine
4. Orchard Valley Mine Coal Storage/Loading Facility
5. Paonia
6. Highway 135
7. Conveyor line and paralleling construction/maintenance access road
8. Buried Waterline/Powerline
9. Refuse Disposal Site
10. Diversion Channel
11. Sediment Retention Dams

The proposed conveyor consists of a 42-inch-wide conveyor belt completely enclosed by a metal shroud approximately 4 feet 8 inches in diameter.

A strip of land approximately 9 feet wide would allow for occupancy and installation of the conveyor. In addition, an access and construction road is planned, at some points in a nonparallel route in order to minimize surface disturbance, depending upon terrain. The access road will be a primitive four-wheel drive only. The width of the road will not exceed 12 feet, with occasional turnouts not exceeding 20 feet. Turnouts will be constructed where ground is level enough to permit vehicles to pass. The maximum slope of the road will not exceed 15 percent in grade. Cut slopes will be avoided or kept to a minimum wherever possible. For this reason a 100-foot right-of-way has been requested.

The maintenance road will be a restricted access road and will be used only for monitoring and servicing the conveyor. Once a day, a four-wheel drive vehicle will travel the road in both directions. On occasions, additional equipment may be required for specific maintenance operations.

A portion of the proposed conveyor would be constructed underground. By using the underground construction method, the entire conveyor can be built as near to the ground as possible, reducing the visual impact of the project. The conveyor would be underground at three points along the proposed route. The structure would leave the crushing site underground and emerge on public land in the NE¼SE¼, Section 24, T. 13 S., R. 92 W. It would then enter the hill via a tunnel on public land in the NW¼NW¼, Section 30, T. 13 S., R. 91 W., at an elevation of 6,685, and exit the hill at an elevation of 6,605. The structure would return underground to cross private land in the SE¼SE¼, Section 30, T. 13 S., R. 91 W., pass under Highway 133, and emerge a little to the west of the coal storage silos.

There will be game passages under the conveyor where it exits from the hill and where it crosses two drainages. There will also be a game passage at the point where it goes underground (figure I-1).

The materials resulting from the tunneling will be used for fill in the area of the bridge under construction and as fill in an area along the county road being realigned by CWI.

Where the conveyor goes underground, the entire structure, belt, shroud, and truss, would be contained inside a 10-foot diameter, externally-coated, corrugated steel tube. When aboveground the conveyor and shroud would sit atop a metal

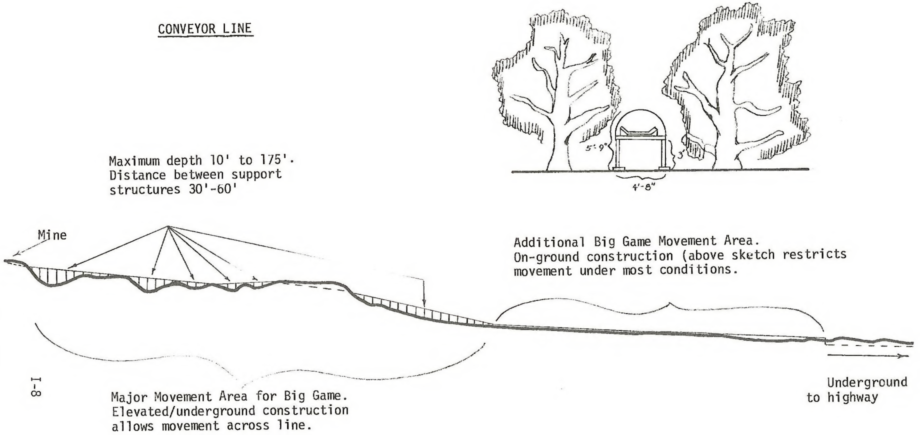

CONVEYOR LINE
5'-9"
3'
4'-8"
Maximum depth 10' to 175'.
Distance between support
structures 30'-60'
Mine
Additional Big Game Movement Area.
On-ground construction (above sketch restricts
movement under most conditions.
Major Movement Area for Big Game.
Elevated/underground construction
allows movement across line.
Underground
to highway

Figure I-1

truss structure. The truss will anchor the structure to the ground and give the conveyor the proper elevation above the ground. Truss height varies depending on topography. Concrete supports will anchor the trusses to the ground.

Conveyor minimum/maximum heights from ground level would be:

a. A minimum height of 3.6 feet from ground level to belts and a minimum height of 6 feet from ground to top of conveyor structure.

b. A maximum of 140-175 feet at the support structure. Maximum distance between support structure would be 60 feet; minimum distance, 30 feet.

All service and utility lines will be attached to either the conveyor truss or channel frame structures as required. There is no need for power lines or poles above the conveyor profile.

Anticipated noise levels at a distance of 3 feet from the conveyor are as follows:

a. For aboveground portion of conveyor, approximate sound power level would not exceed 64.

b. For underground portion of conveyor, approximate sound level would be less.

The conveyor will be audible during operations from 25 to 50 feet away, and at no time would it approach EPA recommended noise limits.

Lighting will be required only during periodic maintenance periods and need not be utilized on a constant basis. Lights will be turned off when not needed.

The conveyor will be in operation approximately 16 hours per day in normal operations but could be increased to operate 24 hours per day.

Helicopters will be used for conveyor installation in the highly inaccessible areas immediately adjacent to the mine and other inaccessible areas along the route. In addition to the helicopters, equipment required for the installation of the overland conveyor include:

a. One caisson drilling rig

b. Two bulldozers

c. Two cranes, plus delivery truck

d. One 2-cubic yard backhoe

e. Three portable air compressors

f. Two welders

g. Two generators

h. One rubber tire scoop loader

i. Various concrete trucks

j. One dump truck

k. One concrete pump

2. Buried Waterline/Powerline

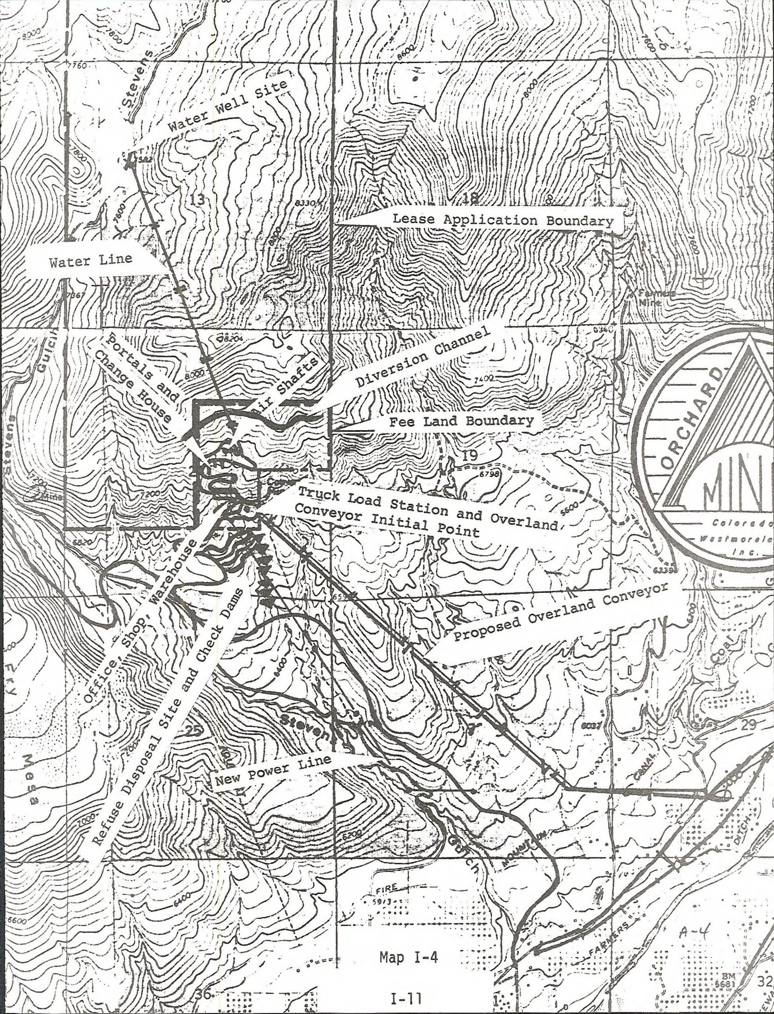
The proposed right-of-way is 100 feet wide and 6,000 feet long. In most areas, 12 feet or less would be required for the actual installation of the buried water and powerline unit. A maintenance road is not necessary.

The right-of-way would make possible the installation of a buried, 4-inch outside diameter, plastic water pipeline and 7.2-KW underground powerline. The subject lines would be located in the same trench.

The proposed powerline, originating at a point on the Orchard Valley mining property, would provide the electrical power necessary to operate an electric water pump located on Westmoreland property in the S½NW¼, Section 13, T. 13 S., R. 92 W., 6th P.M.

The proposed pipeline would transport water from the Westmoreland well site to a water storage tank located on the Orchard Valley mining property. The water would be used for coal dust suppression measures and provide water for the mine bath facilities.

The proposed pipeline/powerline project would require removal of some vegetation from the immediate construction site. A backhoe would be used to dig a trench approximately 2 feet wide and 4 feet deep. The pipeline/powerline unit will be buried in this trench. (See map I-4 for project location.)


Water Well Site
Water Line
Lease Application Boundary
Portals and Change House
Air Shafts
Diversion Channel
Fee Land Boundary
Truck Load Station and Overland Conveyor Initial Point
Office, Shop, Warehouse
Refuse Disposal Site and Check Dams
Proposed Overland Conveyor
New Power Line
Stevens
Gulch
Mesa
Canal
Farmers
Ditch
Coal
ORCHARD
MINE
Colorado
Westmoreland
Inc.

Map I-4

3. <u>Watershed, Drainage/Diversion Structures, Retention Dams and Mine Waste Area</u>

The proposed right-of-way is for an area of approximately 200 acres, described as E½SE¼NW¼, E½SW¼ lying north of the Stevens Gulch Road, NE¼SE¼, SW¼SE¼, SE¼SE¼, Section 24, T. 13 S., R. 92 W., 6th P.M., and that portion of the NE¼, Section 25, that lies north of the Stevens Gulch Road in the same township and range as above. (See site map I-4.)

The proposed right-of-way area would allow for the construction, maintenance, and operation of three closely related structures: (a) upper diversion channel, (b) mine refuse disposal site, and (c) sediment retention dams.

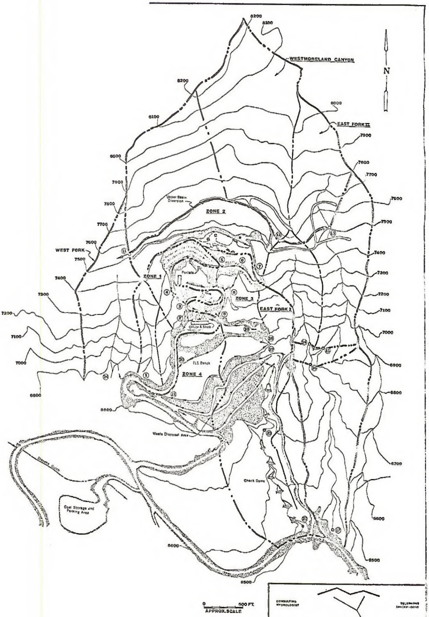
The drainage plan proposes to divert storm runoff from the upper basin by means of a contour channel. This channel would be laid out on a 5 to 7 percent grade and discharge water into the watershed adjacent to Westmoreland Canyon. Since failure would result in extreme damage and perhaps loss of life, the channel would be designed to carry runoff from the probable maximum thunderstorm (PMTS).

The second element of the proposed drainage plan is a storm runoff system to handle flows generated from the lower basin. This system would require some modifications in existing grades, etc., in order to safely and efficiently dispose of the water.

If protection is provided in the upper basin from the PMTS, then the storm design criteria in the lower basin can be relaxed somewhat. The appropriate design storm is often related to the 100-year storm recurrence interval precipitation. By definition, the 100-year storm is that storm which will occur at an average interval of 100 years. Note that the definition refers to an <u>average</u> interval, hence there is no guarantee that a storm of this magnitude cannot occur twice in 10 years. The 100-year storm coincides with about a one percent probability of being exceeded in any given year, or the "OPP" storm as used by MESA (1976).

The OPP is the smallest design storm recommended by MESA (1976) for drainage installations where the hazard potential is high. A high hazard potential is defined as (MESA 1976):

> <u>High Hazard Potential</u>-Facilities located where a failure could be reasonably expected to cause loss of life, serious damage to homes, industrial and commercial buildings, and important utilities, highways and railroads.



CONSULTING HYDROLOGIST

Charles F. Leaf, P.E.

DRAINAGE PLAN & WASTE OISPOSAL AREA
(PRELIMINARY)
WESTMORELANO ORCHARD VALLEY MINE
Map I-5

Table I-1. Design flow summary sheet--Drainage plan Orchard Valley Mine.

Node No. (Plate 3)	Approx. Area Upstream (acres)	Design Discharge (c.f.s.) Watershed PMTS[1]	Watershed OPP[2]	Imported PMTS	Imported OPP	Total PMTS	Total OPP	Remarks
Upper Basin Diversion								
11	33.7	399	43			399	43	
12	50.6	590	61			590	61	
13	71.7	827	84			827	84	Includes portion of
15	97.1	1117	112			1117	112	Westmoreland Canyon
Zone 1								
1	27.1		36				36	
2	14.3		22				22	
3	10.5		18				18	
4	6.0		13				13	
Zone 2								
7	18.3		26				26	
14	33.2		42				42	Includes that portion of Westmoreland Canyon in Zone 2
Zone 3								
5	1.9		9				9	
6	1.0		8				8	
8	9.5		17				17	
9	12.6		20				20	
10	17.0		25				25	
18	1.9		9				9	
19	1.5		8				8	
Zone 4								
20	3.6		11				11	
21	10.3		18				18	
East Fork I/Westmoreland Canyon								
22	81.8		91				91	
23	41.9		57				57	
22	209.5[3]		233		-142		91	
East Fork II								
13	20.8	253	29	590		843		
14	14.8	184	23		19		42	Approx. 7 c.f.s.
15	46.5	527	56	590		1117		intercepted by
16	65.1	711	85		87		172	upper basin diversion
17	99.7	1146	114		87		201	above node 14
West Fork								
24	27.5	329	36	399	43	728	79	

1/ PMTS = Probable Maximum 1-Hour Thunderstorm.

2/ OPP = One Percent Probability (100-year) 1-Hour Thunderstorm.

3/ Area of Westmoreland Canyon Prior to disturbance.

The purpose of the proposed drainage system in the lower basin would be to limit damage to primary structures, limit erosion, and prevent slope instability through ponding and subsequent saturation of benches. The design would not provide total hydraulic control during major storms. Significant repair costs at the end of normal occurrence rainstorms would not be required. However, significant repair costs would be necessary after extreme storm events. It is believed that the 100-year storm is a reasonable compromise given the present mine layout, and the cost of complete hydraulic control of the very large storms in this confined area.

Map I-5 shows the proposed drainage plan. The approximate locations of several check dams to be located downstream of the waste disposal area are also shown. These dams would control sediment generated from the spoils embankments and from much of the mine area upstream.

The drainage plan shown in map I-5 proposes to collect and dispose of storm runoff generated from upstream areas--including water imported from Westmoreland Canyon (nodes 7, 11, and 13). Runoff from zones 1 and 3 in the lower basin would be discharged at nodes 1, 10, 18, and 19. Runoff from zone 4 would be collected at nodes 20 and 21. Flows from nodes 10, 18, and 19 would be routed through the check dams to control sediment generated from these areas. Subwatershed boundaries are also plotted on map I-5, and design flows are summarized in table I-1.

The following narrative will consider these structures.

a. Diversion Channel

The proposed right-of-way would provide a site for the construction of an upper basin diversion channel. The channel would be designed to intercept the runoff from a probable maximum thunderstorm (PMTS) and discharge the water into watersheds adjacent to the Orchard Valley Mine property. The impact of the mining activity on private (CWI) land has increased the runoff potential. The proposed diversion channel will act to protect life and property should a large flood event occur and maintain the integrity of the environment.

The proposed diversion channel would be approximately 3,300 feet long (total length). The diversion channel will cross public lands at NE¼SE¼NW¼, Section 24, T. 13 S., R. 92 W., 6th P.M., located along the northwest edge of the mine property. The remaining length of diversion will be located on private land owned by CWI.

The channel will begin in the bottom of the central watershed (mine location), at elevation 7,620 feet, and discharge water into the watershed to the east at elevation 6,950 feet and into the watershed to the west at elevation 7,525 feet. The proposed discharge capacity will be approximately 550 cfs at both ends.

The diversion would be constructed with tapered sides (V-shaped), allowing downhill runoff to enter the diversion channel. The sides would be stabilized by vegetation, riprap, and metal bins. The diversion bottom would be 25 feet across. The bottom would be divided into a 5-foot wide by 5-foot deep, heavily-riprapped low flow channel and a 20-foot wide by 3-foot deep, high flow channel, with a maximum 5 percent gradient (see figure I-2).

The diversion north and west of the mine portal will drain on the 40-acre parcel of public land located just west of the CWI property. Construction of the proposed diversion would require removal of vegetation from the diversion site.

b. Refuse Disposal Site

The proposed right-of-way would allow for the development of access roads and a refuse disposal site for mine debris located on public land in the SW¼SE¼, Section 24, T. 13 S., R. 92 W., 6th P.M., just south of the Orchard Valley mine property. The proposed site would contain approximately 4 acres.

Clearing and development would occur in stages to minimize the amount of bare soil exposed at any one time (see figure I-3). For each successive stage, vegetation and top soil would first be removed from the working area; a refuse lift would then be laid down and compacted. Refuse would be covered by at least 15 inches of topsoil and seeded. Upon completion of one refuse lift, another would be laid down in a bench-like configuration (see figure I-4).

Benches would be approximately 20 to 30 feet wide. Refuse lifts would be approximately 40 to 50 feet deep. Refuse slopes would be approximately 2.5 to 1. Each bench would contain a drainage ditch to help control surface runoff and reduce erosion.

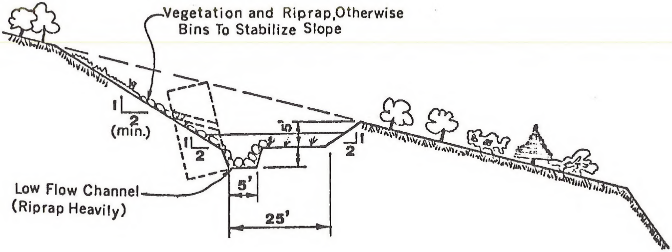
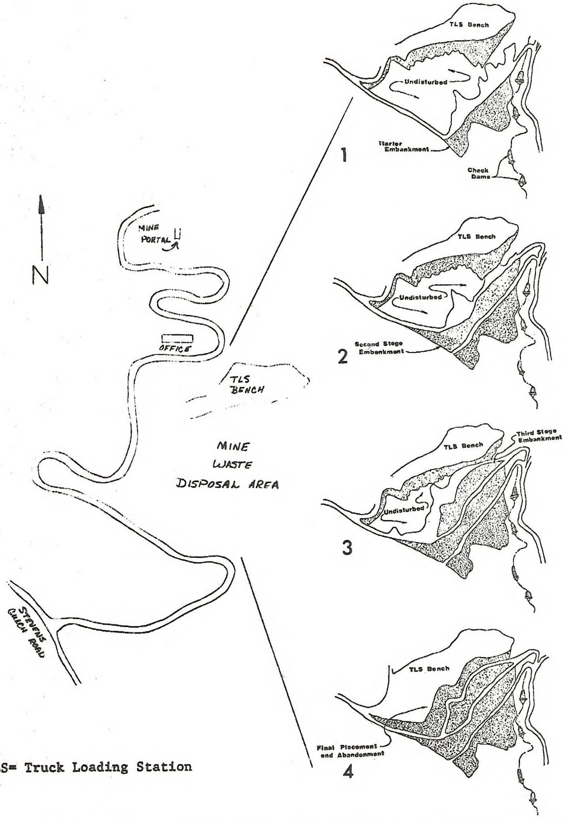


Figure I-2. Diversion Channel cross section.



TLS= Truck Loading Station

Figure I-3. Sequential development stages of mine waste disposal area.

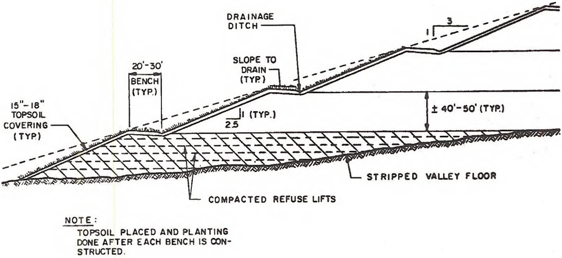


Figure I-4. Bench configuration for refuse disposal area.

Earth-moving equipment such as a bulldozer and scrapers would be used to remove vegetation and topsoil, lay down and shape refuse lifts, and construct access roads. Topsoil replacement and seeding could also be accomplished using mechanized equipment.

c. Sediment Retention Dams

The proposed right-of-way would provide for the construction of a series of small sediment retention dams located immediately downstream from the waste-disposal site, in the S½SE¼SE¼, Section 24, and the NE¼SE¼, SE¼NE¼ (north of Stevens Gulch Road), Section 25, T. 13 S., R. 92 W., 6th P.M.

Dams will be placed as needed, starting in the upper portions of the drainage. The old Cowen Mine Bridge will not be disturbed. The dams are designed to detain water, acting to dissipate the energy and reduce the flow rate, allowing the suspended sediment to settle out. The dams will act to protect Stevens Gulch from excessive and unusual quantities of suspended sediment and help minimize dissolved solids from the disturbed areas on CWI lands. The capacity of each dam will be approximately one-fourth acre-foot.

The proposed dams would vary in width and depth depending on the channel diversions of the original drainage. Detention dams will be earth if possible. Metal, concrete, or rock materials will be used if required. See map 5 for approximate dam locations.

B. Interrelationships

This section provides information on the relationship between the proposed action and (1) BLM's planning program, (2) Colorado Division of Wildlife (DOW), (3) House Bill 1041 and EMARS, and (4) Stevens Gulch Allotment Management Plan (AMP).

1. Planning Goals

There is a direct relationship between the proposed action and BLM's planning process. This planning process is guided by the basic resource inventory data called unit resource analyses (URAs) and by management decisions developed in the management framework plans (MFPs). The URA is a summarized and coordinated resource inventory prepared in the detail needed for multiple-use planning. A URA is prepared on planning units, which are the basic geographic units used by BLM to aggregate resource data. The North Fork planning unit is the only planning unit that will be impacted by this proposed action. The URA developed for this planning unit, which was updated in fiscal year 1976, indicates present and potential management within the resource area. Recommendations and decisions necessary to develop such proposals were subsequently worked out in the MFP.

The MFP is the planning instrument which establishes coordinated land use allocations for all resources and establishes objectives and constraints for each resource and support activity. The internal multiple-use planning process is based upon an adversary concept. Each resource activity specialist is encouraged to identify the full potential of the resources in the specialist's area. The overlaps and conflicts are reconciled through extensive study and discussion, including public response. The major objectives established by the MFP for the key resources in the North Fork planning unit are summarized below.

a. Initiate administrative or other actions to further stabilize the livestock industry and encourage input and interest in long-term planning and management. Upon completion of an environmental statement, implement 22 AMPs with full grazing systems designed around the key species concept for improvement of range conditions. Administrative actions on small allotments not identified for AMPs could include (1) change in class of livestock, (2) change in season of use, and (3) adjustment in use where applicable to improve range condition, meet forage production goals. Provide forage for 11,986 animal unit months of Class I qualifications on a sustained yield basis in the North Fork planning unit.

b. Specific recommendations for wildlife are as follows:

1. Develop grazing management systems.

2. Change winter grazing of livestock to spring-early summer grazing when or where necessary to protect wildlife winter range.

3. Do not increase livestock pressure during fall, winter, or early spring on those browse species found, by the inventory and analysis, to be critical to wildlife.

4. Do not allow men and equipment, during exploration or construction phase of development, to work in crucial game winter ranges when the animals are concentrated (12/1 to 4/15).

5. Provide "buffer" areas (± ¼ mile) around raptor nests.

6. Do not construct fences which will impede big game movement (16 inch bottom height and 42 inch top height).

c. For watershed (soil and water resources) reduce the current rate of accelerated erosion where condition classes are worse than slight. Specific recommendations to accomplish this objective are (1) coordinate all watershed proposals with other activities, (2) apply district chaining guidelines to all chainings, leaving islands and buffer strips, (3) conduct hydrologic, soil, and erosion studies throughout the area, and (4) implement livestock management systems.

d. Recommendations for timber resources are (1) continue the sale of woodland products when it does not adversely affect other resources and (2) develop plans for harvests of standing trees to accommodate and enhance other values, including such things as hunter campsites, recreation areas, watershed, grazing, wildlife habitat, and access.

e. Allow no strip or auger mining on new leases for coal. Exploration and mining plans are reviewed and approved by U.S. Geological Survey and BLM prior to any development. Exploration and mining roads will be located so as to minimize damage to valuable watershed areas, water resources, and management facilities. Allow for the construction of mining associated facilities (i.e., access roads, transmission lines, water lines, waste disposal sites, etc.) on public lands. All permits will have stipulations requiring rehabilitation of all disturbed areas. Specific MFP recommendations concerning the leasing of coal are contained in the introduction of this chapter.

Pending review of the overall coal leasing program, the only coal leasing actions which might occur in the planning unit within the next three to five years would be those which satisfy the revised short-term criteria. No such applications are now pending other than CWI's.

It should be noted that the MFP by definition provides fairly broad guidance concerning management direction and constraints from which to develop a more detailed plan of action. Specific action plans for resource management, involving programs such as range, wildlife, soils, watershed, minerals, cultural resources, and realty management on public lands, are developed based on the MFPs. The activity plan in the case of mineral management is based on industry interest, and demand. It also provides for "Bureau motion" leasing of minerals through the EMARs process, as discussed below.

2. <u>Colorado Division of Wildlife</u>

The Colorado Division of Wildlife's "Strategic Plan" is a comprehensive wildlife management plan for Colorado. The plan calls for increasing deer and elk populations in the southwestern region. It identifies the primary problem as inadequate habitat. The maintenance of present populations of mourning dove, bandtailed pigeon, mountain lion, cold water stream fish, and coyote are goals of the plan. Additionally the plan provides for the monitoring of populations of raptorial birds, including golden eagles and prairie falcons, due to their high susceptibility to environmental change.

In addition, DOW personnel have indicated that the objectives for Game Management Unit 521 (map I-6) are to maintain or slightly increase deer number. (Hal Burdick and Dave Kenvin, personal communication)

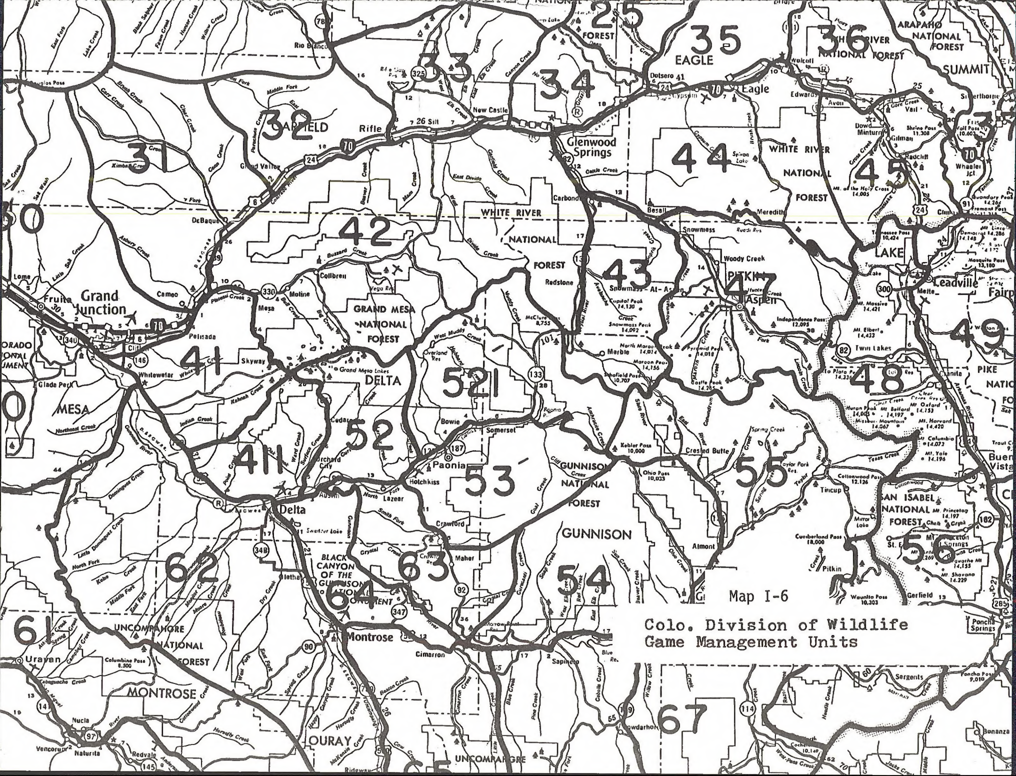
3. <u>House Bill 1041 and EMARS</u>

DOW is currently developing information for input into county planning (House Bill 1041) and participating in the EMARS program in cooperation with U.S. Fish and Wildlife Service (USFWS). Both of these efforts are incomplete. (Harold Tyers, USFWS; Terry McGowan, USFWS; Don Schrupp, DOW; and Rex Taliaferro, DOW; personal communication).

The input into EMARS is a system of rating habitat values to aid in land use and leasing decisions. The proposed action will involve an area whose habitat values are likely to be rated in the upper 25 percent of some 20 areas in west central Colorado. To date, Delta County has not initiated any planning or zoning which would utilize or require the HB 1041 data.

4. <u>Stevens Gulch Allotment Management Plan</u>

This AMP is part of the proposed action analyzed in the Uncompahgre Basin Resource Area Grazing Environmental Statement. The plan includes objectives to improve the watershed condition, livestock forage (grasses), and big game browse through a combination of range management and land treatments (primarily interseeding and chaining). The tentative location of some of the land treatments, water facilities, and fences is in close proximity to the location of the proposed conveyor, waste disposal area and drainage structures. (See map in appendix G.) The AMP proposals can be modified and relocated to avoid any conflicts. Implementation of the Stevens Gulch AMP is scheduled for 1984.



Map I-6

Colo. Division of Wildlife
Game Management Units

CHAPTER II

Chapter II - Description of the Environment

A. Geology

The lease application tract is in the Paonia coal field, which is located on the southeastern flank of the Piceance Basin in northwestern Colorado. The coal in this area is present in a 700- to 800-foot zone near the base of the Upper Cretaceous Mesa Verde formation. Numerous coal beds four feet or more in thickness are present throughout the entire coal zone, which is separated from the underlying Mancos shale by the thick, resistant Rollins sandstone. The Mesa Verde formation is overlain by the Early Tertiary Ohio Creek Conglomerate, and much of the surface of the lease application tract is covered by a layer of gravel and lava boulders with a thickness of up to 200 feet. The application tract is within the Paonia-Somerset Known Recoverable Coal Resource Area.

The Mesa Verde formation of this area consists of four members, two of which contain minable coal seams. In ascending order, these members are the Rollins Sandstone Member, the Bowie Shale Member (with two minable seams, the "B", and "C"), the Paonia Shale Member (the "D" seam being the only minable seam), and the Barren Member.

For physical and chemical characteristics of the coal, refer to appendix A-10.

B. Climate

The climate of the North Fork area is typical of the Rocky Mountain region, which is generally subhumid. This region is composed of hydrologic extremes including low rainfall and water yield, with high evapotranspiration potential at lower elevations. Average annual precipitation varies from less than 15 inches at the lower elevations to more than 30 inches in the subalpine. Tables II-1 and II-2 give the monthly temperature and precipitation data for two stations in the North Fork area, Paonia (5,600 feet) and Cedaredge (6,200 feet). Average snowfall at the 9,500-foot level (Park Reservoir) produces a peak snowpack around April 1 containing an average of 25.3 inches of water; 48 percent of the time the snowpack exceeds this level. Prevailing winds are from the south-southeast with windspeeds of 10 miles per hour occurring in June.

C. Air Quality

1. Federal and State Legislation

The ambient air quality of the Paonia area falls under the laws and regulations established (1) under the provisions of the Federal Clean Air Act of 1970 and its amendments (see table II-3), and (2) by the Colorado Air Pollution Control Commission (created by the Colorado Air Pollution Control Act of 1970, Title 25 Article 7 Sec. 104).

Temperature and predipitation data.

	TEMPERATURE					PRECIPITATION				
	AVERAGE DAILY MAXIMUM (°F)	AVERAGE DAILY MINIMUM (°F)	AVERAGE DAILY (°F)	2 YEARS IN 10 WILL HAVE....		AVERAGE (IN.)	2 YEARS IN 10 WILL HAVE		AVERAGE NUMBER OF DAYS WITH 0.1 INCH OR MORE (IN.)	AVERAGE SNOWFALL (IN.)
				MAXIMUM TEMPERATURE HIGHER THAN.. (°F)	MINIMUM TEMPERATURE LOWER THAN.. (°F)		LESS THAN.. (IN.)	MORE THAN.. (IN.)		
JANUARY	39.2	12.0	25.6	58	-17	0.90	0.39	1.75	2.9	9.6
FEBRUARY	46.0	19.5	32.8	64	- 3	1.13	0.40	1.66	3.9	7.2
MARCH	53.3	24.5	38.9	74	4	1.30	0.55	1.85	3.9	10.2
APRIL	63.2	31.6	47.4	80	16	1.45	0.84	1.98	4.1	3.0
MAY	73.4	40.3	56.9	88	25	1/05	0.46	1.85	3.1	0.1
JUNE	82.6	48.5	65.6	94	35	0.82	0.26	1.29	2.6	0.0
JULY	88.5	55.2	71.9	96	45	1.01	0.39	1.60	2.8	0.0
AUGUST	86.3	53.9	70.1	95	42	1.50	0.64	2.12	4.3	0.0
SEPTEMBER	77.9	45.3	61.6	91	29	1.61	0.62	2.25	4.4	0.0
OCTOBER	67.1	35.1	51.1	82	16	1.60	0.57	2.32	3.9	0.4
NOVEMBER	52.5	24.6	38.6	71	8	1.28	0.70	1.64	4.4	2.7
DECEMBER	41.6	15.1	28.4	62	- 9	1.63	0.87	2.12	5.9	18.6
— YEAR —	64.6	34.0	49.4	--	--	15.29	--	--	46.1	51.8

Paonia, Colorado, elevation 5693 ft., (1958–1972)

Table II-1

Temperature and precipitation data.

	TEMPERATURE					PRECIPITATION				
				2 YEARS IN 10 WILL HAVE....			2 YEARS IN 10 WILL HAVE			
	AVERAGE DAILY MAXIMUM (°F)	AVERAGE DAILY MINIMUM (°F)	AVERAGE DAILY (°F)	MAXIMUM TEMPERATURE HIGHER THAN.. (°F)	MINIMUM TEMPERATURE LOWER THAN.. (°F)	AVERAGE (IN.)	LESS THAN.. (IN.)	MORE THAN.. (IN.)	AVERAGE NUMBER OF DAYS WITH 0.1 INCH OR MORE (IN.)	AVERAGE SNOWFALL (IN.)
JANUARY	38.8	14.5	26.7	58	- 7	0.82	0.24	1.26	4.4	10.1
FEBRUARY	44.2	19.7	31.9	62	- 3	0.88	0.26	1.18	4.1	8.4
MARCH	51.7	25.6	38.7	72	6	1.00	0.31	1.29	5.0	6.1
APRIL	62.1	33.1	47.6	78	18	1.09	0.46	1.26	4.8	3.4
MAY	71.9	40.9	56.4	88	26	1.07	0.35	1.44	4.8	0.5
JUNE	81.6	48.5	65.0	95	35	0.80	0.20	1.30	3.3	0.0
JULY	87.6	55.2	71.4	90	46	0.88	0.31	1.33	4.3	0.0
AUGUST	85.4	53.3	69.3	93	42	1.24	0.72	1.88	5.2	0.0
SEPTEMBER	77.8	45.5	61.7	91	30	1.24	0.28	1.91	4.8	0.0
OCTOBER	65.9	35.5	50.7	81	19	1.32	0.45	2.21	3.9	0.7
NOVEMBER	51.0	24.7	37.9	69	5	0.73	0.57	1.26	3.3	3.6
DECEMBER	40.3	24.7	37.9	38	- 4	0.84	0.56	1.30	3.0	8.6
— YEAR —	40.3	16.7	28.5	--	--	11.91	--	--	37	43.5

Cedaredge, Colorado, elevation 6180 ft., (1907-1972)

Table II-2

TABLE II-3

Air Quality

National Ambient Air Quality Standards

	Pollutant	Primary STandard	Secondary Standard
1.	Sulfur Oxides	80 ug/m^3 (0.03 ppm) annual arith. mean 365 ug/m^3 (0.14 ppm) max 24 hr. conc. not to be exceeded more than once a year.	1,300 ug/m^3 (0.5 ppm) max 3 hr. conc. not to be exceeded more than once a year.
2.	Particulate Matter	75 ug/m^3 annual geom. mean 260 ug/m^3 max 24 hr. conc. not to be exceeded more than once a year.	60 ug/m^3 annual geom. mean *, 150 ug/m^3 max 24 hr. conc. not to be exceeded more than once a year.
3.	Carbon Monoxide	10,000 ug/m^3 (9 ppm) max 8 hr. conc. not to be exceeded more than once a year.	Same as primary.
		40,000 ug/m^3 (35 ppm) max conc. not to be exceeded more than once a year.	Same as primary.
4.	Photo Chemical Oxidants (corrected for NO_2 and SO_2 interference)	160 ug/m^3 (0.08 ppm) max 1 hr. conc. not to be exceeded more than once a year.	Same as primary.
5.	Hydrocarbons (corrected for CH_4)	160 ug/m^3 (0.24 ppm) max 3 hr. conc. (6 to 9 a.m.) not to be exceeded more than once a year.	Same as primary.
6.	Nitrogen Oxides (as Nitrogen Dioxide)	100 ug/m^3 (0.05 ppm) annual arith. mean.	Same as primary.

* To be used as guide in assessing State Implementation Plans.

The Colorado Air Pollution Control Commission has placed the Paonia area in the Grand Mesa Air Quality Control Region (Region #7). In addition, the commission has not placed Paonia or the vicinity in an Air Quality Maintenance Area (AQMA)[1] nor has it given the area a designated status.[2] The State Air Pollution Control Commission on August 11, 1977, adopted new emission standards for SO_2 as they apply to both new sources and ambient air standards. Later this year new SO_2 standards for existing sources may also be considered. Table II-4 presents the adopted regulations.

In addition, the federal EPA criteria governing significant air quality degradation are applicable to the public lands in the Paonia area. The area has been designated as Class II, wherein "...deterioration normally accompanying moderate well-controlled growth would be considered insignificant." In such areas, pollutant concentrations can be allowed an incremental increase shown in table II-5 over baseline concentrations.

2. <u>Baseline Conditions</u>

Because the Paonia area is rural or agricultural, there is a meager amount of information with which to estimate the baseline conditions of air quality.

The Colorado Department of Health, Air Pollution Control Division, maintains a network of particulate and/or gaseous air quality monitoring stations throughout the state. Particulate (or HiVol) sampling stations have been established in Montrose, Delta, Gunnison, and Crested Butte; no stations have been established in Paonia or the North Fork Valley. Table II-6 presents the data available for the four monitoring sites

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[1]Air Quality Maintenance Areas (AQMA) were established to meet federal EPA requirements that each state "...identify those areas (counties, urbanized areas, standard metropolitan statistical area, etc.) which due to current air quality and/or projected growth rate, may have the potential for exceeding any national ambient air quality standard in the next 10 years." (Federal Register, Vol. 38, No. 116)

[2]Areas carrying a designated status are those in which ambient air quality standards for one or more pollutants were being violated at the time of designation. The nearest designated area is Grand Junction, Colorado.

TABLE II-4
AMBIENT AIR STANDARD FOR AIR QUALITY CONTROL AREAS

SUSPENDED PARTICULATE MATTER AND SULFUR DIOXIDE
(Micrograms per cubic meter - mg/m^3)

Pollutant	Nondesignated Areas
Suspended Particulate Matter 1/	
Short-Term 3/ (a)	150
Long-Term 4/	45
Sulfur Dioxide 2/	
One-Hour Level 5/	
Short-Term 3/ (b)	15
	(0.0050) 6/
Long-Term 4/	

1/ Measured at ambient conditions.
2/ 0^o Centigrade - 760 mm Hg (Torr.)
3/ Short-Term Level
(a) A 24-hour maximum of any 24-hour period and must not be exceeded more than once in a 12-month period.
(b) A 24-hour maximum arithmetic mean of any 24-hour period, and must not be exceeded more than once in a 12-month period.
4/ Long-Term Level - An annual arithmetic mean of all 24-hour concentrations.
5/ One-Hour Level - A 1-hour maximum arithmetic mean in any 24-hour period, and must not be exceeded more than once in any 1-month period.
6/ (--) = Equivalent values in parts per million; 1 ppm = 2,860 mg/m^3 at 0^oC and 760 mm Hg (Torr).

TABLE II-5
FEDERAL NONDETERIORATION STANDARDS
Allowable Increments mg/m3

	Class I	Class II
Particulate Matter:		
Ann. Geom. Mean	5	10
24-Hour Maximum	10	30
Sulfur Dioxide:		
Ann. Arith. Mean	2	15
24-Hour Maximum	5	100
3-Hour Maximum	25	700

CLASS III

Concentrations limited to those prescribed by National Ambient Air Quality Standards.

TABLE II-6
SUSPENDED PARTICULATES, micrograms per cubic meter

	SUSPENDED PARTICULATES						
	QUARTERLY AVERAGES				YEARLY		
	1st	2nd	3rd	4th	Aver	High	Low
1971							
47. Montrose	97	108	70	67	88	271	22
1972							
47. Montrose	127	83	48	57	79	343	6
105. Delta		DATA NOT VALIDATED					
106. Gunnison	79	62	ID	ID	79	376	30
1973							
47. Montrose	75	76	53	54	64	156	14
105. Delta	142	86	82	99	101	278	5
106. Gunnison	69	41	40	63	60	138	21
117. Crested Butte	NS	NS	NS	50	ID	96	16
1974							
47. Montrose	72	66	65	76	69	177	13
105. Delta	110	ID	69	80	84	295	20
106. Gunnison	68	57	51	56	59	250	11
117. Crested Butte	54	88	90	90	77	169	15
1975							
47. Montrose	79	71	47	72	67	260	12
105. Delta	87	94	67	101	88	330	16
106. Gunnison	70	74	39	47	57	166	15
117. Crested Butte	40	63	(152)	(64)	72	301	2
1976							
105. Delta					97	238	
1977							
105. Delta					103*	183**	

Colorado Department of Health -- Air Pollution Laboratory
ID = Insufficient Data
NS = No Samples
() = Average based on limited available data
* = First 5 month average
** = For the first 5 months

which are outside the North Fork Valley. Table II-7 presents data collected during December, 1976, by William Marlatt in Paonia[1] and data collected during the same time period at the Delta and Montrose monitoring stations for comparison. It would appear that Paonia and Montrose have comparable air quality.

Currently both Colorado Westmoreland Coal Company (CWI) and Atlantic Richfield Corporation are conducting air quality monitoring programs in the North Fork Valley in anticipation of federal environmental statements. In connection with these programs, four HiVol sampling stations have been established in the following locations:

a. Bear Mine, Somerset, established September 1976
b. Paonia Fire Station, Paonia, established December 1976
c. Meadow below Orchard Valley Mine, established June 1976
d. CWI railsiding, Paonia

Data collection for the Atlantic Richfield program will be completed and the data analyzed at the end of 1977. None of the data from that program is available (McSparron, oral communication). In addition, very little of the data collected by Marlatt of Thorne Ecological Institute has been refined or analyzed. (Marlatt, oral communication) The data, which are not presented in table II-7, will be included in the fourth quarterly report for Thorne Ecological Institute (Marlatt, oral communication) but are not currently available.

A small amount of gaseous air quality data was collected in Paonia in May 1977, by Thorne Ecological Institute. Those data and the Thorne analyses are presented in table II-8.

From the limited quantity of data available, the Paonia area appears to have air quality which can be considered to be good during much of the year. However, under the stagnant or stable meteorological conditions which occur frequently in the area during winter months, short-term levels of TSP (total suspended particulates) probably now exceed current Colorado ambient air quality standards (150 micrograms per cubic meter). In addition, concentrations in the Somerset and Mesa areas may exceed the National Ambient Air Quality Standards (260 micrograms per cubic meter) for particulates. Levels of gaseous pollutants appear to be at or below detectability and clearly within acceptable standards.

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[1]Due to a delay in receiving or processing raw data from the Thorne study, these are the only data now available from that study.

Table II-7. Measured levels of total suspended particulates for Paonia, Delta, and Montrose from December 1976.

TOTAL SUSPENDED PARTICULATES
(micrograms/cubic meter)

Date	Paonia	Delta	Montrose
12/4	-	158*	114
12/8	-	148	msg
12/12	56	113	70
12/16	121	198*	116
12/20	102	230*	106
12/24	28	121	73
12/28	n.a.	214*	98

*Exceeds Colorado 24-hour standards.

Note that background levels of 20 mg/m^3 are considered typical of completely rural monitoring sites.

Table II-8. Levels of SO_2 and NO_2 as measured in May 1977 by Marlatt with commentary from third quarterly Thorne report.

SO_2 AND NO_2 MEASUREMENTS AT THE FIRE STATION, PAONIA, COLORADO
(micrograms/cubic meter)

Date	SO_2		NO_2	
	A	B	A	B
May 19-20	19.2	4.8	21.4	11.4
May 25-26	0.0	4.8	3.6	11.4

Measurements of sulfur dioxide and nitrogen dioxide were made in Paonia during May 1977.

Minimum detection level for the West-Gaeke method of analysis is normally assumed to be about 20 mg/m^3 for SO_2 and about 25 mg/m^3 for NO_2. For these samples, very careful titration results were compared to calibration curves established using the same stock chemicals for each sample.

As a part of the environmental program conducted by Thorne, Marlatt. Wood, and Sestak have generated an emissions summary table which identifies the major sources of particulate matter in the North Fork Valley. Tables L-3 and L-4 in appendix L presents these data. From these data it can be seen that the largest sources of particulate matter included in the analysis are the three operating mines in the Somerset area. These mines appear to have low efficiencies for controlling or retaining fugitive dust generated during their operations. The second major source of particulate pollution in the North Fork Valley appears to be dust entrainment by traffic over unpaved roadways.[1] Residential space heating and rail traffic are other major sources of particulate pollution in the area. It is believed that agricultural practices are, on occasion, major sources of fugitive dust. These were not included in the analysis performed by Marlatt.

Finally, the modified ventilated valley model was used to generate "worst case" or maximum levels of total suspended particulates which might occur in the Paonia area under nondispersive conditions. Table II-9 presents that data.

Although the direct contribution which the CWI operation makes to the total air quality burden is minor, it would appear that the anticipated growth planned for the area warrants a regional air quality monitoring program. The State Air Pollution Control Division is contemplating such a study currently.

3. Colorado Emissions Permits

On November 30, 1976, the Air Pollution Control Division of the Colorado Department of Health conducted preliminary studies at Colorado Westmoreland's Orchard Valley Mine. These studies were conducted for all operations on the private coal lease (that is, from portal to railroad out, exclusive of truck emissions) prior to issuance of a minimal operations permit. The Colorado Department of Health study shows that for a 500,000 ton per year production level the Orchard Valley Mine emits 13.8 tons per year of suspended particulate material. This figure is extremely low for a mining operation of CWI's size and probably results from the use of negative pressure bag houses (currently the best practical control technology for suppression of particulate emissions) on crushing, grinding, and loading facilities (Miller, Air Pollution Control Division, Colorado Department of Health, oral communication).

In the future, six more source tests will be run to determine if the original studies were accurate in their estimates. Emissions permits will be granted or denied on this basis.

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[1]The Marlatt study notes that "Unfortunately, no data are available regarding current traffic volumes over these types of roads in the study areas. The figures used were assumptions and can only be considered 'order of magnitude' estimates. Similar uncertainties exist with respect to traffic exhaust emissions over the low volume roadways in the area, but the resulting contaminant from this source is much smaller than that from unpaved road emissions."

TABLE II-9
Estimated 24-Hour Average Particulate Concentrations That Could be Obtained in 1977 Under Nondispersive Meteorological Conditions for Selected Areas Within the North Fork River Valley. Taken From Thorne Ecological Institute 4th Quarterly Report (Draft Copy).
(See map II-1)

1977 24-Hour Average Concentrations* (micrograms per cubic meter)

Box Number	Case 1 a/	Case 2 b/	Case 3 c/
1	1.3	274.4	275.6
2	1.2	160.6	161.8
3	1.2	176.7	177.9
4	18.0	11.0	29.0
5	10.6	208.3	218.8
6	0.5	19.6	20.0
7	15.6	358.3	373.9
8	10.3	254.5	264.8

a/ Case 1 considers the Orchard Valley Mine the only producing mine in the North Fork Valley--production level 650,000 tons per year.
b/ Case 2 considers only mining operations which currently exist in the Somerset area--production of 1,520,000 tons per year.
c/ Case 3 considers both the Orchard Valley Mine and all existing mines in the Somerset area--production of 2,170,000 tons per year.
* Assumes "worst case" meteorological conditions with a persistent low level air temperature inversion and light winds.

In addition, the Mining Enforcement Safety Administration (MESA), Coal Division, has monitored levels of respirable dust in areas near workers. MESA standards require that levels of respirable dust be at or below 2 milligrams for an eight-hour period. Tests are run three times per year for surface operations and twice per year for underground operations. CWI's Orchard Valley Mine has met the standards for a one-year period.

4. Inversion Phenomena

Residents of the Paonia area report widespread inversions occurring on an almost daily basis. The following is taken from Marlatt and Woods' model.

> The phenomenon of mountain-valley flow in the North Fork Valley has been discussed in detail in a previous report (Thorne Ecological Institute 1977b). During a warm, sunny day, the heating of the sunlit valley slopes causes the adjacent air to warm and rise. At night, radiative cooling of the valley walls and higher elevations cools the adjacent air, which slides down the slope, draining into the lowest portion of the valley. The shape and orientation of the North Fork Valley is such that the drainage (or katabatic) flow is the dominant flow for most hours of the day. Information from the Meteorological Monitoring Network established in the study area indicates a fairly common wintertime condition of approximately 16 hours of downslope (easterly) flow and 8 hour of upslope (westerly) flow through the Paonia area (Thorne Ecological Institute 1977a). Onset of the upvalley flow occurs most often around 9 a.m. and the direction is reversed around 5 p.m.
>
> Downslope flow often gives rise to a surface temperature inversion. A positive lapse rate, that is, increasing air temperature with height, is present in the lower levels of the regional atmosphere due to cold air draining into the lowest areas of the valley and underlying warmer air. Such a situation in a mountain valley is associated with very light downslope winds. Similar conditions may occur when a large high pressure air mass dominates a region. The subsiding air of a high pressure system is very stable and usually associated with light winds and air stagnation. Studies performed by Holzworth (1964, 1972) indicate that the study area is located within a region where stagnation episodes lasting more than one day can occur with some frequency. In the absence of strong regional air mass movement, such as would occur during a large scale stagnation, the local, thermally driven winds dominate the climate of the North Fork Valley.

In addition, the inversions which occur in the Paonia area should be similar to those which occur in Craig, Colorado. (Scott Miller, Air Pollution Control Division, Colorado Department of Health.) A typical period of stagnation or an inversion will last for three days (Adams, Air Pollution Control Division, Colorado Department of Health). During unusual prolonged cold spells an inversion may last up to two weeks (Adams).

D. Noise

In order to determine the existing noise environment in the Paonia area, noise levels were sampled in various locations prescribed as a result of predetermined site criteria set forth in appendix M. An attempt was made to select and adequately describe monitoring sites which would be representative of the range of development and land use in the Paonia area. Sampling locations, shown in map 1, were monitored over 24-hour periods using a Gen Rad 1945 Community Noise Analyser. Prominent noise sources were recorded on tape for detailed analysis. Details of the methodology used are discussed in appendix M. Results are shown in graphs I through XII and table II-10.

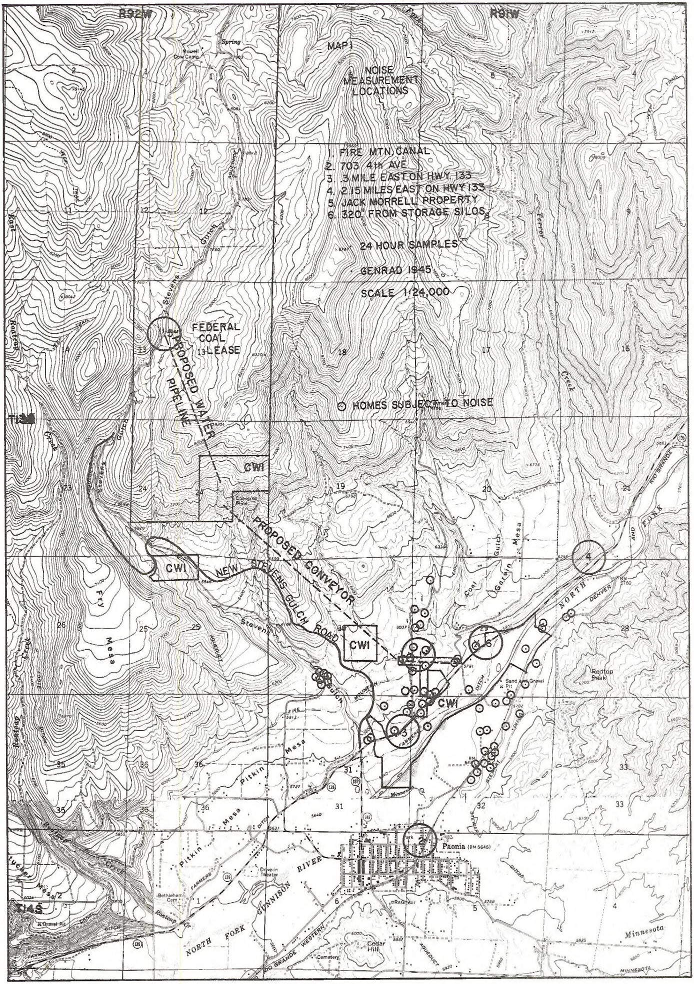
Based on tabulated data, a day/night map (map 2) was generated to represent graphically major noise sources and their impact upon the Paonia area. U.S. Environmental Protection Agency (EPA) guidelines concerning noise levels requisite to protect the public health and welfare with an adequate margin of safety are as follows:

EFFECT	LEVEL	AREA
OUTDOOR ACTIVITY INTERFERENCE AND ANNOYANCE	$L_{dn} \geq 55dB(A)$	Residential areas, farms, and other quiet outdoor areas
	$L_{eq} \geq 55dB(A)$	Schoolyards, playgrounds, etc.
INDOOR ACTIVITY INTERFENCE AND ANNOYANCE	$L_{dn} \geq 45dB(A)$	Indoor residential areas
	$L_{eq} \geq 45dB(A)$	Indoor areas of schools, etc.

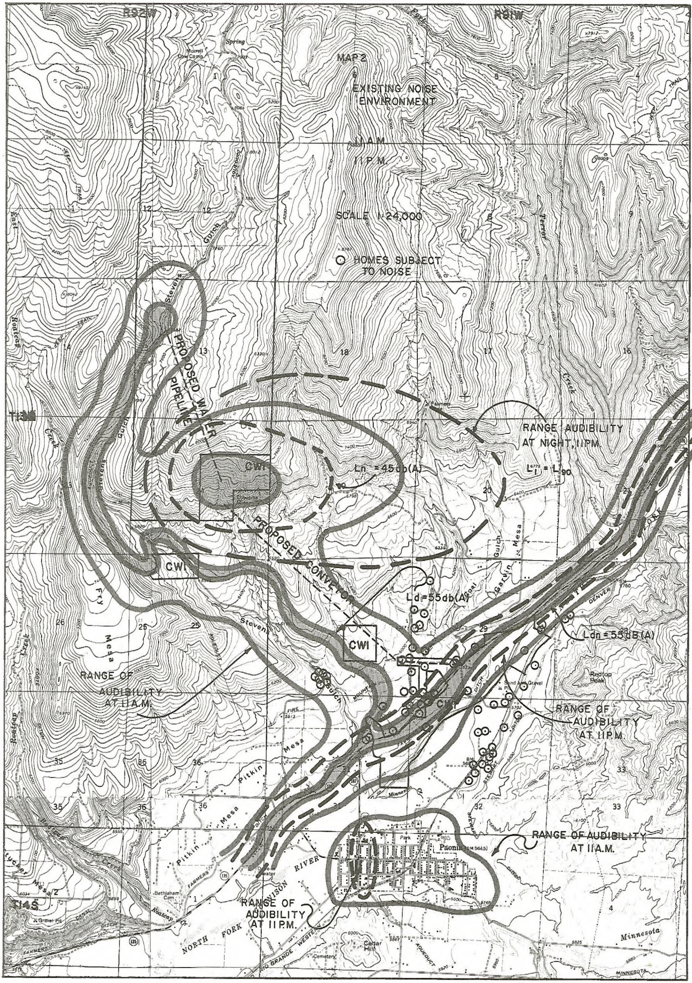
When these levels are exceeded, potential for speech interference and sleeping difficulties exist. (See appendix M for supportive tables).

In the area of Paonia Park, a quiet suburb of Paonia, weighted nighttime equivalent sound levels indicate that some speech and sleep interference could occur. (See table II-10 and map 2.) The dominant noise sources are loud vehicle exhausts, daily trains, and barking dogs. (A state of Colorado inspection law regarding vehicle exhausts would reduce the nighttime sound levels if it were enforced. Currently, however, this law is largely ignored. It states that no vehicle inspected for use on Colorado public roadways shall have an exhaust system louder than stock. Until this law is enforced, little relief is available from local cars and light trucks.)

Train noise impacts most of Paonia to some extent because Paonia surrounds the tracks. (See table II-10 and map 2.) Many homes have been located along the rail bed for many years. The major sources of train noise are the warning whistle, diesel locomotive exhaust noise, and wheel truck/track noise. (The EPA is mandated to control locomotive noise and has set up a timetable to begin quieting locomotives. Starting with locomotives built in 1979, all locomotives will be required to have an exhaust



R92W
R91W
MAP 1
NOISE MEASUREMENT LOCATIONS
1. FIRE MTN. CANAL
2. 703 4th AVE
3. .3 MILE EAST ON HWY 133
4. 2.15 MILES EAST ON HWY 133
5. JACK MORRELL PROPERTY
6. 320' FROM STORAGE SILOS
24 HOUR SAMPLES
GENRAD 1945
SCALE 1/24,000
FEDERAL COAL LEASE
PROPOSED WATER PIPELINE
HOMES SUBJECT TO NOISE
CWI
PROPOSED CONVEYOR
NEW STEVENS GULCH ROAD
Stevens Gulch
Fry Mesa
Pitkin Mesa
Garvin Mesa
Redtop Peak
NORTH FORK GUNNISON RIVER
Paonia (BM 5645)
Cedar Hill
T14S



MAP 2
EXISTING NOISE ENVIRONMENT
11 A.M.
11 P.M.
SCALE 1:24,000
HOMES SUBJECT TO NOISE
PROPOSED WATER PIPELINE
PROPOSED CONVEYOR
CWI
RANGE AUDIBILITY AT NIGHT, 11 P.M.
Ln = 45db(A)
Ld = 55db(A)
Ldn = 55dB(A)
RANGE OF AUDIBILITY AT 11 A.M.
RANGE OF AUDIBILITY AT 11 P.M.
RANGE OF AUDIBILITY AT 11 A.M.
RANGE OF AUDIBILITY AT 11 P.M.
R92W
R91W
T14S
Paonia
NORTH FORK
RIVER
Minnesota

muffler and meet a maximum of 90 dB(A) at 100 feet and at speeds less than 35 mph. Well maintained locomotives such as utilized by the Denver and Rio Grand Western (D&RGW) currently meet this noise standard. Rail operations incident to transportation of goods, such as loading, are limited by Colorado Statute 25-12-103 (1973 CRS Revised) to no more than 80 dB(A) emitted 25 feet into adjoining property lines with an allowable 90 dB(A) for 15 minutes per hour between the hours of 7 am and 7 pm.)

Along Highway 133, an L_{eq}=55 dB(A) contour is approximately 200 feet to either side of the highway. (See map 2 and table II-10.) In the immediate vicinity of CWI's loading site, highway noise affects 12 homes, 11 of which are within 100 feet of the highway and several of which are owned by CWI. The homes are shown on the accompanying maps. It can be demonstrated that speech interference could be present at these 12 sites outdoors, and sleep might be interfered with by an occasional loud truck or car, usually not attributable to CWI operations since trucking is a daytime only operation.

In the area of the CWI storage and rail car loading facility, construction and truck noise are dominant. (See map 2 and table II-10.) L_{eq} contours of 55 dB(A) extend in a 600-foot radius from the construction area and impact three homes. Speech outdoors is occasionally interrupted by backup beepers and exhaust noise of heavy equipment. Once construction is completed, traffic noise would still impact the three homes.

Undeveloped land located in the hills surrounding Paonia has typical sound characteristics such as squirrels, birds, insects, and wind caused noises such as rustling leaves and grasses. At one location on Jack Morell's property, northeast of CWI property off the Stevens Gulch Road, no human-caused interference or annoyance problems are evident. The sound levels are below recommended levels, and no houses are in the vicinity. (See table II-10.)

Currently the prominent noise sources associated with the CWI operations are:

1. Coal trucking used by CWI (under contract from Savage Brothers, Utah) to transport coal from the Orchard Valley Mine to the rail siding and loadout facilities 1 mile northeast of Paonia. Five trucks are currently making 80 round trips each workday (6 days per week). These trucks are operating from 7 am and are now running 8 hours but may, in case of malfunction, make up to 120 trips per day during a 12-14 hour day, depending upon the daily requirements. The existing contract with Savage Brothers requires that the coal trucks meet California noise restrictions, which are more stringent than EPA noise regulations.

2. A weekly unit train which hauls the coal out of the North Fork Valley. Projections call for the train to be loaded and moving out 2 hours after arriving for coal.

TABLE II-10 Results of Noise Level Samples in the Paonia Area

LOCATION	PERCENTILE LEVELS dB(A) re: 20μN/M^2					
FIRE MOUNTAIN ROAD	MAX	L10	L50	L90	MIN	LEQ
7am - 11am	61	48	38	37	32	43
11am - 3pm	62	44	38	35	31	43
3pm - 7pm	60	45	43	37	35	50
7pm - 11pm	54	38	30	32	28	34
11pm - 3am	51	34	24	23	22	36
3am - 7am	57	43	32	26	21	44

COMMENTS: insects, birds, traffic in background, wind - dominant

703 FOURTH AVENUE						
7am - 9am	59	53	50	45	39	50
9am - 11am	75	54	49	45	39	52
11am - 1pm	74	51	42	38	34	53
1pm - 3pm	78	52	46	42	37	51
3pm - 5pm	120	120	52	41	36	53
5pm - 7pm	69	54	49	45	42	52
7pm - 9pm	76	52	44	42	41	52
9pm - 11pm	73	52	43	36	31	50
11pm - 3am	120	42	36	32	30	94
3am - 7am	66	52	47	40	30	49

COMMENTS:
- U.S. Steel train in town at 10:30am, peak 57 whistle, 46-49 steady on passby
- U.S. Steel train out of town at 3pm
- traffic noise, barking dogs, wind - dominant

LOCATION	PERCENTILE LEVELS dB(A) re: 20μN/M^2					
0.3 MILE E. OF STEVENS GULCH ON HIGHWAY 133	MAX	L10	L50	L90	MIN	LEQ
7am - 9am	82	64	52	44	37	61
9am - 11am	84	66	51	38	31	64
11am - 1pm	82	66	53	40	31	66
1pm - 3pm	86	67	55	43	37	65
3pm - 5pm	79	63	49	40	31	62
5pm - 7pm	80	62	47	36	30	60
7pm - 9pm	79	58	43	32	26	58
9pm - 11pm	84	56	42	37	32	56
11pm - 3am	75	56	45	40	34	54
3am - 7am	82	59	50	42	37	57

COMMENTS: traffic noise dominant

2.15 MILE E. OF STEVENS GULCH ON HIGHWAY 133						
7am - 9am	79	64	63	61	47	63
9am - 11am	120	61	37	28	25	92
11am - 1pm	84	62	38	29	23	59
1pm - 3pm	80	63	39	29	24	59
3pm - 5pm	79	65	44	31	24	60
5pm - 7pm	79	60	34	31	26	57

LOCATION	PERCENTILE LEVELS dB(A) re: $20\mu N/M^2$					
ORCHARD 50 S OF TRACKS & S OF SILOS	MAX	L10	L50	L90	MIN	LEQ
7am - 9am	61	54	50	48	45	52
9am - 10am	74	57	49	47	44	56
10am - 2pm	85	59	55	52	48	60
2pm - 5pm	71	49	47	45	39	49
5pm - 7pm	68	50	48	56	30	48
7pm - 11pm	62	46	37	32	28	42
11pm - 3am	60	48	41	35	30	44
3am - 7am	65	55	51	46	37	52

COMMENTS: CWI train in at 10:30am, U.S. Steel train by at 9:00am. Cars slamming is peak of 85, U.S. Steel train by at 3:00pm, CWI train out at 2:45pm
construction 7am - 5pm

LOCATION	PERCENTILE LEVELS dB(A) re: 20μN/M²					
7pm - 9pm	75	62	37	30	26	60
9pm - 11pm	79	64	63	61	47	63
11pm - 3am	79	60	34	29	26	57
3am - 7am	75	62	37	30	26	60

COMMENTS: traffic noise, animals, wind - dominant

300' FROM STEVENS GULCH ON JACK MORREL PROPERTY						
7am - 9am	64	45	35	28	24	42
9am - 11am	63	41	34	32	29	42
11am - 1pm						
1pm - 3pm	54	38	34	33	32	38
3pm - 5pm	57	44	35	32	31	42
5pm - 7pm	49	35	33	32	31	35
7pm - 11pm	48	31	28	26	24	30
11pm - 3am	51	23	17	16	16	26
3am - 7am	60	41	19	17	16	37

COMMENTS: generator, wind, animals, insects - dominant
generator off 10pm - 6am

3. A watering truck which operates approximately 12 hours a day, transporting water to the mine's 300,000-gallon water storage tank from four wells drilled just off Stevens Gulch Road by Westmoreland.

4. Equipment associated with the mine site:

   a. Generator which pumps water for mine use.
   b. The mine's ventilation fan (currently, no home is impacted by the operating fan).
   c. Conveyor drive motors and drive stations and future crushing and screening operation (not yet completed).

5. Operations and equipment associated with the loading facilities that is the conveyors, dust scrubbers, belt conveyor drive stations and the loading operation itself.

E. Visual Resources

The landscape is characterized by gently sloping to steep hills covered with mountain shrub and pinyon-juniper forests. The hills on which the Orchard Valley Mine and the proposed facilities are located are part of the overall linear arrangement of hills which define the North Fork River Valley and compose the lower flanks of Grand Mesa. These hills rise high above the valley for a short horizontal distance, giving strong valley definition in the Paonia area. The mine and adjacent hillsides are also highly visible from the Stevens Gulch Road, although the mine and the locations of the proposed projects are mostly screened from Highway 133.

Therefore, only two points of view will be considered in the following descriptions and analysis of the proposed action: (1) from the more distant Paonia and its surrounding farms and dispersed homes (Pan American properties on the east of Paonia as this area best represents the view from the Paonia area) and (2) from the nearby Stevens Gulch Road. See map II-2. (Note: While the emphasis here is on the proposed action, landscape and visual impact descriptions and analyses cannot ignore the presence of the mine and other nearby artificial features which could influence the perception of any of the proposed projects either by visually overwhelming and absorbing the proposed facilities and thus reducing visual impact or by serving as a focus to draw attention to the proposed project.)

Photos 2, 3, and 4, taken from the Pan American properties, Paonia Cemetery, and Stevens Gulch Road respectively, show the character of the hills and the contrasts of existing mine facilities. Except for rock outcroppings, there are no natural focal points; as a result, the color and texture of the vegetation are the most dominant features in the natural landscape (photo 4).

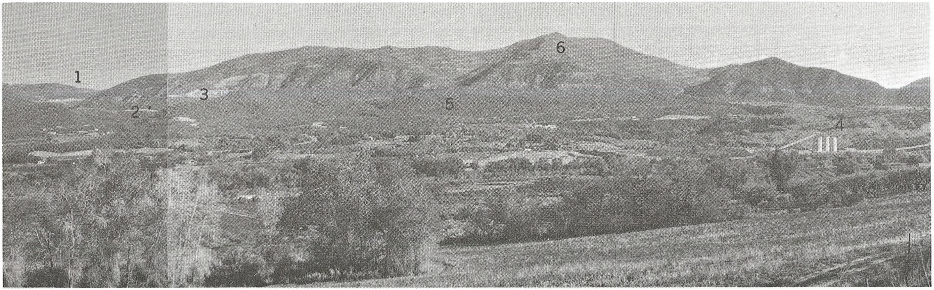


Photo 2

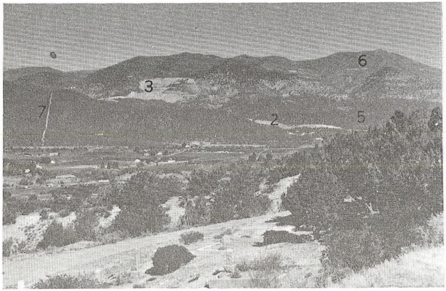


Photo 3

North Fork Valley - Orchard Mine Area

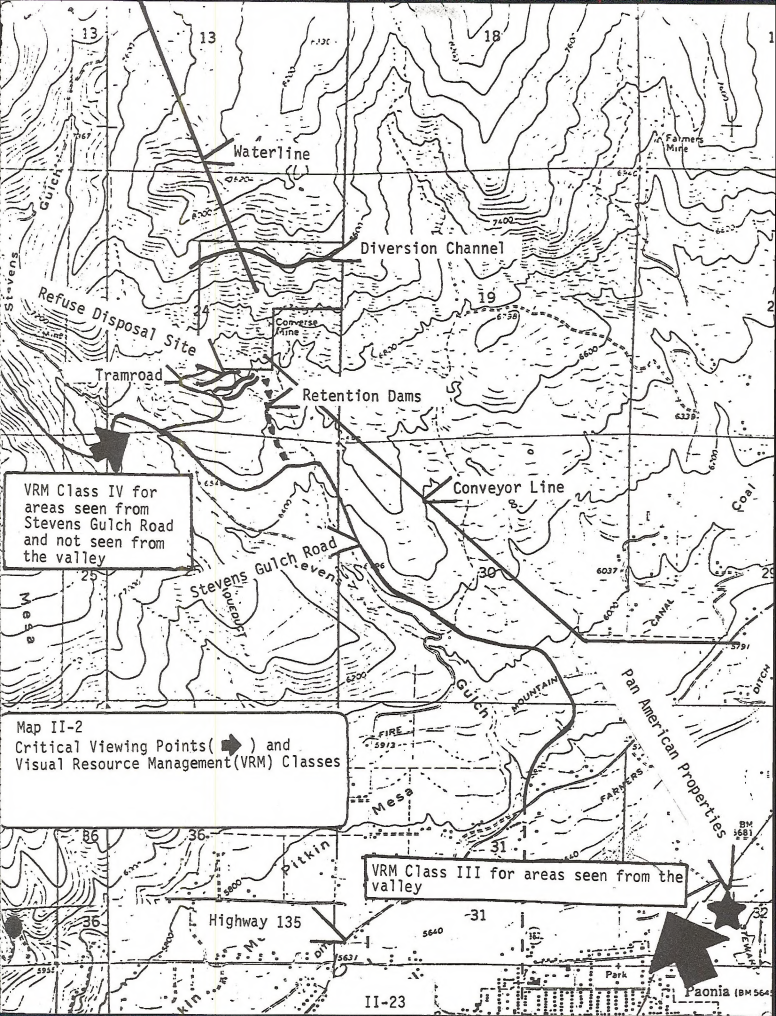
Photo #2 is from Pan American Properties; Photo #3 is from Paonia cemetery on the southwest edge of Paonia. Key to reference numbers on photos:

1. Stevens Gulch
2. Stevens Gulch Road
3. Orchard Valley Mine
4. Orchard Valley Mine Coal Storage/Loading Facility
5. Pinyon-Juniper Vegetation
6. Mountain Shrub Vegetation
7. Aqueduct

Photo #4 - <u>Orchard Valley Mine</u>

Photo is taken from the Stevens Gulch Road from the switchback above the exit to the mine. Key to reference number on photo:

1. Orchard Valley Mine
2. Stevens Gulch Road
3. North Fork River Canyon
4. Train Road
5. TLS (Truck Loading Station)(also origin of proposed conveyor line)



Map II-2
Critical Viewing Points( ) and
Visual Resource Management(VRM) Classes

Two visual resource management (VRM) classes apply to the area of the proposed action. For all areas visible from the valley, the VRM class is III. For all areas visible from the Stevens Gulch Road but not from the valley and for areas screened from common points of view, the VRM class is IV. (See map II-2.) For definitions of these classes and more detail on the VRM system methodology, see appendix B-1.

F. Recreation

The areas in the bottom of the North Fork Valley and in the high country of the surrounding region have high recreation values and capacities to support most types of recreational activities, while the intermediate hills--the public lands managed by the BLM--have a relatively low value and capacity to support anything other than dispersed activities. The privately owned pastoral lands of the valley bottom and the lands in the high country possess a greater diversity of environmental features which provide outstanding opportunities for hunting, fishing, camping, picnicking, cross country skiing, and snowmobiling.

The pastoral valley bottom is a highly scenic arrangement of farmlands, orchards, farm facilities, river forest, and rural town (Paonia). Several hills and mesas provide added variety to the views and added viewing opportunities, making the area a very desirable residential area. The adjacent hills of the public lands serve mainly as a backdrop for these views. The blooming and ripening of the orchards are of regional significance. Driving for pleasure (sightseeing) constitutes the main recreation activity along the valley bottom, whether it is done by residents, people coming to see the orchards, or people passing through to the high country.

The Stevens Gulch Road provides access to the high country of Grand Mesa for snowmobiling,[1] hunting, and 4-wheel driving.[2] More recently it has been used by people wanting to obtain a closer look at the Orchard Valley Mine or drive to the mine for a tour.

G. Water Resources

1. Surface Water

Relevant hydrologic data were obtained from publications by the U.S. Department of Agriculture, Soil Conservation Service (1936-present) for snow surveys, U.S. Geological Survey for streamflow and water quality summaries, and National Weather Service for climatological data; and

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[1]Use figures for 1972 show that 150 visits were made up Stevens Gulch Road by snowmobilers.

[2]The area's wildlife conservation officer, Dave Kenvin, estimates a maximum of 25 deer hunters would use the area within a one mile radius of Westmoreland's operation on any one day of the regular deer season.

Table II-11 Regional Runoff Summary - North Fork of the Gunnison River (Leaf, 1977)

Year	N. Fork Nr. Somerset Ann. Yield (a.-f.)	N. Fork Nr. Somerset Max. (c.f.s.)	N. Fork Nr. Somerset Min. (c.f.s.)	W. Muddy Nr. Ragged Mtn. Ann. (a.-f.)	W. Muddy Nr. Ragged Mtn. Max. (c.f.s.)	W. Muddy Nr. Ragged Mtn. Min. (c.f.s.)	Leroux Nr. Cedaredge Ann. (a.-f.)	Leroux Nr. Cedaredge Max. (c.f.s.)	Leroux Nr. Cedaredge Min. (c.f.s.)
1950	335,590	3240	42				34,600	625	5.0
51	256,100	3210	17				25,620	765	1.8
52	474,700	5320	28				53,620	815	4.0
53	248,400	3660	30				28,720	498	5.0
54	142,300	1150	30				22,450	412	4.5
55	239,830	2700	38				30,770	512	4.0
56	245,600	2940	35				26,170	553	4.0
57	593,800	7860	29						
58	367,700	3920	60	5,060	130	0.2			
59	193,300	2390	35	1,810	43	0			
60	255,400	3370	40	2,410	46	0			
61	195,300	2320	36	2,090	83	0.2	21,530	404	--
62	459,240	4800	44	6,370	260	0.3	46,600	628	5.0
63	173,590[1]	1880	24	1,730	26	0.1	21,110	520	4.0
64	275,100	4950	26	2,970	178	--	28,100	1050	2.0
65	440,080	4440	32	4,320	72	--	38,660	689	--
66	232,760	2220	50				27,720	432	5.5
67	253,310	2730	45				31,950	810	4.4
68	345,190	3690	40				33,240	835	2.9
69	358,000	3050	40				45,470	640	6.1
70	347,090	3570	56						
71	318,040	2320	68						
72	219,240	1930	56						
73	432,700	6580	50						
74	321,070	5130	50						
O.A.	513			7.52			35.1		
Q	308,898	3578	40.36	3,345	105.37	0.133	31,959	636.19	4.21
S	108,365	1550	12.65	1,715	80.11	0.121	9,703	181.19	1.244
ASH	501.73	6.97	0.0787	442.81	14.01	0.0177	910.51	18.12	0.1201
H	8700			8500			9150		

Year	W. Muddy Nr. Somerset Ann. (a.-f.)	W. Muddy Nr. Somerset Max. (c.f.s.)	W. Muddy Nr. Somerset Min. (c.f.s.)	Main Hubbard Nr. Paonia Ann. (a.-f.)	Main Hubbard Nr. Paonia Max. (c.f.s.)	Main Hubbard Nr. Paonia Min. (c.f.s.)	Mid. Hubbard Nr. Paonia Ann. (a.-f.)	Mid. Hubbard Nr. Paonia Max. (c.f.s.)	Mid. Hubbard Nr. Paonia Min. (c.f.s.)	W. Hubbard Nr. Paonia Ann. (a.-f.)	W. Hubbard Nr. Paonia Max. (c.f.s.)	W. Hubbard Nr. Paonia Min. (c.f.s.)
61				772	15	0.1	874	19	0.2	1,720	39	--
62	42,760	900	0.4	1,860	22	0.2	1,930	36	0.2	3,780	51	--
63	7,940	129	0.1	950	24	0.1	963	27	0.1	1,630	32	[illegible]
64	13,460	638	--	942	20	0.1	1,050	24	0.1	2,140	46	0.1
65	26,010	545	--	1,560	24	--	1,720	33	0.1	3,480	52	--
66	18,020	371	1.4	857	14	--	1,130	18	--	2,030	34	--
67	12,820	137	0.8	1,240	18	0.1	1,570	35	0.2	2,640	40	0.3
68	22,300	575	3.2	1,340	40	0.1	1,370	47	0.2	2,290	53	0.3
69	30,010	760	3.5							3,180	93	0.4
70	26,300	030	4.5							2,930	55	0.1
71	26,740	465	1.8							2,560	44	0.5
72	12,130	120	1.0							1,530	26	0.3
73	35,810	1190	1.1							3,410	68	0.3
O.A.	50.1			1.31			1.34			2.36		
Q	22,858	555.0	1.78	1,190	22.12	0.1167	1,326	29.87	0.1571	2,563	48.69	0.2880
S	10,455	335.03	1.46	381	8.15	0.4080	384	9.77	0.0535	750	17.37	0.1269
ASH	456.25	11.08	0.355	908.49	16.89	0.0891	989.46	22.29	0.1173	1086.05	20.63	0.1724
H	8500			9500			9500			9500		

[1] Corrected for Storage in Paonia Reservoir.

LEGEND:

O.A. = Drainage area in mi.^{2}

Q = Average annual yield and peak flow in a.-f. and c.f.s., respectively.

S = Standard deviation of annual yield and peak flow.

ASH = Average yield and peak flow in a.-f./mi.^{2} and c.f.s./mi^2, respectively.

H = Average elevation of watershed, ft. m.s.l.

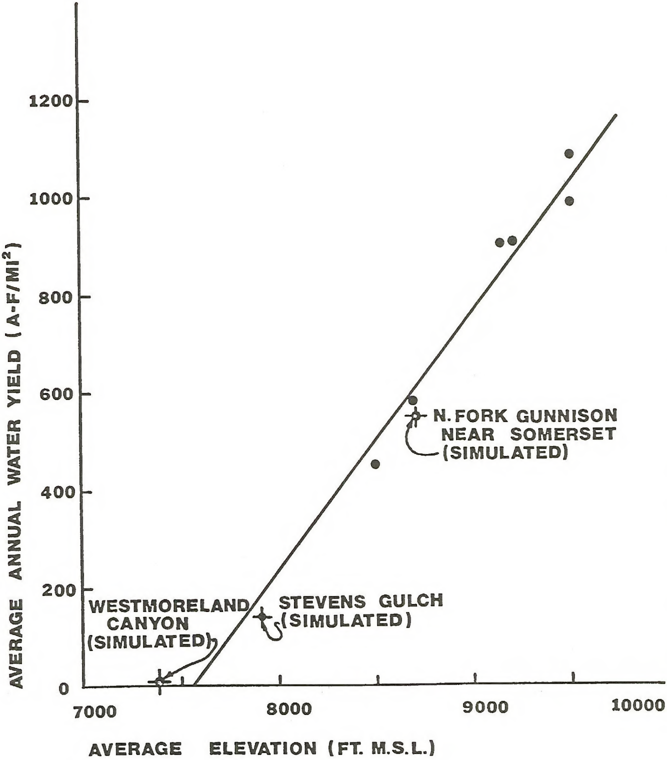


Figure II-1. Correlation of Average Annual Water Yield with Elevation.

site specific water quality data along the North Fork of the Gunnison were obtained from the Colorado State Department of Health.

Table II-11 is a regional summary of the streamflow characteristics of seven drainage basins that vary from 1.3 to 513 square miles in size. Runoff is generally lowest in January through March and highest in May, June, or July. Approximately 75 percent of the annual flow occurs during the snowmelt runoff season (April-July). Rainfall during peak snowmelt can produce extreme flooding. Subsequent rainfall during summer and fall does not produce significant quantities of streamflow.

Annual runoff correlates well with average watershed elevation as shown in figure II-1. Below 7,500 feet mean sea level (MSL), much of the precipitation is consumed by vegetation and absorbed by the soils, rather than flowing from the valley as runoff. However, at elevations above 9,000 feet, annual water yields average more than 800 acre-feet per square mile.

Peak flows are summarized in table II-11 and plotted as a function of average elevation in figure II-2(a). Figure II-3 shows peak flow frequency curves for the North Fork near Somerset below Paonia Dam and for West Hubbard Creek. It is emphasized that these relationships are valid only for snowmelt peaks. As discussed subsequently in this report, peaks generated by short-duration storm runoff are quite a different story.

Of particular environmental concern are the extremely low flows which routinely occur during winter. Flow regime is the product of climatic and physiographic factors. Watersheds in the subalpine zone of the North Fork are typically covered with coniferous forests to timberline at about 11,500 feet. Soils decrease in depth with increasing elevation, thus limiting the amount of moisture that can be stored in the soil mantle. Moderate water consumption by vegetation on relatively shallow mountain soils coupled with the bedrock at or very near the ground surface over much of the area precludes any significant subsurface runoff. Moreover, the natural and artificial lakes, ponds, and swampy areas, while providing some storage, are not extensive enough to completely regulate streamflow in the North Fork. The net result is sharp-peaked, high-intensity runoff during spring with rapid recession of flows to extremely low levels in late winter. This is illustrated in figure 2(b). At 9,000 feet in average years, flows can vary from a high of nearly 16 cubic feet per second per square mile (csm) to a low in winter of near 0.08 csm--a factor of 200.

The average annual discharge of the North Fork of the Gunnison River is 314,374 acre-feet, which drain 513 square miles with an average elevation of 8,700 feet. This is a water yield of 602 acre-feet per square mile. The consumptive use from this flow in the North Fork Valley as of 1962 totalled 100,770 acre-feet annually, of which 77,580 acre-feet were used for agriculture, 17,173 acre-feet were used by riparian vegetation, and 6,014 acre-feet were used for recreation, domestic, municipal, and losses to evaporation (Soil Conservation Service 1962).

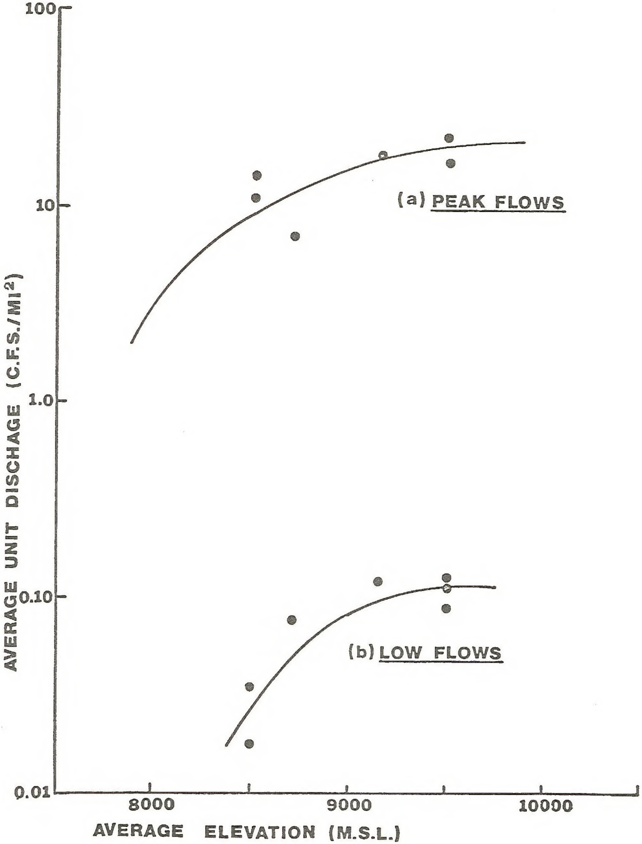


Figure II-2. Peak and Low Flow characteristics, North Fork of the Gunnison River.

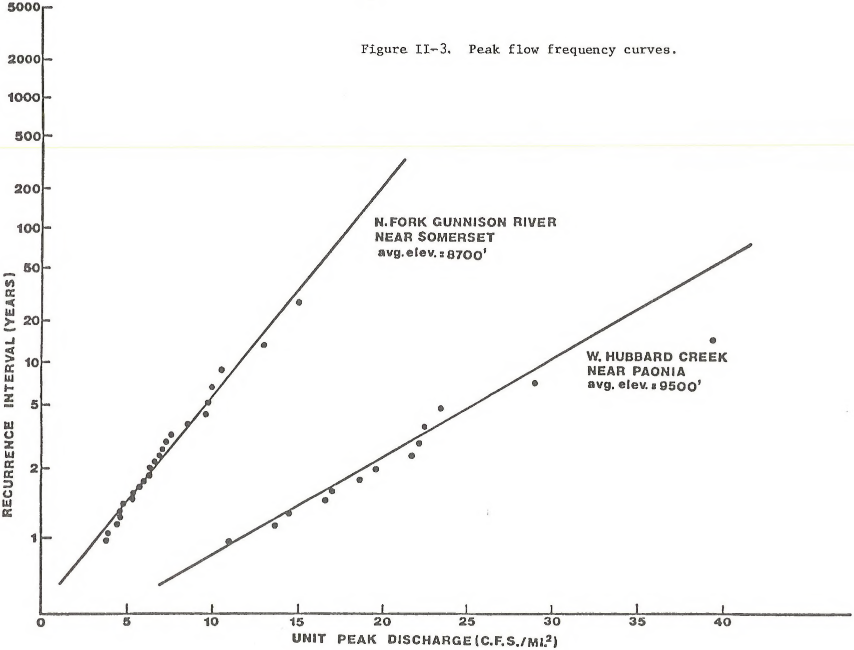


Figure II-3. Peak flow frequency curves.

Flow records for small subwatersheds like Stevens Gulch or Westmoreland Canyon usually are not kept. For this reason there are no site-specific hydrometeorological data available for determining annual runoff rates, infiltration rates, etc. However, there are several techniques available to estimate water budgets of ungauged basins. The best approach for this analysis is the hydrologic simulation modeling. A detailed explanation of this method is given in appendix C. Of the many water balance models available, the "Subalpine Water Balance Model" was chosen to simulate watersheds in the North Fork, since it was developed and calibrated for the high-elevation subalpine zone of the Central and Southern Rocky Mountains. This dynamic hydrologic model was developed by the U.S. Forest Service, and is specifically designed to simulate the hydrologic impacts of watershed management (Leaf and Brink 1973b). It simulates on a daily basis: (1) winter snow accumulation, (2) the energy balance, (3) snowpack condition, (4) evapotranspiration, (5) snowmelt, and (6) resultant water yield on all combinations of aspect, slope, elevation, and forest cover composition and density. The model determines the form of precipitation (rain or snow), the melting process, and snowpack condition in terms of energy levels and free water requirements. This model is more thoroughly described in appendix C, "Application and Use of Computer Models." This model was tested on the North Fork of the Gunnison River and compared to actual data obtained from a gauging station near Somerset, to evaluate the credibility of the model. Table II-12 gives the water balance result, and figure II-4 graphically compares the simulated and observed response.

The simulated water balance for Stevens Gulch drainage (a "potential balance") represents an estimate of the amount of runoff available to surface or subsurface flow without consideration for the disposition of that flow. Geomorphic factors in this low-to-intermediate elevation zone have produced watersheds which apparently are not tight. In other words, some amount of water generated from this zone may be lost to adjacent watersheds and to deep seepage in the dipping sedimentary formations. That which is left results as intermittent surface flow and subsurface runoff which percolates through alluvial surface aquifers. Accurate quantification of this component through additional, detailed hydrogeologic studies has been done on Stevens Gulch by Wright Water Engineers, Inc. Their well completion report is included in appendix C. A conservative estimate of generated runoff (including surface runoff, groundwater flow, and deep seepage losses) appears to be at least 2.5 inches in the average year. During dry years, water yields are approximately 0.5 inch, whereas in high years, they may be 5 to 7 inches. Table II-13 is the water balance simulation for Stevens Gulch. Of the 2.48-inch average annual yield, perhaps 0.5 inch results as near-surface runoff during April and May. The remaining 2 inches are generated as ground water and deep seepage flow.

The hydrology of Westmoreland Canyon is complex in that streamflow is ephemeral and is derived from both stormflow and snowmelt. The average water balance for the 1950-59 water years is given in table II-14.

Table II-12

WATER BALANCE SIMULATION

NORTH FORK GUNNISON NR. SOMERSET

DATA BASE: AVERAGE OF YEARS 1950 - 1959   02/22/77 10.39.24.

	CURRENT SNOWPACK W. E.	CURRENT RECHARGE REQ	INTERVAL TOTALS PRECIP	INTERVAL TOTALS INPUT	INTERVAL TOTALS EVAPOTRANS FROM	INTERVAL TOTALS GENERATED RUNOFF	YEAR TO DATE PRECIP	YEAR TO DATE INPUT	YEAR TO DATE EVAPOTRANS	YEAR TO DATE GEN RUNOFF	YEAR TO DATE CHANGE IN RCHRG RQ
10 6	.59	-2.82	.18	.10	.1238	.01	.18	.10	.1238	.01	-.01
10 12	.72	-2.90	.20	.04	.1264	.01	.37	.14	.2501	.03	-.08
10 18	.49	-2.99	.29	0.00	.1100	0.00	.66	.14	.3601	.03	-.17
10 24	1.42	-3.06	.47	0.00	.0957	0.00	1.13	.14	.4558	.03	-.24
10 30	1.63	-3.10	.23	0.00	.0668	0.00	1.35	.14	.5227	.03	-.29
11 5	1.86	-3.13	.25	0.00	.0406	0.00	1.61	.14	.5633	.03	-.31
11 11	2.14	-3.15	.30	0.00	.0354	0.00	1.90	.14	.5988	.03	-.33
11 17	2.76	-3.16	.66	0.00	.0377	0.00	2.56	.14	.6365	.03	-.34
11 23	3.10	-3.17	.34	0.00	.0326	0.00	2.89	.14	.6691	.03	-.36
11 29	3.23	-3.18	.14	0.00	.0237	0.00	3.04	.14	.6927	.03	-.37
12 5	3.81	-3.19	.62	0.00	.0252	0.00	3.66	.14	.7180	.03	-.38
12 11	4.39	-3.19	.59	.00	.0297	0.00	4.25	.14	.7477	.03	-.38
12 17	4.74	-3.20	.37	0.00	.0221	0.00	4.62	.14	.7698	.03	-.38
12 23	5.14	-3.20	.42	0.00	.0237	0.00	5.04	.14	.7935	.03	-.39
12 29	5.59	-3.20	.47	0.00	.0199	0.00	5.51	.14	.8133	.03	-.39
1 4	6.22	-3.21	.64	0.00	.0261	0.00	6.15	.14	.8394	.03	-.39
1 10	6.79	-3.21	.60	.00	.0307	0.00	6.75	.14	.8702	.03	-.39
1 16	7.36	-3.21	.62	0.00	.0334	0.00	7.37	.14	.9035	.03	-.40
1 22	7.87	-3.21	.52	0.00	.0346	0.00	7.89	.14	.9382	.03	-.40
1 28	9.01	-3.21	1.22	.00	.0434	0.00	9.11	.14	.9816	.03	-.40
2 3	9.56	-3.22	.57	0.00	.0445	0.00	9.67	.14	1.0261	.03	-.40
2 9	10.13	-3.22	.62	0.00	.0464	0.00	10.29	.14	1.0725	.03	-.40
2 15	10.43	-3.22	.33	0.00	.0400	0.00	10.63	.14	1.1125	.03	-.40
2 21	10.96	-3.22	.59	0.00	.0460	0.00	11.21	.14	1.1585	.03	-.41
2 27	11.50	-3.22	.58	.00	.0472	0.00	11.79	.14	1.2057	.03	-.41
3 4	11.85	-3.22	.46	0.00	.0609	0.00	12.25	.14	1.2666	.03	-.41
3 10	12.19	-3.22	.40	0.00	.0631	0.00	12.65	.14	1.3297	.03	-.41
3 16	12.71	-3.22	.59	0.00	.0696	0.00	13.24	.14	1.3993	.03	-.41
3 22	13.34	-3.22	.72	.00	.0802	0.00	13.96	.14	1.4795	.03	-.41
3 28	13.98	-3.22	.72	.00	.0880	0.00	14.68	.14	1.5676	.03	-.41
4 3	14.37	-3.22	.49	0.00	.1060	0.00	15.17	.14	1.6736	.03	-.41
4 9	14.94	-3.22	.72	0.00	.1491	0.00	15.89	.14	1.8226	.03	-.41
4 15	14.96	-3.22	.15	0.00	.1289	0.00	16.04	.14	1.9515	.03	-.41
4 21	15.03	-3.17	.34	.10	.1701	.04	16.38	.24	2.1216	.07	-.35
4 27	14.49	-3.05	.42	.27	.1952	.15	16.80	.51	2.3168	.22	-.24
5 3	14.40	-2.97	.35	.20	.2483	.12	17.15	.71	2.5652	.33	-.16
5 9	14.07	-2.66	.23	.70	.3832	.37	17.37	1.40	2.9484	.70	.15
5 15	12.99	-2.29	.18	.95	.3362	.55	17.55	2.36	3.2846	1.25	.52
5 21	12.14	-2.07	.48	1.04	.3318	.77	18.03	3.40	3.6164	2.02	.74
5 27	11.23	-1.94	.37	1.04	.3013	.85	18.40	4.45	3.9177	2.87	.87
6 2	10.03	-1.83	.24	1.10	.4402	.88	18.63	5.54	4.3579	3.75	.98
6 8	8.61	-1.70	.28	1.33	.5235	1.05	18.91	6.87	4.8814	4.80	1.11
6 14	7.30	-1.66	.20	1.20	.5427	.92	19.11	8.07	5.4241	5.72	1.15
6 20	6.26	-1.53	.27	1.05	.4778	.70	19.38	9.12	5.9019	6.42	1.29
6 26	5.44	-1.51	.11	.68	.5150	.40	19.49	9.80	6.4169	6.82	1.30
7 2	4.60	-1.60	.16	.74	.6064	.48	19.64	10.53	7.0233	7.29	1.22
7 8	3.86	-1.71	.24	.72	.6918	.40	19.88	11.25	7.7150	7.69	1.10
7 14	3.13	-1.81	.21	.70	.6962	.34	20.09	11.95	8.4112	8.04	1.00
7 20	2.45	-1.60	.52	1.06	.6517	.34	20.61	13.01	9.0629	8.38	1.22
7 26	1.69	-1.64	.31	.96	.6710	.44	20.92	13.97	9.7340	8.82	1.18
8 1	1.21	-1.69	.51	.89	.6532	.39	21.43	14.86	10.3872	9.20	1.12
8 7	.81	-1.65	.60	.95	.5065	.46	22.04	15.81	10.8936	9.66	1.17
8 13	.60	-1.83	.34	.52	.5706	.16	22.37	16.33	11.4643	9.82	.98
8 19	.34	-1.97	.29	.53	.5172	.16	22.66	16.86	11.9815	9.98	.85
8 25	.24	-2.16	.27	.36	.4914	.07	22.93	17.22	12.4729	10.05	.65
8 31	.32	-2.40	.38	.30	.5003	.04	23.31	17.52	12.9732	10.09	.42
9 6	.25	-2.58	.10	.16	.3015	.05	23.41	17.69	13.2747	10.14	.23
9 12	.32	-2.70	.27	.19	.2697	.05	23.68	17.87	13.5444	10.19	.11
9 18	.39	-2.79	.25	.15	.2450	.02	23.93	18.03	13.7894	10.22	.02
9 24	.64	-2.87	.38	.11	.2154	.00	24.32	18.13	14.0049	10.22	-.06
9 30	.73	-2.92	.30	.17	.2302	.02	24.61	18.31	14.2351	10.24	-.10

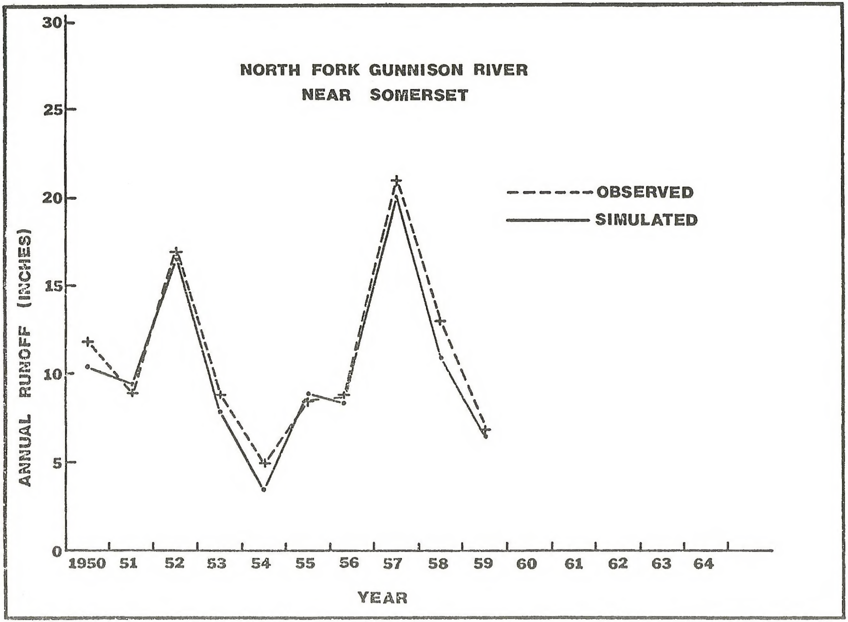


Figure II-4 Observed versus Simulated Annual Runoff.

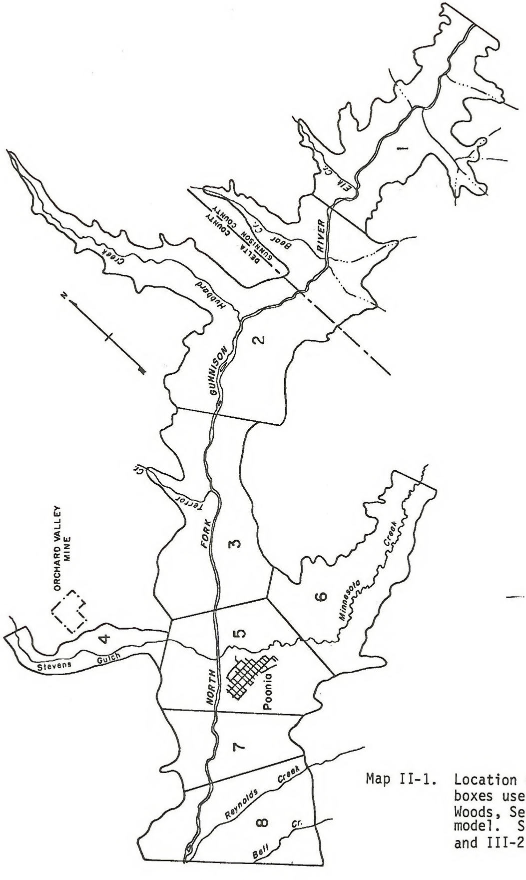
TABLE II-13

WATER BALANCE SIMULATION

STEVENS GULCH

DATA BASE: AVERAGE OF YEARS 1950 - 1959 03/03/77 10.10.13.

	CURRENT		INTERVAL TOTALS				YEAR TO DATE				
	SNOWPACK W. E.	RECHARGE REQ	PRECIP	INPUT	EVAPOTRANS FROM	GENERATED RUNOFF	PRECIP	INPUT	EVAPOTRANS	GEN RUNOFF	CHANGE IN RCHRG RQ
10 6	.01	-4.11	.10	.09	.0961	0.00	.10	.09	.0961	0.00	-.01
10 12	.00	-4.11	.10	.10	.1032	.00	.20	.18	.1993	.00	-.01
10 18	.06	-4.13	.13	.03	.0926	.00	.33	.22	.2919	.00	-.03
10 24	.22	-4.13	.24	0.00	.0872	0.00	.57	.22	.3791	.00	-.03
10 30	.18	-4.14	.11	0.00	.1515	0.00	.68	.22	.5306	.00	-.04
11 5	.20	-4.10	.14	.05	.0675	.01	.81	.27	.5981	.01	-.00
11 11	.30	-4.10	.16	.00	.0682	0.00	.97	.27	.6663	.01	-.00
11 17	.59	-4.10	.38	0.00	.0853	0.00	1.35	.27	.7516	.01	-.00
11 23	.73	-4.10	.21	0.00	.0751	0.00	1.56	.27	.8267	.01	-.00
11 29	.74	-4.10	.08	0.00	.0720	0.00	1.65	.27	.8987	.01	-.00
12 5	1.09	-4.10	.40	0.00	.0438	0.00	2.04	.27	.9425	.01	-.00
12 11	1.41	-4.10	.35	0.00	.0361	0.00	2.39	.27	.9787	.01	-.01
12 17	1.57	-4.10	.26	0.00	.0371	0.00	2.59	.27	1.0158	.01	-.01
12 23	1.76	-4.10	.23	0.00	.0387	0.00	2.82	.27	1.0545	.01	-.01
12 29	1.99	-4.10	.26	0.00	.0363	0.00	3.09	.27	1.0909	.01	-.01
1 4	2.33	-4.10	.37	0.00	.0381	0.00	3.46	.27	1.1289	.01	-.01
1 10	2.62	-4.11	.33	0.00	.0415	0.00	3.80	.27	1.1703	.01	-.01
1 16	2.94	-4.11	.36	0.00	.0405	0.00	4.16	.27	1.2109	.01	-.01
1 22	3.24	-4.11	.33	0.00	.0412	0.00	4.49	.27	1.2520	.01	-.01
1 28	3.46	-4.11	.77	0.00	.0439	0.00	5.26	.27	1.2959	.01	-.01
2 3	4.27	-4.11	.34	0.00	.0522	0.00	5.62	.27	1.3481	.01	-.01
2 9	4.60	-4.11	.39	0.00	.0630	0.00	6.01	.27	1.4111	.01	-.01
2 15	4.80	-4.11	.27	0.00	.0616	0.00	6.29	.27	1.4727	.01	-.01
2 21	5.10	-4.09	.39	.01	.0662	0.00	6.66	.28	1.5390	.01	.01
2 27	5.43	-4.09	.40	0.00	.0674	0.00	7.06	.28	1.6063	.01	.01
3 4	5.65	-4.09	.34	0.00	.0885	0.00	7.39	.28	1.6947	.01	.01
3 10	5.82	-4.09	.29	0.00	.1204	0.00	7.68	.29	1.8151	.01	.01
3 16	6.09	-4.09	.39	0.00	.1115	0.00	8.07	.29	1.9266	.01	.01
3 22	6.45	-4.07	.50	.02	.1230	0.00	8.57	.31	2.0497	.01	.03
3 28	6.75	-3.98	.55	.09	.1534	.00	9.12	.40	2.2031	.01	.12
4 3	6.78	-3.90	.34	.14	.1846	.04	9.47	.54	2.3876	.06	.20
4 9	6.92	-3.82	.46	.15	.1982	.04	9.92	.69	2.5859	.10	.28
4 15	6.47	-3.66	.09	.32	.2573	.13	10.01	1.01	2.8431	.23	.44
4 21	5.54	-3.24	.21	.89	.3209	.40	10.22	1.90	3.1640	.62	.86
4 27	4.48	-2.66	.31	1.21	.3035	.49	10.53	3.11	3.4673	1.11	1.44
5 3	3.61	-2.28	.21	.91	.3792	.31	10.73	4.02	3.8467	1.42	1.82
5 9	2.25	-1.71	.14	1.36	.5532	.37	10.87	5.36	4.3999	1.80	2.38
5 15	1.43	-1.60	.11	.84	.5543	.26	10.98	6.20	4.9542	2.06	2.50
5 21	1.29	-1.73	.29	.32	.4846	.08	11.26	6.52	5.4388	2.13	2.36
5 27	.82	-1.63	.22	.60	.4793	.11	11.48	7.12	5.9181	2.24	2.47
6 2	.57	-1.97	.14	.35	.6263	.10	11.63	7.47	6.5444	2.35	2.13
6 8	.20	-2.23	.17	.52	.7051	.10	11.79	7.99	7.2495	2.44	1.87
6 14	0.00	-2.58	.12	.31	.6642	.00	11.91	8.31	7.9137	2.45	1.52
6 20	0.00	-2.99	.16	.16	.5515	.02	12.07	8.47	8.4652	2.46	1.11
6 26	0.00	-3.45	.06	.06	.5260	0.00	12.14	8.53	8.9913	2.46	.65
7 2	0.00	-3.82	.09	.09	.4657	0.00	12.23	8.62	9.4579	2.46	.28
7 8	0.00	-4.09	.14	.14	.4153	0.00	12.38	8.77	9.8723	2.46	.01
7 14	0.00	-4.29	.13	.13	.3274	0.00	12.50	8.89	10.1997	2.46	-.19
7 20	0.00	-4.24	.31	.31	.2593	0.00	12.82	9.21	10.4590	2.46	-.14
7 26	0.00	-4.29	.19	.19	.2411	.00	13.00	9.39	10.7001	2.46	-.19
8 1	0.00	-4.25	.31	.31	.2578	.00	13.31	9.71	10.9579	2.47	-.15
8 7	0.00	-4.12	.36	.36	.2284	.01	13.67	10.05	11.1852	2.47	-.02
8 13	0.00	-4.19	.20	.20	.2690	0.00	13.87	10.26	11.4552	2.47	-.09
8 19	0.00	-4.25	.17	.17	.2320	0.00	14.05	10.43	11.6873	2.47	-.15
8 25	0.00	-4.30	.16	.16	.2118	.00	14.21	10.60	11.8990	2.47	-.20
8 31	0.00	-4.29	.23	.23	.2168	.00	14.43	10.82	12.1159	2.48	-.19
9 6	0.00	-4.38	.06	.06	.1465	.00	14.50	10.88	12.2624	2.48	-.29
9 12	.01	-4.36	.16	.15	.1276	0.00	14.66	11.03	12.3900	2.48	-.26
9 18	0.00	-4.34	.15	.16	.1443	0.00	14.81	11.19	12.5349	2.48	-.24
9 24	.01	-4.26	.23	.22	.1500	.00	15.04	11.41	12.6849	2.48	-.17
9 30	.06	-4.29	.18	.11	.1480	.00	15.22	11.53	12.8329	2.48	-.20



Map II-1. Location of air quality boxes used in Marlatt, Woods, Sestak air quality model. See tables II-9, and III-2.

Table II-14

Simulated Runoff For 1951-59 Water Years
Stevens Gulch Watershed

Year	Precipitation (inches)	Water Yield (inches)
1951	15.1	1.9
1952	19.7	6.5
1953	12.8	0.7
1954	12.5	0.5
1955	14.7	2.1
1956	14.2	1.0
1957	21.2	4.5
1958	14.7	2.1
1959	11.8	0.6
	9)136.5	9)19.9
	15.17	2.2

TABLE II-15

WATER BALANCE SIMULATION

STEVENS GULCH - WESTMORELAND CANYON (UNDISTURBED)

03/08/77 10.04.17.
DATA BASE: AVERAGE OF YEARS 1950 - 1959

	CURRENT		INTERVAL TOTALS				YEAR TO DATE				
	SNOWPACK W. E.	RECHARGE REQ	PRECIP	INPUT	EVAPOTRANS FROM	GENERATED RUNOFF	PRECIP	INPUT	EVAPOTRANS	GEN RUNOFF	CHANGE IN RCHRG RQ
10 6	.00	-4.68	.07	.06	.0963	0.00	.07	.06	.0963	0.00	-.03
10 12	0.00	-4.71	.06	.06	.1020	0.00	.13	.12	.1983	0.00	-.06
10 18	.04	-4.74	.10	.02	.0887	0.00	.23	.14	.2870	0.00	-.09
10 24	.16	-4.74	.21	0.00	.0892	0.00	.44	.14	.3763	0.00	-.09
10 30	.09	-4.74	.08	0.00	.1457	0.00	.52	.14	.5219	0.00	-.09
11 5	.12	-4.71	.12	.03	.0594	0.00	.64	.18	.6813	0.00	-.06
11 11	.17	-4.70	.13	.00	.0735	0.00	.77	.18	.4548	0.00	-.05
11 17	.38	-4.70	.29	0.00	.0907	0.00	1.06	.18	.7455	0.00	-.05
11 23	.46	-4.70	.17	0.00	.0829	0.00	1.23	.18	.8283	0.00	-.05
11 29	.45	-4.70	.06	0.00	.0726	0.00	1.29	.18	.9009	0.00	-.05
12 5	.69	-4.70	.29	0.00	.0498	0.00	1.58	.18	.9507	0.00	-.05
12 11	.93	-4.70	.29	0.00	.0411	0.00	1.86	.18	.9918	0.00	-.05
12 17	1.05	-4.70	.16	0.00	.0423	0.00	2.02	.18	1.0341	0.00	-.05
12 23	1.20	-4.70	.19	0.00	.0441	0.00	2.22	.18	1.0782	0.00	-.05
12 29	1.36	-4.70	.20	0.00	.0413	0.00	2.42	.18	1.1195	0.00	-.05
1 4	1.59	-4.70	.27	0.00	.0427	0.00	2.69	.18	1.1622	0.00	-.05
1 10	1.81	-4.70	.27	0.00	.0466	0.00	2.96	.18	1.2088	0.00	-.05
1 16	2.06	-4.70	.29	0.00	.0452	0.00	3.25	.18	1.2540	0.00	-.05
1 22	2.29	-4.70	.28	0.00	.0455	0.00	3.53	.18	1.2995	0.00	-.05
1 28	2.90	-4.70	.66	0.00	.0481	0.00	4.19	.18	1.3477	0.00	-.05
2 3	3.13	-4.70	.28	0.00	.0555	0.00	4.47	.18	1.4032	0.00	-.05
2 9	3.40	-4.70	.34	0.00	.0667	0.00	4.81	.18	1.4699	0.00	-.05
2 15	3.64	-4.70	.30	0.00	.0647	0.00	5.12	.18	1.5345	0.00	-.05
2 21	3.89	-4.70	.32	0.00	.0684	0.00	5.43	.18	1.6029	0.00	-.05
2 27	4.18	-4.70	.36	0.00	.0689	0.00	5.79	.18	1.6719	0.00	-.05
3 4	4.38	-4.70	.32	0.00	.0900	0.00	6.11	.18	1.7619	0.00	-.05
3 10	4.50	-4.70	.25	0.00	.1236	0.00	6.36	.18	1.8854	0.00	-.05
3 16	4.72	-4.70	.33	0.00	.1145	0.00	6.69	.18	2.0000	0.00	-.05
3 22	4.96	-4.64	.43	.07	.1261	0.00	7.12	.24	2.1261	0.00	.01
3 28	5.00	-4.43	.41	.21	.1562	0.00	7.53	.45	2.2823	0.00	.22
4 3	4.90	-4.19	.29	.27	.1525	0.00	7.82	.72	2.4345	0.00	.46
4 9	4.93	-3.96	.44	.30	.1521	.03	8.26	1.03	2.5869	.03	.69
4 15	[illegible]	-3.86	[illegible]	[illegible]	.2105	.14	8.34	1.36	2.7973	.17	.79
4 21	4.05	-3.64	.20	.55	.2701	.21	8.54	1.92	3.0674	.38	1.01
4 27	3.47	-3.41	.23	.71	.2780	.31	8.78	2.63	3.3455	.69	1.24
5 3	3.19	-3.27	.21	.36	.3557	0.00	8.98	2.99	3.7011	.69	1.38
5 9	2.25	-2.72	.14	.99	.5197	0.00	9.12	3.98	4.2208	.69	1.93
5 15	1.62	-2.55	.11	.66	.5654	0.00	9.23	4.64	4.7862	.69	2.10
5 21	1.60	-2.73	.29	.21	.4916	0.00	9.51	4.86	5.2778	.69	1.92
5 27	1.18	-2.59	.22	.54	.5061	0.00	9.73	5.39	5.7839	.69	2.06
6 2	1.15	-3.06	.14	.08	.6426	0.00	9.88	5.47	6.4265	.69	1.59
6 8	.56	-3.03	.17	.71	.7175	0.00	10.04	6.18	7.1440	.69	1.62
6 14	0.00	-3.06	.12	.68	.6967	.01	10.16	6.85	7.8407	.70	1.59
6 20	0.00	-3.48	.16	.16	.5720	.01	10.32	7.01	8.4127	.71	1.17
6 26	0.00	-3.97	.06	.06	.5543	0.00	10.39	7.07	8.9670	.71	.68
7 2	0.00	-4.37	.09	.09	.4946	0.00	10.48	7.17	9.4615	.71	.28
7 8	0.00	-4.67	.14	.14	.4415	0.00	10.63	7.31	9.9031	.71	-.02
7 14	0.00	-4.88	.13	.13	.3416	0.00	10.75	7.44	10.2447	.71	-.23
7 20	0.00	-4.83	.31	.31	.2623	0.00	11.07	7.75	10.5070	.71	-.18
7 26	0.00	-4.89	.19	.19	.2425	0.00	11.25	7.94	10.7495	.71	-.24
8 1	0.00	-4.84	.31	.31	.2579	0.00	11.56	8.24	11.0074	.71	-.19
8 7	0.00	-4.70	.36	.36	.2251	0.00	11.92	8.60	11.2325	.71	-.05
8 13	0.00	-4.77	.20	.20	.2680	0.00	12.12	8.81	11.5005	.71	-.12
8 19	0.00	-4.83	.17	.17	.2350	0.00	12.29	8.98	11.7354	.71	-.18
8 25	0.00	-4.88	.16	.16	.2152	0.00	12.45	9.14	11.9505	.71	-.24
8 31	0.00	-4.88	.23	.23	.2210	0.00	12.68	9.37	12.1717	.71	-.23
9 6	0.00	-4.97	.06	.06	.1501	0.00	12.75	9.43	12.3219	.71	-.32
9 12	.01	-4.95	.16	.15	.1294	0.00	12.91	9.58	12.4512	.71	-.30
9 18	0.00	-4.92	.15	.16	.1429	0.00	13.06	9.74	12.5940	.71	-.28
9 24	.01	-4.85	.23	.22	.1485	0.00	13.29	9.95	12.7425	.71	-.20
9 30	.06	-4.88	.18	.11	.1486	0.00	13.47	10.07	12.8912	.71	-.23

TABLE II-16

WATER BALANCE SIMULATION

STEVENS GULCH - WESTMORELAND CANYON (PRESENT CONDITIONS)

03/08/77 21.23.25.

DATA BASE: AVERAGE OF YEARS 1950 - 1959

	CURRENT		INTERVAL TOTALS				- - - YEAR TO DATE - - -				
	SNOWPACK W. E.	RECHARGE REQ	PRECIP	INPUT	EVAPOTRANS FROM	GENERATED RUNOFF	PRECIP	INPUT	EVAPOTRANS	GEN RUNOFF	CHANGE IN RCHRG RQ
10 6	.00	-2.59	.07	.06	.0808	0.00	.07	.06	.0809	0.00	-.02
10 12	0.00	-2.60	.06	.07	.0786	0.00	.13	.13	.1595	0.00	-.03
10 18	.04	-2.61	.10	.04	.0734	0.00	.23	.16	.2329	0.00	-.04
10 24	.21	-2.63	.21	0.00	.0639	0.00	.44	.16	.2958	0.00	-.06
10 30	.21	-2.65	.08	0.00	.0860	0.00	.52	.16	.3828	0.00	-.07
11 5	.23	-2.62	.11	.06	.0396	.02	.63	.22	.4225	.02	-.05
11 11	.42	-2.62	.12	.00	.0432	0.00	.75	.23	.4657	.02	-.05
11 17	.55	-2.63	.28	0.00	.0488	0.00	1.03	.23	.5145	.02	-.05
11 23	.67	-2.63	.16	0.00	.0444	0.00	1.19	.23	.5539	.02	-.06
11 29	.69	-2.63	.05	0.00	.0392	0.00	1.25	.23	.5990	.02	-.06
12 5	.94	-2.63	.27	0.00	.0264	0.00	1.52	.23	.6244	.02	-.06
12 11	1.18	-2.64	.26	0.00	.0218	0.00	1.78	.23	.6452	.02	-.06
12 17	1.30	-2.64	.14	0.00	.0224	0.00	1.93	.23	.6687	.02	-.06
12 23	1.45	-2.64	.17	0.00	.0232	0.00	2.10	.23	.6918	.02	-.07
12 29	1.62	-2.64	.19	0.00	.0217	0.00	2.29	.23	.7135	.02	-.07
1 4	1.85	-2.64	.25	0.00	.0240	0.00	2.54	.23	.7375	.02	-.07
1 10	2.06	-2.64	.24	0.00	.0264	0.00	2.78	.23	.7639	.02	-.07
1 16	2.29	-2.64	.26	0.00	.0261	0.00	3.03	.23	.7900	.02	-.07
1 22	2.51	-2.64	.24	0.00	.0262	0.00	3.28	.23	.8152	.02	-.07
1 28	3.05	-2.64	.57	0.00	.0275	0.00	3.85	.23	.8435	.02	-.07
2 3	3.28	-2.64	.26	0.00	.0315	0.00	4.10	.23	.8752	.02	-.07
2 9	3.54	-2.65	.29	0.00	.0377	0.00	4.40	.23	.9129	.02	-.07
2 15	3.73	-2.64	.24	.01	.0393	0.00	4.63	.24	.9521	.02	-.06
2 21	3.97	-2.64	.28	0.00	.0429	0.00	4.92	.24	.9950	.02	-.07
2 27	4.24	-2.64	.32	0.00	.0456	0.00	5.23	.24	1.0405	.02	-.07
3 4	4.45	-2.64	.31	0.00	.0642	0.00	5.54	.24	1.1049	.02	-.07
3 10	4.61	-2.64	.24	0.00	.0848	0.00	5.78	.24	1.1895	.02	-.07
3 16	4.85	-2.64	.33	.00	.0845	0.00	6.11	.24	1.2741	.02	-.07
3 22	5.05	-2.55	.43	.13	.1012	.04	6.54	.37	1.3753	.07	.02
3 28	4.99	-2.39	.41	.36	.1202	.18	6.94	.73	1.4955	.25	.18
4 3	4.71	-2.28	.29	.47	.1402	.32	7.24	1.20	1.6357	.57	.30
4 9	4.61	-2.16	.44	.43	.1605	.26	7.68	1.63	1.7952	.83	.41
4 15	4.25	-2.13	.09	.32	.1964	.22	7.76	1.95	1.9926	1.05	.44
4 21	3.85	-1.99	.20	.46	.2462	.22	7.96	2.41	2.2389	1.27	.58
4 27	3.21	-1.83	.23	.77	.2498	.46	8.19	3.18	2.4895	1.73	.74
5 3	2.54	-1.75	.21	.79	.3078	.48	8.40	3.97	2.7953	2.21	.82
5 9	1.41	-1.49	.14	1.22	.4056	.60	8.54	5.19	3.2019	2.81	1.09
5 15	1.09	-1.46	.11	.38	.3987	.00	8.65	5.57	3.6007	2.91	1.11
5 21	.92	-1.54	.29	.41	.3339	.20	8.93	5.98	3.9345	3.02	1.03
5 27	.64	-1.46	.22	.44	.3669	.05	9.15	6.43	4.3014	3.06	1.11
6 2	.00	-1.74	.14	.14	.4287	.04	9.30	6.56	4.7301	3.10	.83
6 8	.28	-1.73	.17	.47	.4671	.01	9.46	7.03	5.1971	3.11	.84
6 14	0.00	-1.76	.12	.40	.4235	.00	9.58	7.43	5.6205	3.11	.81
6 20	0.00	-1.98	.16	.16	.3583	.02	9.74	7.59	6.0789	3.14	.60
6 26	0.00	-2.25	.06	.06	.3375	0.00	9.81	7.65	6.3155	3.14	.32
7 2	0.00	-2.45	.09	.09	.2937	0.00	9.90	7.74	6.6102	3.14	.12
7 8	0.00	-2.58	.14	.14	.2797	0.00	10.04	7.89	6.8899	3.14	-.01
7 14	0.00	-2.70	.13	.13	.2448	0.00	10.17	8.01	7.1347	3.14	-.13
7 20	0.00	-2.62	.31	.31	.2252	0.00	10.48	8.33	7.3599	3.14	-.04
7 26	0.00	-2.65	.19	.19	.2212	.00	10.67	8.51	7.5811	3.14	-.08
8 1	0.00	-2.61	.31	.31	.2480	.01	10.98	8.82	7.8290	3.15	-.04
8 7	0.00	-2.51	.36	.36	.2326	.03	11.34	9.18	8.0617	3.18	.07
8 13	0.00	-2.57	.20	.20	.2678	0.00	11.54	9.38	8.3294	3.18	.00
8 19	0.00	-2.62	.17	.17	.2205	0.00	11.71	9.56	8.5500	3.18	-.05
8 25	0.00	-2.66	.16	.16	.2001	.00	11.87	9.72	8.7500	3.18	-.09
8 31	0.00	-2.65	.23	.23	.2037	.01	12.10	9.94	8.9537	3.19	-.07
9 6	0.00	-2.72	.06	.06	.1356	.00	12.16	10.01	9.0893	3.19	-.15
9 12	.01	-2.70	.16	.15	.1222	0.00	12.33	10.15	9.2115	3.19	-.12
9 18	0.00	-2.68	.15	.16	.1499	0.00	12.48	10.32	9.3614	3.19	-.11
9 24	.01	-2.62	.23	.22	.1539	.01	12.71	10.54	9.5154	3.20	-.05
9 30	.07	-2.66	.19	.11	.1459	.01	12.89	10.65	9.6613	3.21	-.08

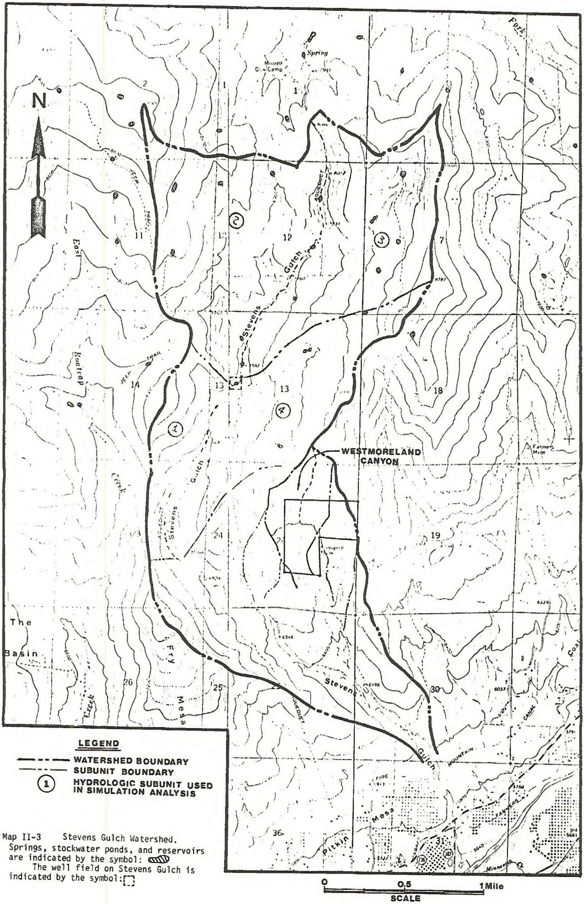
Table II-17

Westmoreland Canyon Subsurface and Surface

Runoff Summary
(inches)

Average Year - Present Condition

Date	Surface R.O.	Subsurface and Deep Seepage
11/15		.02
.		.
.		.
3/22		.04
3/28		.18
4/3		.32
4/9		.26
4/15		.22
4/21		.22
4/27	.04	.42
5/3	.05	.43
5/9	.27	.33
5/15		0
5/21		.20
		.05
		.04
		.01
		0
		.02
		.
		.
		.
8/1		.01
		.03
		.
		.
8/31		.01
		.
		.
9/24		.01
9/30		.01
TOTAL	.36	2.83



Map II-3 Stevens Gulch Watershed.
Springs, stockwater ponds, and reservoirs are indicated by the symbol:
The well field on Stevens Gulch is indicated by the symbol:

Under undisturbed conditions water yields were low, averaging only 0.7 inch due mainly to excess water produced during two wet years. Extremes vary from 0 in dry or normal years to 4 or more inches when seasonal snow accumulation is greater than normal. It is estimated that under natural conditions in eight of ten years virtually all of the rainfall and snowmelt is consumed by vegetation. The water balance (simulated) of Westmoreland Canyon under present conditions, with existing mining activity, is given in table II-16. Due to the mining activity, runoff has been increased from 0.7 inch to greater than 3 inches, on the average a significant increase.

In addition, recent studies indicate that there are approximately 42 springs or stock water ponds in the vicinity of the Stevens Gulch drainage above the Orchard Valley Mine (see map II-3. The existence of these springs, etc., was determined from color infrared imagery and most are plotted on a USGS 1:24000 quadrangle map.

2. Ground Water

The best general information on ground water conditions is contained in a reconnaisance report recently published by Price and Arnow (1974). The complex hydrologic properties of rocks and geology are the principal factors controlling the quantity, quality, and availability of ground water in the area. According to Tweto (1976), Quaternary, Cretaceous, and Tertiary rocks are found from Paonia northward to Grand Mesa. Characteristics of these rocks are summarized below:

QUARTERNARY

a. Unconsolidated surface deposits

b. Glacial drift of Pinedale and Bull Lake glaciations; includes some unclassified glacial deposits

CRETACEOUS

a. Mesa Verde group, undivided: sandstone and shale

b. Mancos shale; lower part contains Juana Lopez member

c. Juana Lopez member: calcareous sandstone; a thin but persistent unit distinguished only locally

TERTIARY

a. Uinta formation: sandstone and siltstone; in Piceance Basin; formerly Evacuation Creek member of Green River formation

b. Parachute Creek member: oil shale, marlstone, and siltstone; in Piceance Basin

c. Basalt flows and associated tuff, breccia, and conglomerate of late-volcanic bimodal suite

d. Basaltic intrusive rocks related to basalt flows; in dikes and plugs

e. Wasatch formation (including Ft. Union equiv. at base) and Ohio Creek formation: claystone, mudstone, sandstone, and conglomerate

The Mesa Verde formation includes much of the area of Westmoreland Canyon and Stevens Gulch (Dunrud 1976). Mancos shale underlies the Mesa Verde. The ledges and cliffs above the Mesa Verde formation are rocks of the Ohio Creek formation. Higher up, are rocks of the Wasatch formation, which overlies the Ohio Creek formation. The basaltic rocks are remnants of the cap on Grand Mesa.

According to Yeend (1969), much of Grand Mesa has been glaciated several times; however, till deposits from the earliest period of glaciation have been essentially destroyed. Most of the Quarternary deposits are associated with the more recent Pinedale and Bull Lake glaciations.

The primary areas of recharge are in the plateau country: they receive the largest amounts of precipitation and are the major surface water source areas. Ground water discharge areas include numerous springs and the lower reaches of perennial streams. The Stevens Gulch area is an important, but relatively minor recharge area. However, the presence of numerous lineaments (Dunrud 1976) in addition to outcrop areas suggests that local recharge of deep strata occurs.

Recoverable ground water in the upper 100 feet of saturated rock varies from 0.6 to 1.3 thousand acre-feet per square mile (asm) in the high elevation zone. At intermediate to low elevations, volume of recoverable ground water varies from 0 to 0.6 asm (Price and Arnow 1974). Properly located and constructed wells that tap rock aquifers can be expected to yield from 5 to 50 gallons per minute (gpm) at the higher elevations and from 1 to 10 gpm at low elevations. Depth to ground water is less than 50 feet along the major perennial streams. Depths to water elsewhere in the area are unknown, save for meager unpublished data from exploratory wells, etc.

Ground water exists under both water table (unconfined) and artesian (confined) conditions. Wells that tap the basaltic rocks on Grand Mesa can be expected to yield from 5 to 50 gpm. Locally, yields can range from 50 to more than 500 gpm (Price and Arnow 1975).

The sedimentaries of the Mesa Verde formation in the vicinity of Stevens Gulch dip northwestward at approximately 3° to 6° (Dunrud 1976). Artesian conditions occur locally; however, the water cannot be recovered in large quantities owing to the low permeability of these aquifers. Apparently, these rocks are mostly of marine origin and may yield less than 10 gpm. Sedimentary rocks of continental origin may yield 5 to 50 gpm.

The unconsolidated deposits are mostly of fluvial or glacio-fluvial origin. Yields of wells that tap these deposits range from 5 to more than 500 gpm. Although the alluvium in Stevens Gulch is not widespread, it is an important local source of ground water. Ground water studies by Wright Water Engineers, Inc., have provided quantitative data on the characteristics of this aquifer (appendix C). In general, Wright Water Engineers reported that the alluvium in Stevens Gulch is not widespread and is an important local source of ground water. Well test indicated that highest water yields from the Westmoreland well are obtained from 70 to 90 feet. Data from their 24-hour pumping test indicated that Colorado Westmoreland can pump about 40,000 gpd for at least 10 years. This conclusion is contingent on the simplifying assumptions made in the analysis. Conclusions reached from the water balance analysis subsequently discussed in this EAR may be more meaningful.

Data collected during CWI's initial drilling program into the Mesa Verde formation, in the Stevens Gulch area, indicated that this formation is not an aquifer because of a lack of saturated intervals. The absence of water suggests no recharge takes place. The Stevens Gulch aquifer appears to be isolated from other aquifers in the area. The only effect of pumping from the Stevens Gulch aquifer is a depletion of surface flows in Stevens Gulch and depletion (recharge) to the local shallow alluvium in the vicinity of the Stevens Gulch wells. (Wright Water Engineers, Inc., letter in appendix C)

Dissolved solids concentrations vary from more than 3,000 milligrams per liter (mg/l) at the lower elevations to less than 1,000 mg/l in the major water production areas (Price and Arnow 1974). Ground water temperatures vary from 10° to 20° C.

3. Water Quality

All water quality data used in this report came from three sources:

a. Relatively long-term data from the USGS gauging station below Hotchkiss is available from the STORET system and has been summarized in appendix C. These data provide information from 1971 to 1976 on the North Fork but are not specific to the Paonia area. Although water quality of the Hotchkiss and Paonia areas of the river are known to differ considerably for some parameters (for instance dissolved solids are higher at Hotchkiss), these data do provide some indication of problem and nonproblem areas with regard to certain water quality parameters and provide a comparison with data taken directly in the Paonia study area.

b. Short-term, site-specific data on the North Fork of the Gunnison were obtained from a report by the Colorado Department of Health entitled "Water Quality Investigation, North Fork of the Gunnison River, Delta and Gunnison Counties, Colorado" (1975). Data were collected during the last half of 1975 only (appendix C).

c. Additional site-specific information on the North Fork of the Gunnison River plus Stevens Gulch was collected by Thorne Ecological Institute and analyzed by CDM-Accu-Laboratory, Denver, which was just rated number 1 in the nation by Research Triangle Parks in a publication "Evaluation of Commercial Laboratories." Data available from this study were obtained from October 1976 to June 1977 (appendix C).

Water yields and quantity in the North Fork are strongly influenced by water control through Paonia Reservoir, by water withdrawal from several irrigation canals, and by return flows from irrigated lands back into the river. Withdrawals at Bowie (Fire Mountain Canal), between Bowie and Paonia (Stewart's Ditch), and just above Paonia (Farmer's Ditch) withdraw significant flows and cause significant dewatering of the North Fork of the Gunnison.

Approximately 77 percent of the consumptive water use in the North Fork Valley is for irrigation. Irrigation is also the primary factor causing increases in salinities, nutrients, sediment, and herbicide/pesticide levels. Municipal and recreational uses and evaporation account for about 6 percent of the consumption. There is little industrial use or discharge of water; however, several coal mines have been operating. Of these, Hawksnest and Black Bear mines in the vicinity of Somerset are the most significant. The effects of mining on the water quality of the North Fork of the Gunnison are small compared with agriculture. Analysis of the river above and below the Hawksnest Mine by the Colorado Department of Health indicated increases in total hardness of 1.1 percent, calcium hardness of 1.3 percent, electrical conductivity of 1.0 percent, suspended solids of 1.4 percent, and chlorides of 175 percent. Analysis of the irrigation return flow below Paonia by the Colorado Department of Health resulted in increases in total hardness of 817 percent, calcium hardness of 998 percent, electrical conductivity of 630 percent, suspended solids of 1,200 percent, and chlorides of 157 percent. (Colorado Department of Health 1975) Sampling station numbers used in this comparison are NF 12 and 13 for the Hawksnest Mine and NF 6 and 7 for irrigation return flows. Also, lower flows due to irrigation dewatering of the North Fork of the Gunnison River contribute to higher summer water temperatures.

Major factors influencing existing water quality in the North Fork are:

a. Soils and chemicals characteristic of the upper drainage basin

b. The volume of water in the stream

c. The relative magnitude of ground water and surface runoff

d. Paonia reservoir

e. Diversion of water for irrigation and smaller amounts of municipal and industrial use

f. Return flow of irrigation water

g. Discharges from municipalities upstream

h. Discharges or runoff from upstream mining activities

i. Pesticides and herbicides used on cattle and crops

Of the above, the soil and chemical characteristics of the basin, the influence of Paonia Reservoir as a settling basin and a modifier of runoff, and dewatering and return flow from irrigation use are probably the most important.

USGS STORET data indicate temperature ranges from 32° to 68° F with a mean of 50° F. This would generally be considered a cool-to-cold-water stream. River temperatures in the Paonia area have ranged from 32° to 79.7° F (0-26.5° C). It is likely that river temperatures will get even warmer during August and September due to low flows and warmer air temperatures. State standards for the B_1 water classification are no nonnatural increases above 68° F (20° C).

Dissolved oxygen values are generally high and adequate for a cold-water stream (8.7 to 13.8 below Hotchkiss and 7.8 to 12.5 mg/l in the Paonia area). These values fall within state standards. However, during summer periods with low flows and high algal build-ups in the stream, plant use of oxygen during nonphotosynthetic periods may reduce oxygen levels to lower levels. (A 24-hour test in the Paonia area during July showed values ranging from 4.9 to 12.0 mg/l.)

BOD values are generally low, as partially indicated by the high dissolved oxygen values. STORET data indicated values of 0.9 to 5.5 mg/l and data from Paonia ranged from less than 1 to 2.5 mg/l.

The river is generally slightly on the alkaline side, with pH values ranging from 7.7 to 9.0 (STORET data) and 7.1 to 8.2 (Paonia area). One single lower value of 6.6 is believed suspect.

Conductivity in the North Fork indicates a moderate level of dissolved solids (but low compared with such rivers as the Colorado). Irrigation return flow undoubtedly contributes to this as well as ground water sources. Figure II-5 (from the Colorado Public Health Department, unpublished) indicates a sharp change in total hardness (generally related to conductivity and dissolved solids) from Bowie to Paonia and an even sharper rise farther downstream. Major agricultural irrigation begins in the Paonia area. Below Hotchkiss, mean conductivity was 926 with a range of approximately 200 to 1,350 umhos (25^{o}C). Conductivity in the Paonia area ranged from approximately 100 to 1,000 umhos with higher values generally occurring in June and July.

Nutrient values, as reflected by ammonia, nitrite, nitrate, and phosphate, are not excessively high in the North Fork (immediately below municipal discharges it is likely that these values may change significantly). Nitrate-N was in the order of 0 to 1.8 mg/l (mean of 0.91 mg/l) and phosphate from 0.0 to 0.30 (mean 0.18) based on STORET data. In the Paonia area Nitrate-N ranged from 0.05 to 0.15 mg/l with most values less than 0.1. Phosphate values (with one exception) ranged from 0.02 to 0.25 mg/l. The exception was one value in early June of approximately ten times the highest previous value. This analysis was performed by a different laboratory than the other analyses and is believed suspect.

The North Fork does not show evidence of serious pollution by any of the dissolved metals or other substances, based on the Hotchkiss data. There is little to no chromium, mercury, copper, zinc, silver, arsenic, cadmium, and cyanide present. Values for molybdenum, selenium, fluorine, manganese, lead, and boron are low, and iron is generally low to moderate with some high peaks (up to 3 mg/l). In the Paonia area, metals and other trace substances are generally within the range of the values found at Hotchkiss, except that iron levels reached a very high value on one occasion in March (approximately ten times what previous values were and three times the peaks reported in STORET data). This value does not appear to be typical and may represent relatively infrequent discharges from some upstream location.

All indications are of very low levels of bacterial contamination in the North Fork. Bacterial counts below Hotchkiss ranged from 2 to 22,000 per 100 milliliters (ml) in total coliforms. State standards are in terms of 10,000 total coliforms per 100 ml or 1,000 fecal coliforms per 100 ml. Most of the samples from the Hotchkiss area were below the 10,000 per 100 ml figure. Data are available from the Paonia area on a monthly or twice-monthly basis for fecal coliforms.

No information is available on herbicide-pesticide levels in the North Fork, although there are likely contaminants in an agricultural region. It is known, for instance, that sprays used for cherry crops have caused problems with the Paonia sewage systems.

Radioactivity levels reported at Hotchkiss would be similar to those of the entire North Fork. There is no local source of radioactive materials except for small natural amounts from the drainage and fall-out. Levels of alpha and beta counts are below standards for drinking water.

There are no prior data on oil and grease levels in the North Fork. Sources would primarily be from combustion engines, gas stations, farm machinery, and some small industries. Data from the study area generally indicate low levels of 1 to 3 mg/l, with one value at 5 mg/l.

Except for its lower 500 feet, Stevens Gulch Creek is an intermittent stream which flows only during heavy rains or snowmelt. The lower section has a small flow during a significant portion, but not all of the year. This water appears to originate from two sources, a small ditch that intersects the drainage approximately 500 feet up from the mouth and ground water sources.

Major factors influencing water quality in the Stevens Gulch drainage are:

a. Soils and chemical characteristics of the drainage basin

b. The amount of runoff

c. Drainage from cattle ponds and springs in the watershed above the Orchard Valley Mine

d. The amount of surface area disturbed within the drainage

In addition, a number of homes located along one section (near Fire Mountain Canal) may contribute nutrients from septic tanks, and several dumps, including one with many old car bodies, may contribute contaminants during runoff.

There are no state water quality standards for this type of stream; however, the influence of Stevens Gulch on the quality of the North Fork would be considered. The influence of the quality of any water issuing from Stevens Gulch into the North Fork would depend on the relative volumes of flow of the North Fork and the gulch. Maximum influence would occur during periods of low flow in the river and high flow in the gulch, as in a highly localized cloudburst. Most frequently, however, high water in the gulch would also mean high water in the river. During periods when most of the flow from the gulch appears to be due to ground water, the flow rate is in the order of 1 to 10 cfs or less.

All data available are from the studies by Thorne Ecological Institute (Erickson 1977), and because there was rarely any water in the upper areas, almost all data are from the lower 500 feet of stream. These data are shown in appendix C and are summarized below.

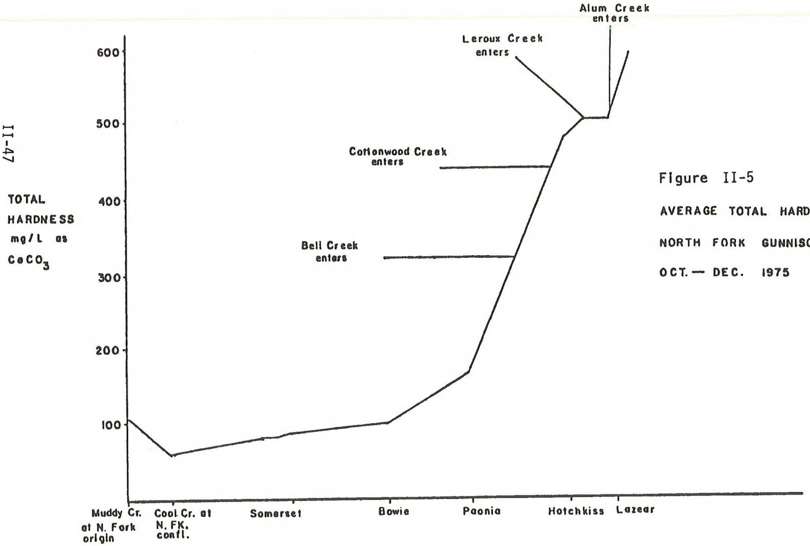


Figure II-5

AVERAGE TOTAL HARDNESS LEVELS

NORTH FORK GUNNISON RIVER

OCT. — DEC. 1975

During the cold months, warmer water in the order of 3^{o} to 7^{o} C indicated a ground water source to the lower Stevens Gulch Creek. At other periods when water was available (late spring and early summer), water temperatures were about the same or slightly higher than river water.

Conductivity ranged from 122 to 1,734 umhos and often was two to three times as high as adjacent river conductivities. This was particularly so in the December to February period, when ground water appeared to be the main source. Creek water is slightly alkaline (7.1 to 7.5) and slightly less alkaline than river water. Dissolved oxygen values varied considerably by date and precise location but were generally lower than the river (2.9 to 11.3 mg/l).

Nutrient levels were about the same as for the river. Metals and trace elements were generally similar and low with some exceptions. The sample location on the west branch of Stevens Gulch (above the mine) showed some higher levels of zinc and aluminum, and one sample of iron was very high (9,400 mg/l). Stations low on the gulch showed no unusual values, except manganese was generally high (280 to 720 mg/l versus 20 to 30 in the river and at the upper station).

Oil and grease levels were about the same as river values (1 to 3 mg/l), except for one higher value of 13 mg/l at a sampling station above the mine area.

Table II-18 gives the water quality standards for B_1 water classification for the state of Colorado (Colorado Department of Health 1974).

4. Flood Hazard Evaluation

Although the Orchard Valley Mine is in an area of low annual precipitation, the area is subject to short, high-intensity rainfalls resulting in infrequent but major flash floods. Rainfall and associated flooding can produce significant geologic as well as hydrologic effects. Local geologic processes triggered by such floods can be intensified by improper land use, causing heavy property and resource damage and even loss of life.

The probable maximum thunderstorm (PMTS) is the design storm computed by engineers when the stakes are high in terms of life and property, and the area of interest is small. It is defined as the simultaneous occurrence of the maximum of several elements or conditions which contribute to the "big" flood (U.S. Bureau of Reclamation 1973). This concept is necessary, since data from recorded floods in a given area are not adequate to provide a reliable basis for estimating maximum probable flood flows.

As pointed out by the USBR (1973), ". . . it is the unusual event or series of events that produces the great floods." Recent experience during the past 11 years (1965, 1969, 1973, and 1976) should be proof

Table II-18. Colorado water standards for B_1 water classification.

STANDARD	B_1
Settleable Solids	Free From
Floating Solids	Free From
Taste, Odor, Color	Free From
Toxic Materials	Free From
Oil and Grease	Cause a film or other discoloration
Radioactive Material	Drinking Water Standards
Fecal Coliform Bacteria	Geometric Mean of <1000/100ml from five samples in 30-day per.
Turbidity	No increase of more than 10 J.T.U.
Dissolved Oxygen	6 mg/l minimum
pH	6.0 - 9.0
Temperature	Maximum 68°F. Maximum Change 2°F.
Fecal Streptococcus	----

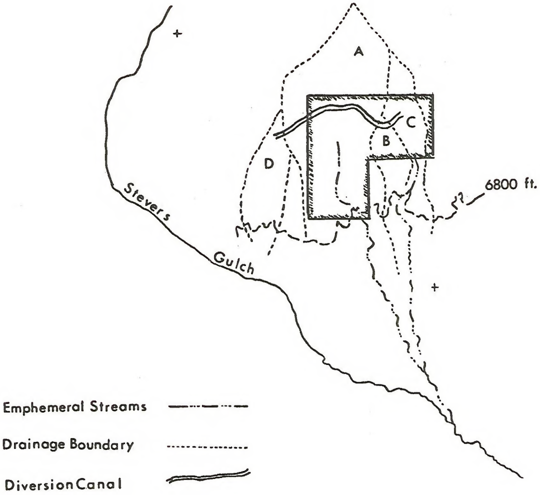


Figure II-6 Orchard Valley mine and associated watershed drainages.

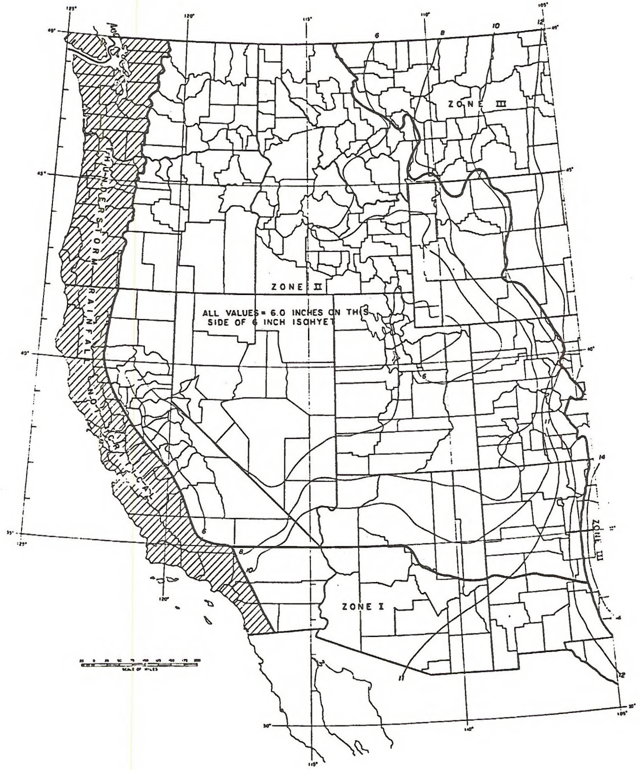


Figure II-7 Probable maximum thunderstorm 1-hour rainfall (point values in inches) for area west of 105° meridian. (USBR, 1973) enough that large floods can and do happen in Colorado. Often a misconception prevails that the absence of flooding in a particular area during the past 10, 25, or perhaps 50 years somehow makes that area immune from high water. To ignore the possibility of flash flooding in the design, construction, and operation of major engineering works, simply on the strength of recent experience, is to court disaster. Thus, the "maximum probable flood" is an essential part of the engineering studies for a mining project of wide scope and complexity. In the case of the ongoing Westmoreland operation, an estimate of the magnitude of this flood is a must from the standpoint of compliance with federal and state laws.

Westmoreland Canyon, a tributary of Stevens Gulch (figure II-6) drains less than 200 acres (Watershed A is 170 acres, and Watershed B is 21 acres down to the 6,800-foot contour). Runoff resulting from a short, intense rainstorm on small, steep watersheds such as these produces the greatest flood peaks.

The PMTS suggested for design by the USBR (1973) is a point rainfall of approximately 7.5 inches in one hour as shown in figure II-7. Prior to estimating the runoff that might be produced from this design storm, an assessment was made of (1) property ownership, (2) the areas impacted by mining operations to date, and (3) the relationship of this watershed to (1) and (2). Land owned by Colorado Westmoreland, Inc., is completely surrounded by land owned by the BLM. In addition, as shown in map II-3 the watershed of Westmoreland Canyon occupies both public and private land.

In the storm runoff analysis, Westmoreland Canyon was subdivided into two subbasins at the 7,400-foot elevation contour, since the watershed is essentially undisturbed above this elevation. Storm runoff was determined for this "upper basin," and a potential "inflow hydrograph" to the mining area ("lower basin") was derived using guidelines recommended by the USBR (1973). The hydrograph for the PMTS is shown in figure II-15. It is based on an antecedent moisture condition II, curve number 75, and the point rainfall of 7.5 inches.[1] Of this rainfall intensity 4.6 inches would result as surface runoff. It would produce a peak flow of approximately 1,150 cubic feet per second, which would occur within 1 hour after initial rainfall. The entire event would be over in less than 1-1/2 hours, and would produce a volume of about 39 acre-feet. Figures II-16 and II-17 are relationships showing peak discharge and stormflow volume versus watershed area. Stormflow characteristics are for probable maximum (PMTS), 100-year (OPP), and 10-year events.

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[1]This compares with 4.9 inches of storm runoff computed by the U.S. Bureau of Reclamation for the Fruitgrowers Dam Project (appendix C).

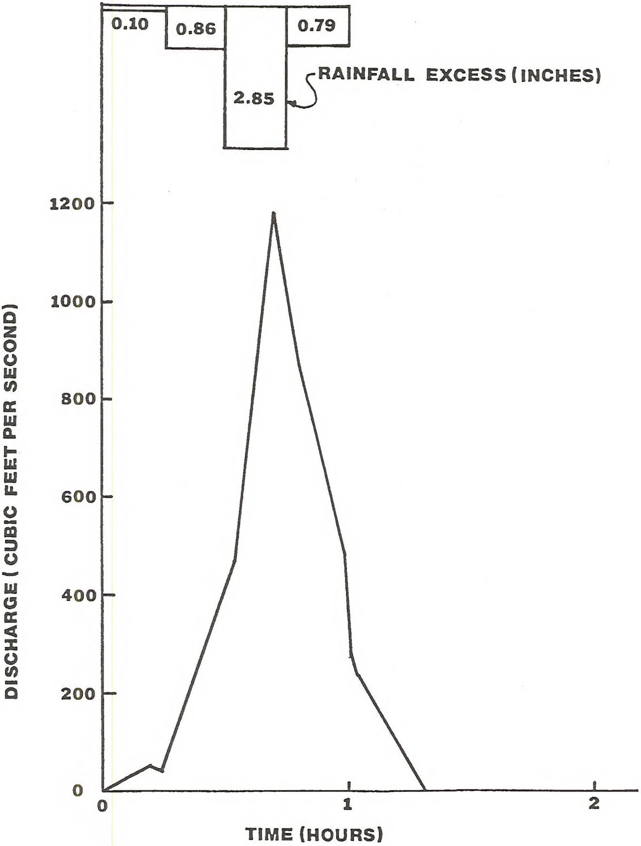


Figure II-8. Probable Maximum Flood Hydrograph for Upper Westmoreland Canyon.

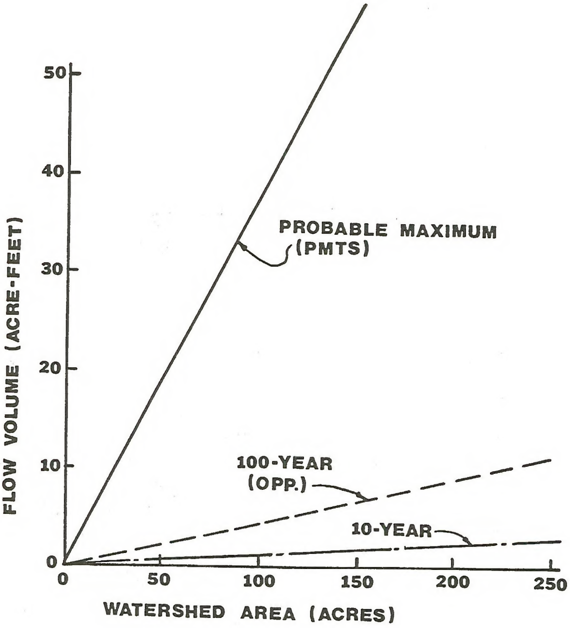


Figure II- 9. Storm Flow Volume as a Function of Watershed Area.

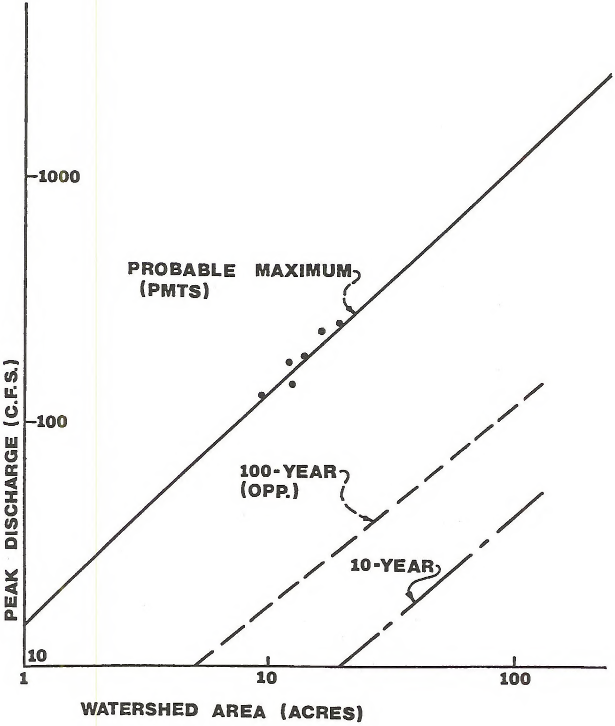


Figure II-10 Peak Discharge as a Function of Watershed Area.

TABLE II-19

WATER RIGHTS OWNED

by WESTMORELAND

NAME OF DITCH OR COMPANY	NUMBER of SHARES or CFS (Ute Report)	NUMBER of SHARES or CFS (Reported by Wesley Wade)
Fire Mountain Canal and Reservoir Company	3364 shares	3578 shares
North Fork Farmer's Ditch Association	10.25 shares	10 shares
Tenor Ditch and Reservoir Company	7 shares	7 shares
Pitkin Mesa Domestic Pipeline Water Company	1 tap	
Tropic Ditch Company	11.4 shares	11.4 shares
John Beezley Ditch -domestic	1.0 cfs 0.1 cfs	1.1 cfs
Heddles and Hofer Waste Ditch	0.26 cfs	0.31cfs
George W. Small Pipeline	0.0083 cfs	1/6 interest Stock 1/4 interest Domesti
Deer Trail Ditch		600 shares

TABLE II-20

ESTIMATED YIELDS OF WATER RIGHTS

CURRENTLY OWNED BY COLORADO WESTMORELAND

(Values in Acre Feet)

DITCH	NO. OF SHARES	AVERAGE YEAR YIELD PER SHARE	AVERAGE YEAR TOTAL	DRY YEAR YIELD PER SHARE	DRY YEAR TOTAL
Fire Mountain Canal	3578	.2	715	.15	537
Farmers Ditch	10	40	400	35	350
Terror Creek	7	10	70	8	42
Deer Trail Ditch	600	.15	90	.10	60
Tropic Ditch	11.4		60		50
John Beezley Ditch	1.1 cfs		200?		100?
Heddles & Hofer Ditch	.31 cfs		150?		90?
Total			1685		1229

Table II-21

Water Flow Diagram Per Day* (in Gallons)

	1976	1977	1978
Belt Feeders	3360	10,080	16,800
Drill	256	768	1280
Cutting Machine	1680	5040	8400
Transfer Points	300	900	1300
Tipple	300	500	700
	5896	17,288	28,480
(Possible			
Continuous Miner	(Late 1977)	4410	8820
		21,698	37,300

Surface Facilities To
Treatment Plant

	1976	1977	1978
Bath House	510	2000	2360
Discharge Into Natural Drainage	26	100	118
Train Load Facility		500	700
Lower Offices			
Septic System		120	120

*Data Furnished By Colorado Westmoreland, Inc.

Obviously, if a probable maximum thunderstorm were to occur, and allowed to flow uncontrolled into the present mining operation, the result would be severe damage to primary structures and perhaps loss of life, as well as the environmental damage that would result from severe channel erosion and movement of debris from the mine site.

5. Water Rights and Requirements

The average annual discharge of the North Fork of the Gunnison is 314,379 acre-feet as measured near Somerset. Of this average yield, approximately 100,770 acre-feet is consumed annually by agriculture, recreation, domestic and municipal uses, evaporation, and transpiration by riparian vegetation.

CWI has purchased water rights in several ditches and canals plus 25 percent of Lost Lake Slough (East Beckwith No. 1). Table II-19 gives a summary of water rights currently owned by CWI, and table II-20 gives the estimated water yield from these rights for average and dry water years. In addition, the water rights in Lost Lake Slough give CWI absolute rights to 142.2 acre-feet and conditional rights to another 69.3 acre-feet annually. At this time, all water rights in the ditches and canals, which were purchased with agricultural lands, are planned to be used to irrigate the orchards on the agricultural lands.

Orchard Valley Mine will require, during peak production, a maximum of 40,000 gpd (45.17 acre-feet per year) for the operation of the belt feeders, drills, cutting machines, bath house, train load facilities, etc. (see table II-21). This quantity of water would be sufficient to sustain about 9 acres of agricultural land on an annual basis. CWI currently has four options for obtaining their required water supply:

a. To obtain water from a well field (two wells) established in Stevens Gulch above the Orchard Valley Mine (water rights case W-2999). If these rights are obtained then CWI plans to release its storage rights in Lost Lake Slough to the North Fork to offset its consumptive use under augmentation plan W-3106.

b. To release water owned by CWI in Lost Lake Slough to the North Fork of the Gunnison, then pump this water from the river up to Orchard Valley Mine.

c. To obtain rights to pump from the North Fork of the Gunnison (Case W-2998).

d. To obtain water rights to Terror Creek (Case W-3000).

A complete discussion of these options including the results of well tests are located in appendix C, in letters from Wright Water Engineers.

Table II-22

ESTIMATED IMPACT OF WATER DIVERSION FROM STEVENS GULCH ON NORTH FORK VALLEY 1/

Year	ANNUAL WATER YIELD (Acre-feet)					RATIO: Stevens Gulch / North Fork	
	Stevens Gulch at Well Field				North Fork near Somerset		
	Natural Runoff	-	Westmore-land Diversion	Total		Natural	With Diversion
High Year	786.9	-	45.2	741.7	593,800	.001325	.001249
Average Year	300.2	-	45.2	255.0	308,898	.000972	.000826
Low Year	60.5	-	45.2	15.3	142.300	.000425	.000108

1/ Based on streamflow in North Fork near Somerset and Stevens Gulch above well field.

The impact of pumping 40,000 gpd (45 acre-feet per year) from their well field or from the North Fork of the Gunnison is summarized in table II-22. In the average year, Stevens Gulch contributes only 0.097 percent of the annual flow of the North Fork of the Gunnison. Approximately 15 percent of this inflow will be consumed by CWI, or 0.015 percent of the average annual yield of the North Fork of the Gunnison River. In normal water years, the ground water recharge will exceed the water requirements of CWI, assuming they receive water rights to the well field (two wells). However, the estimated 0.5-inch runoff during dry years (based on 1954, which, prior to 1977, was the driest year of record) will produce about 50 acre-feet of ground water recharge. This will just offset CWI's water requirements. Because 1977 might produce even less runoff, it is possible that during extremely dry years runoff may not be sufficient to completely recharge the aquifer. Because such years occur infrequently, it is unlikely that there will be critical water shortages in any given dry year. However, if prolonged intervals of drought occur, this source may not provide an adequate water supply. It is then concluded that Stevens Gulch is an adequate but marginal water supply.

H. Soils

Soil delineations for the proposed lease and adjacent areas are shown in figure II-11. Soil descriptions for each mapping unit are given in appendix D-1 through D-12.

In general, the soils in question are deep, well drained, and vary widely in slope. Permeability values are low, thus encouraging surface runoff; as a result, the water erosion hazard is often high. Except for the Torriorthents (11) and Saraton (3,5) mapping units, available water capacities are high, reflecting the potential of these soils to store water for plant use. Topsoil layers are shallow, ranging from about 2 to 8 inches; surface textures are generally loams or clay loams while subsoils range from clay loams to clays. Basaltic cobbles and stones are common throughout the profiles of most soils.

I. Wildlife

1. Aquatic Wildlife and Habitats

Stevens Gulch, an intermittent stream, and the North Fork of the Gunnison River are the only aquatic habitats in the vicinity of the proposed action.

Stevens Gulch contains water during spring runoff and after heavy thundershowers. The flows at these periods are silt laden and quite turbid.

The North Fork is presently affected by irrigation diversions and return in addition to instream activities such as channel alteration and

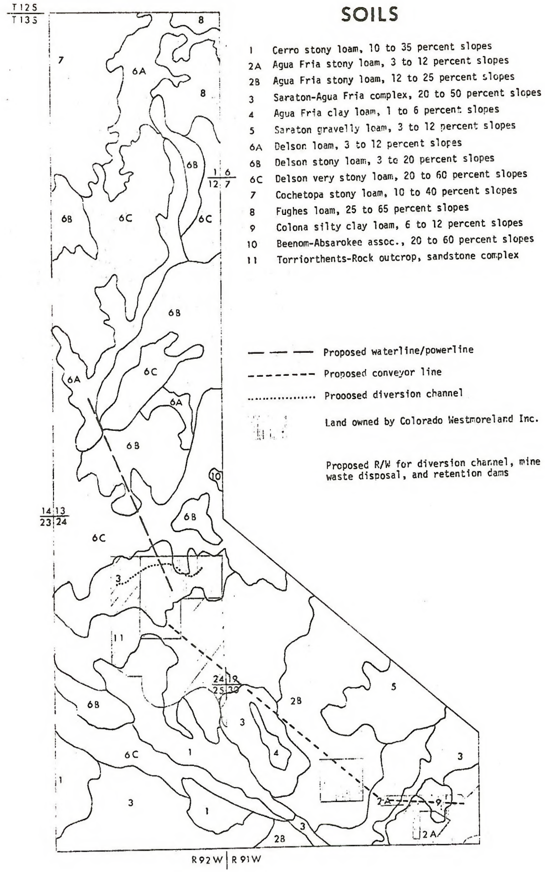

SOILS
1 Cerro stony loam, 10 to 35 percent slopes
2A Agua Fria stony loam, 3 to 12 percent slopes
2B Agua Fria stony loam, 12 to 25 percent slopes
3 Saraton-Agua Fria complex, 20 to 50 percent slopes
4 Agua Fria clay loam, 1 to 6 percent slopes
5 Saraton gravelly loam, 3 to 12 percent slopes
6A Delson loam, 3 to 12 percent slopes
6B Delson stony loam, 3 to 20 percent slopes
6C Delson very stony loam, 20 to 60 percent slopes
7 Cochetopa stony loam, 10 to 40 percent slopes
8 Fughes loam, 25 to 65 percent slopes
9 Colona silty clay loam, 6 to 12 percent slopes
10 Beenom-Absarokee assoc., 20 to 60 percent slopes
11 Torriorthents-Rock outcrop, sandstone complex
Proposed waterline/powerline
Proposed conveyor line
Prooosed diversion channel
Land owned by Colorado Westmoreland Inc.
Proposed R/W for diversion channel, mine waste disposal, and retention dams
T12S
T13S
R92W
R91W

Figure II-11

gravel removal. These factors have created poor quality habitat for trout. (See also water quality section.) Fish species are listed in appendix E-1. The river near Paonia can be characterized by filamentous algae, high diversity of benthic organisms, and low fish populations dominated by minnows and suckers. A detailed study of aquatic habitats is currently being conducted by Thorne Ecological.

2. Terrestrial Wildlife and Habitats

The area surrounding the Orchard Valley Mine is not substantially different from the areas to the east or west along the North Fork of the Gunnison. The habitats range from the pinyon-juniper type through a transition zone up to the mountain brush type (see vegetation section). There is considerable overlap of these habitat types and some special habitat features found among the types (photos 5 to 9). A riparian habitat is found along Stevens Gulch, an intermittent stream. For a complete species list of wildlife found in the general area refer to North Fork Unit Resource Analysis, Steps 2 and 3, or Wildlife Inventory of Delta County, Colorado Division of Wildlife (DOW). Both documents are available at the Montrose District BLM Office.

The following species or their signs have been observed, by BLM personnel in the mine area during April and May of 1977:

Mammals
Mule Deer
Elk (pellets)
Rock squirrel
Coyote (tracks and den)
Porcupine (signs)
Badger (burrows)
Mountain cottontail
Bushytail woodrat (nests)

Birds
Golden eagle (nest and young)
Kestrel
White-throated swift
Tree swallow
Scrub jay
Oregon junco
Blue-gray gnatcatcher
Bewick's wren
Magpie
Red-shafted flicker
Empidonax flycatcher

Reptiles
Smooth green snake
Sagebrush lizard

The riparian habitat provides water and cover for many species which utilize the other three habitat types. Water is also available at stockwater ponds north of the mine and at the irrigation canals. The riparian cottonwoods provide nesting sites for some raptors (probably Buteos or Accipiters), tree swallows, magpies, woodpeckers, and perhaps others.

The snags (dead pinyon and juniper trees), particularly north and east of the mine (photo 6), provide perches for raptorial and insectivorous birds as well as food for insectivorous species. Several of these snags were created by porcupines girdling the tree or weakening it.

An active golden eagle nest is within 1,000 feet of the present mine activity but is partly screened by a small ridge (photo 5). Three sightings, in April and May, of the adult eagles indicate that they hunt to the north and east of the nest and mine. An "alternate" nest is also located in the same cliff.

A den located east of the mine may be used by coyotes, mountain lion (in winter), or other predatory mammals (photo 5).

No endangered animal species are known to utilize the immediate affected area.

The species potentially most impacted are mule deer and elk. The entire area around the mine is critical deer and elk winter range, use of which varies with population levels and snow condition. (See appendices E-2 and E-3. The tables indicate the shrub species most heavily utilized by deer and elk.) Elk use is less frequent (50 to 60 were seen in winter 1977 by DOW personnel), because they generally stay at higher elevations. A resident deer population (approximately 10 deer per square mile) utilizes the area yearlong (Dave Kenvin, personal conversation). These deer make substantial use of arrowleaf balsamroot in the spring when it is conspicuously available. Most of the deer browse is heavily utilized and in a hedged condition (photo 7), particularly the mountain mahogany, bitterbrush, serviceberry, and sagebrush on south-facing slopes. Deer migrate into the area from the north-east. (See map II-4 and photos 6, 8, and 9.)

J. Vegetation

The vegetation zone which will receive the most surface disturbance is a pinyon-juniper/mountain brush transition zone, shown in photo 10. The proposed diversion channel, detention dams, water pipeline, and mine waste disposal will be constructed in this zone. The conveyor belt will partially extend through it. The transition zone extends from about 6,500 feet to 8,400 feet near the Orchard Valley Mine and is characterized by dense to widely scattered pinyon and juniper trees (for the scientific

Photo 5 - Golden eagle nest located on cliff in upper right; note ridge screening nest from the mine. Probable coyote den located in right center.

Photo 6 - Transition zone on south-facing slope above the mine, heavily utilized by deer. Also note the snag in upper left.

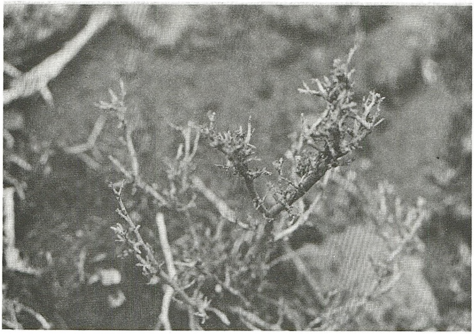


Photo 7 - Bitterbrush plant indicating heavy utilization by big game. Photo taken along proposed conveyor route in NE¼NW¼NW¼, Section 30, T. 14 S., R. 91 W.

Photo 8 - Mountain shrub type on ridge above the mine. This ridgetop and the adjacent south-facing slope are probable movement routes for both deer and elk, and the ridge forms the upper limit of the crucial winter range.

Photo 9 - Looking southeast from the mine at the transition zone. The movement of deer (and some elk) is from left to right and utilization is heaviest on the warmer exposures.

names of the plants listed, see appendix F-1), separated by a sparse to thick understory of shrubs such as serviceberry, Gambel oak, mountain mahogany, snowberry, skunkbush, and squawapple. Big sagebrush, bitterbrush, and mormon tea are scattered in the transition zone on the relatively drier sites. Northern and northeastern slopes in the transition zone tend towards the mountain brush type, having nearly pure stands of shrubs and widely scattered junipers. Other areas resemble the pinyon-juniper community except for the thick undergrowth of shrubs. The herbaceous understory in the transition zone is sparse, consisting of cheatgrass, western wheatgrass, Fendler bluegrass, and forbs such as lambstongue groundsel and bedstraw.

The proposed conveyor belt will extend from the mine portal in the transition zone down into pinyon-juniper woodlands at about 6,500 feet and below. The pinyon-juniper zone is dominated by juniper, with a sparse to thick, woody understory of big sagebrush and scattered bitter-brush. The herbaceous understory is cheatgrass, squirreltail, and various forbs.

Above the area of the proposed action is the mountain brush zone, at about 8,400 feet and above, shown in photo 11. The mountain brush community is usually dominated by Gambel oak but also contains such shrubs as Utah serviceberry, mountain mahogany, squawapple and cliff fendlerbush. In some areas of the mountain brush zone, particularly on east and northeast slopes, Gambel oak is subdominant and the above shrubs are a much larger portion of the mountain brush community. The understory in the mountain shrub zone is sparse, containing Fendler bluegrass, cheatgrass, western wheatgrass, Junegrass, and forbs such as arrowleaf balsamroot, bedstraw, and lambstongue groundsel.

Map II-5 shows the three vegetation zones.

A literature and herbarium search, as well as an in-progress plant inventory, has indicated that there are no endangered or threatened plants in the area of the proposed actions.

K. Livestock-Range

The Stevens Gulch Allotment is presently a community allotment used by Donald and Jack Morrell. The allotment receives cattle use from May 1 until June 30. Jack Morrell again uses the allotment in the fall from October 16 to October 25. At present the allotment has a total of 504 AUMs. Implementation of the AMP is presently scheduled for 1984.

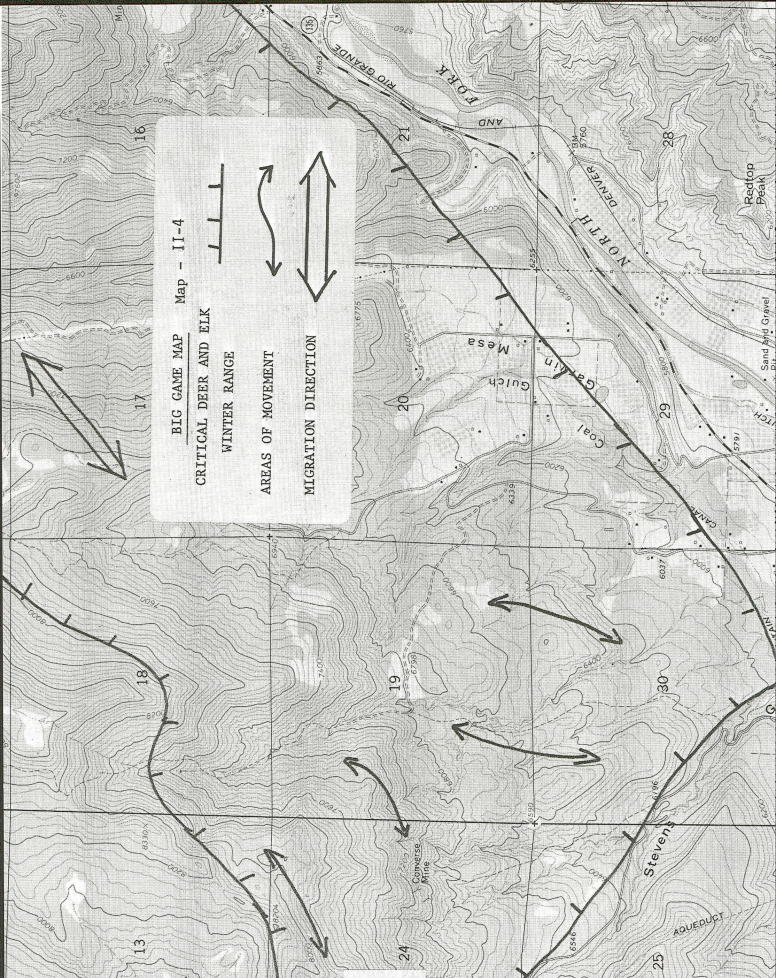
L. Cultural Values

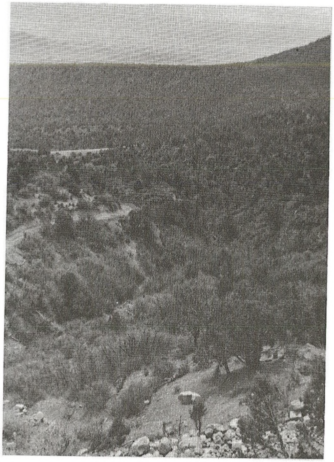
Prior to the right-of-way application, several archeological clearances had been done in the vicinity of the Westmoreland facility. The areas were cleared as parts of various BLM projects in the areas north, east, and west of the Westmoreland property. No archeological or historic sites were found on the BLM-cleared areas.

The cultural resources found in other areas of the North Fork Valley indicate an affinity with the previously defined aboriginal occupation of the area. The aboriginal use has been named the Uncompahgre Complex and reflects human use and exploration of the various environmental zones and ecotones found in the region.

As part of the right-of-way applications, an archeological inventory was completed on all affected BLM land and all affected private surface as well. The inventory was performed by Centuries Research, Inc., as a subcontractor of Thorne Ecological Institute. The Centuries inventory identified no sites on the National Register of Historic Places but did locate eight historic homesteads on private lands. The homesteads date from the 1880s to the first quarter of the twentieth century. One aboriginal site was located on U.S. Forest Service (USFS) land and several isolated pieces of lithic debitage chips were found on private land near the USFS boundary.

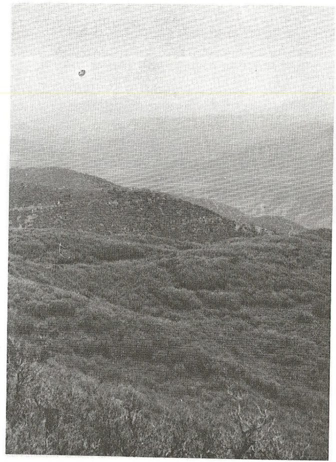
Two historic mine portals and a trestle foundation were also located. The Cowan Mine is located on Westmoreland property, with the Cowan Mine trestle foundation located on the private and BLM boundary line. The Converse Mine portal and spoil pile is located on BLM lands adjacent to the Westmoreland property.


BIG GAME MAP Map - II-4
CRITICAL DEER AND ELK
WINTER RANGE
AREAS OF MOVEMENT
MIGRATION DIRECTION
Converse Mine
Stevens
AQUEDUCT
Redtop Peak
Coal
Gulch
Mesa
NORTH
FORK
DENVER
AND
RIO GRANDE
Sand and Gravel Pit



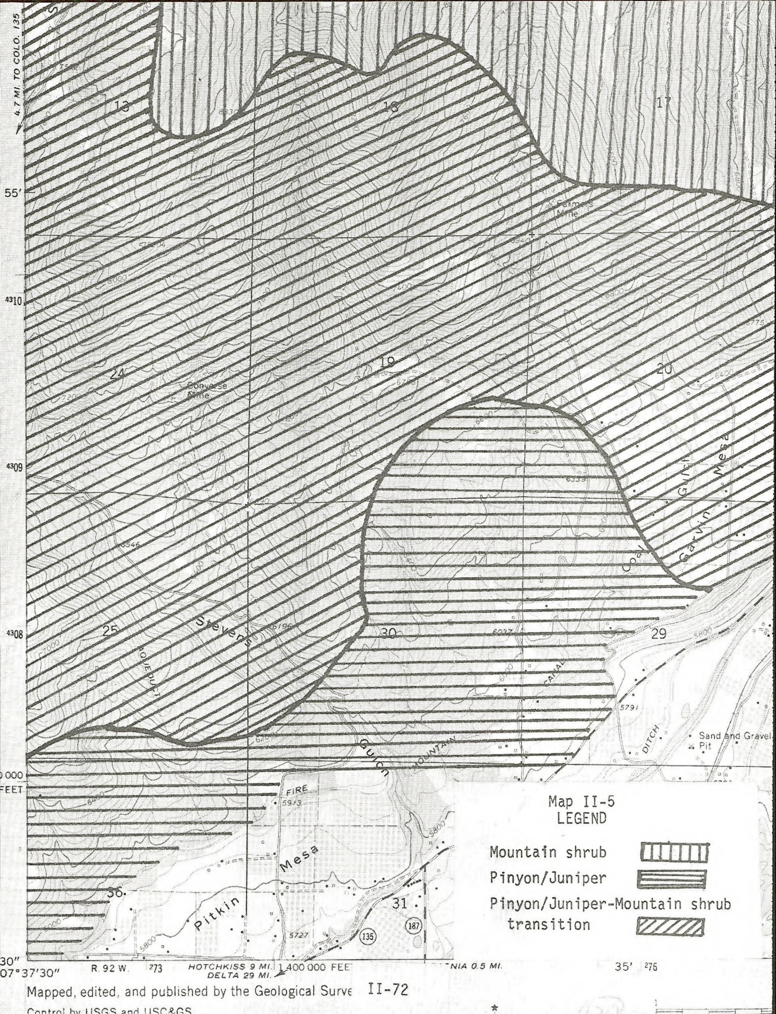
Picture 10.

Pinyon/Juniper - Mountain Brush Transition Zone, showing Pinyon and Juniper interspersed with various shrubs



Picture 11.

Mountain Brush Zone, dominated by Gambel Oak


Map II-5
LEGEND
Mountain shrub
Pinyon/Juniper
Pinyon/Juniper-Mountain shrub transition
4.7 MI. TO COLO. 135
55'
4310
4309
4308
13
18
17
24
19
20
25
30
29
36
31
Converse Mine
Stevens
Gulch
Coal
Gulch
Garvin
Mesa
CANAL
DITCH
MOUNTAIN
FIRE
Mesa
Pitkin
Sand and Gravel Pit
135
187
R. 92 W.
273
HOTCHKISS 9 MI.
DELTA 29 MI.
1 400 000 FEET
35'
276
07°37'30"
Mapped, edited, and published by the Geological Surve
Control by USGS and USC&GS

M. Socio-Economic Conditions

1. Population

The estimated population growth in Delta County between 1970 and May 1, 1977, was from 15,404 to 18,937, an increase of 3,533 people, proportionately an increase of 22.9 percent (energy impact survey conducted by the state of Colorado). Refer to table II-23. Between 1970 and 1975, the estimated growth was from 15,404 to 17,100, an increase of 1,696 persons, or 9.9 percent, less than Colorado's growth rate of 14.7 percent. However, Delta County had an estimated growth of 9.7 percent between 1975 and May 1, 1977.

The influx was the result of several trends: (1) the area has become increasingly popular for older, retired people; (2) as recreation activities and tourism have increased, people have been attracted to the valley; increasing the demand for new developments in the area; and (3) those wishing to escape from urban life have found the area a pleasant place to live. A probable additional cause of the influx was a change in the employment trend in the county between 1970 and 1976, at variance with the 1960-1970 trend which showed that, overall, Delta County lost 203 jobs (table II-24). The decline continued through 1972, but during 1973 there was a reversal in the nonagricultural employment trend that continued through 1976 and, presumably, is still continuing. Agricultural employment continued to decline and overall lost 304 jobs between 1970 and 1976. However, this was offset and surpassed by an increase of 674 jobs in the nonagricultural sector, a net gain of 370 jobs (table II-24).

Additional indicators of increasing population growth are new post office addresses and new telephone installations. The Delta post office added 184 new addresses in 1976 (both rural and city). In the North Fork Valley, the Delta County Cooperative Telephone Company installed 91 new telephones in Paonia, Somerset, and Hotchkiss between April and October, 1976 (Grand Junction <u>Daily Sentinel</u>, November 26, 1976, and the Delta County Cooperative Telephone Company, September 17, 1976). See table II-25.

TABLE II-23

Energy Impact Survey by State of Colorado

Population

	1970	5/1/77	PERCENT INCREASE
Delta Co.	15,404	18,939	22.9
Cedaredge	581	966	66.3
Crawford	171	261	52.6
Delta	3,694	3,705	.3
Hotchkiss	507	727	43.4
Paonia	1,161	1,276	9.9
Orchard City	1,163	1,815	56.1

Table II-24
Labor Force Trends
Delta County
1970-1976

YEAR, ANNUAL AVERAGE	TOTAL LABOR FORCE	TOTAL EMPLOYMENT	NONAG. EMPLOYMENT	AG. EMPLOYMENT	TOTAL UN-EMPLOYMENT	PERCENT UN-EMPLOYMENT
1970	5,912	5,572	4,055	1,517	340	5.8
1971	5,589	5,264	3,956	1,308	325	5.8
Change 70-71	-323	-308	-99	-209	-15	
Percent Change	-5.5	-5.5	-2.4	-13.8	-4.4	
1972	5,571	5,240	3,978	1,262	331	5.9
Change 71-72	-18	-24	22	-46	6	
Percent Change	-0.3	-0.5	0.6	-3.5	1.8	
1973	5,975	5,734	4,338	1,396	241	4.0
Change 72-73	404	494	360	134	-90	
Percent Change	7.3	9.4	9.0	10.6	-27.2	
1974	5,991	5,737	4,387	1,350	254	4.2
Change 73-74	16	3	49	-46	13	
Percent Change	0.3	0.05	1.1	-3.3	5.4	
1975	6,212	5,736	3,774 a/ 682 b/	1,280	476	7.7
Change 74-75	221	-1	69	-70	222	
Percent Change	3.7	0.02	1.6	-5.2	87.4	
1976	6,396	5,942	4,032 a/ 697 b/	1,213	454	7.1
Change 75-76	184	206	273	-67	-22	
Percent change	3.0	3.6	6.1	-5.2	-4.6	
Change 1970-1976	484	370	674	-304	114	
Percent change 1970-1976	8.2	6.6	16.6	-20.0	33.5	

Source: State of Colorado, Division of Employment, Research and Analysis Section, 1977. (Based on place of work.)
a/ Nonagricultural wage and salary employees.
b/ All other nonagricultural employees.

Table II-25
New Telephone Connections

		1969-1970	April-October, 1976
Paonia	Residential		24
	Business		20
	Total	55	44
Somerset	Residential		3
	Business		6
	Total	not available	9
Hotchkiss	Residential		22
	Business		16
	Total	17	38

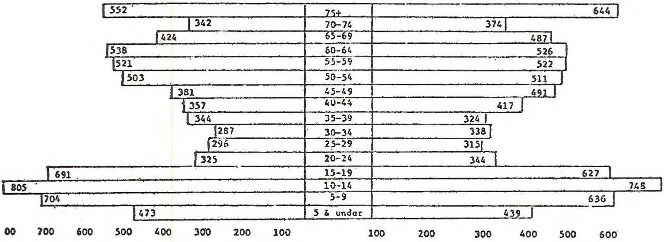
Older retired residents make up a significant segment of the county population. Recent estimates place the percentage of people over 60 at 28.5 percent (with 21.4 percent over 65) (Region 10 Council on Aging). The median age for the county is 39.6 years, as compared with the state's median age of 26.2 (figure II-12).

2. Employment

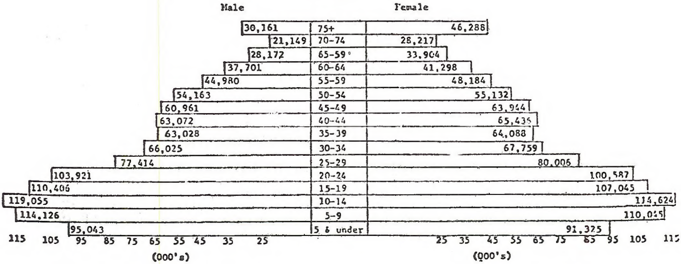
Traditionally agriculture has been the largest employer in Delta County, but it has been declining. Between 1970 and 1976, total employment in the county increased from 5,572 to 5,942, an increase of 370 jobs or 6.6 percent. In the same period, agriculture declined from 1,517 to 1,213 jobs, a 20 percent reduction. In 1970 agriculture's share of the jobs in the county was 27.2 percent; by 1976 its share had declined to 20.4 percent (table II-26). The closing of the Holly Sugar refinery will reduce the number of permanent agricultural jobs by an additional 50 to 60 as well as approximately 200 to 250 seasonal jobs.

One factor significantly affecting the increase in jobs in Delta County and the increase in nonagricultural jobs has been the development under way by Colorado Westmoreland, Inc. (CWI). Following are figures on the construction labor force involved in opening the Orchard Valley Mine since July 1976:

DELTA COUNTY 1/



COLORADO
1970



1/ U.S. Bureau of Census, 1970.

Figure II-12 AGE DISTRIBUTION DELTA COUNTY AND COLORADO

Table II-26
Summary of Labor Force Trends

Delta County

	TOTAL L.F.		TOTAL EMPLOYMENT		NONAG. EMPLOYMENT % of L.F.		AG. EMPLOYMENT % of L.F.		NONAG. EMPLOYMENT % of JOBS		AG. EMPLOYMENT % of JOBS		UNEMPLOYED % of L.F.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1970	5,912	100.0	5,572	100.0	4,055	68.6	1,517	25.7	4,055	72.8	1,517	27.2	340	5.8
1976	6,397	100.0	5,942	100.0	4,729	73.9	1,213	19.0	4,729	79.6	1,213	20.4	454	7.1

Source: State of Colorado, Division of Employment, Research and Analysis Section, 1977. (Based on place of work.)

July 1976	40
August 1976	77
September 1976	135
October 1976	175
November 1976	185
December 1976	209
January 1977	210
February 1977	237
March 1977	274
April 1977	314
May 1977	345
June 1977	490

Approximately half of these construction workers live in Delta, Montrose, and Mesa counties and commute from home to work.

In addition to the above construction workers, CWI employs 107 people. Development of this nature may help to offset the loss of jobs as a result of the closing of the Holly Sugar refinery; however, the majority of those workers were seasonal, and it is not likely they will seek full-time mining employment.

The employment situation in the North Fork Valley around Paonia and Somerset is somewhat different from that of the county. (Information presented in table II-27 is from the fourth count tapes of the 1970 census for the Paonia, Hotchkiss, and Somerset areas; see map II-6. The North Fork economy is quite heavily dependent on the mining sector and somewhat less dependent on the trade and services sector. Many of the mines in the county are located in the North Fork Valley, which is reflected in the area's employment pattern. The North Fork Valley trade sector has not developed as rapidly as that in Delta, the county seat and regional trade center. In addition, Grand Junction is within reasonable shopping distance. However, as the population of the area increases, more retail facilities, including chain stores, may open in the valley. The North Fork Times, June 20, 1977, indicated that Gibson's discount chain is planning to open a store in Delta in the fall of 1977, and City Market is seriously considering building a supermarket just outside Paonia in two or three years.

a. Unemployment and Underemployment

The Delta County unemployment rate for 1976 was 7.1 percent as reported by the State of Colorado Employment Division. It has been estimated that one third of the work force is underemployed or seasonally employed in the construction and agriculture industries. (North Fork Times, February 18, 1976)

The recent opening of the Delta-Montrose vocational-technical school will aid those wishing to gain or improve work skills leading to better job opportunities.

Table II-27
Employment by Industry
Delta County

INDUSTRY	HOTCHKISS DIVISION Number	%	PAONIA DIVISION Number	%	SOMERSET DIVISION Number	%	TOTAL Number	%	DELTA COUNTY Number	%
Agriculture	298	33.3	190	23.2			488	27.2	1,059	21.8
Mining	37	4.1	164	20.0	41	52.6	242	13.5	221	4.6
Construction	100	11.2	79	9.6	11	14.1	190	10.6	379	7.8
Manufacturing	66	7.4	62	7.6			128	7.2	465	9.6
Transportation, Communications and Utilities	36	4.0	42	5.1			78	4.4	277	5.7
Trade	158	17.7	97	11.8	16	20.5	271	15.1	931	19.2
Services	65	7.3	45	5.5			110	6.1	486	10.0
Health	4	.4	9	1.1	5	6.4	18	1.0	202	4.1
Education	72	8.1	85	10.4			157	8.8	425	8.7
Welfare and Misc.	14	1.6	30	3.7			44	2.5	212	4.4
Public Administration	44	4.9	16	2.0	5	6.4	65	3.6	199	4.1
TOTALS	894	100.0	819	100.0	78	100.0	1,791	100.0	4,856	100.0

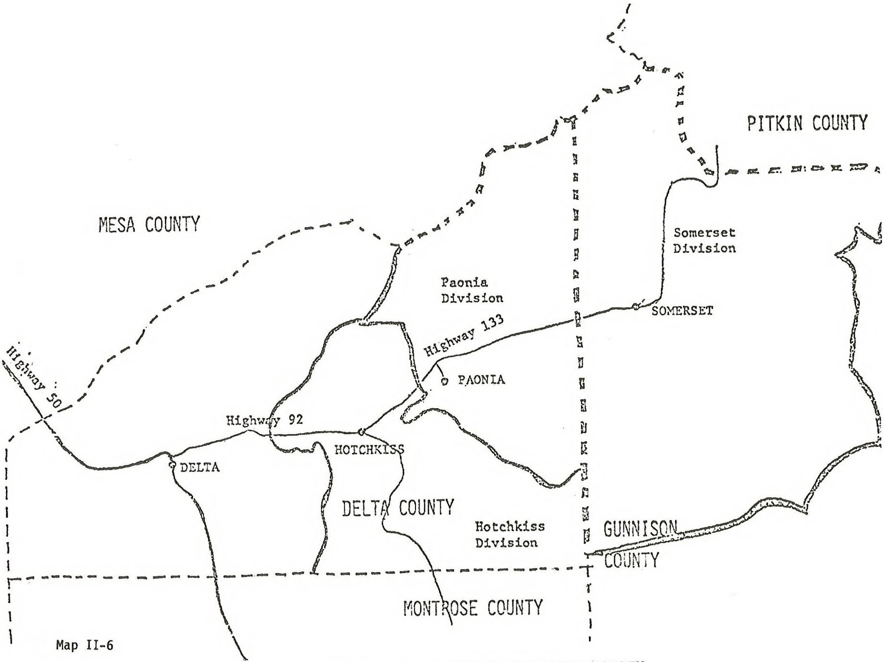
Source: U.S. Bureau of Census, 1970 and Fourth Count Census Tapes, 1970. (Based on place of residence)

Table II-28

City of Delta - Hourly Wage Ranges

	ENTRY RATE	MEDIAN	MAXIMUM
Clerk, gen'l office	$2.00	$2.50	$3.00
Bookkeeper, general	2.00	3.00	3.50
Clerk typist	2.00	2.50	3.00
Secretary	2.00	3.00	4.30
Engineer, senior	4.50		
Machinist	3.00	3.75	4.50
Auto mechanic	2.50	3.25	4.00
Carpenter: union			6.87
nonunion	3.50	4.50	5.50
Electrician			6.00
Power equipment opr.	4.90		6.45
Painter	2.00	4.00	6.00
Plumber-pipefitter	2.50	4.00	8.62
Truck driver	2.50	3.70	5.35
Printer	3.00	5.00	5.50

Source: Estimates by local Colorado Department of Employment Office.



Map II-6

MAP OF CENSUS DIVISIONS NORTH FORK VALLEY

3. Income

The wage rates for the city of Delta, table II-28, are indicative of the county-wide wages.

The April 1975 "Survey of Current Business" gives the following per capita figures for personal income for Delta County, Colorado, and the United States (see table II-29 for personal income in Delta County by major source):

	1969	1972	1973
National	$3,733	$4,549	$5,041
Colorado	3,532	4,601	4,966
Delta County	2,379	3,094	3,637

Per capita income has remained below the state and national averages, and in 1970, 19.4 percent of the population had incomes below the poverty level. This is, in part, a reflection of the number of retired people in the area living on fixed incomes. The Rocky Mountain Area Agency on Aging reports that 30.8 percent of those age 60 or over have incomes below poverty level. In fiscal year 1975-1976, 13.8 percent of the population was on some type of welfare assistance; this was slightly lower than the 1974-1975 figure of 14.8 percent.

The closing of the Holly Sugar plant in Delta will have an adverse effect on many beet farmers until such time as they can make a transfer to another viable crop. In 1974 sugar beets made up 11 percent (or $1,562,000) of the total value of all field crops in Delta County. (Colorado Dept. of Agriculture, Colorado Agricultural Statistics, Denver, Colo. 1974) Since incomes from beet production and processing have an effect on the entire economy of the area (e.g., manufacturing, trade, and services sectors), the total economic impact of Western Colorado's beet business was $31,576,545 in 1974. (District 10 Regional Planning Commission, Economic Impact of Western Sugar Beet Production and Processing, Montrose, Colo. 1977) The impact on Delta County is as follows:

Holly Sugar Plant (Delta)

Labor expenses	$856,326*
Field Labor @$40/acre	$420,000**
	$1,276,326

* Holly Sugar Corporation
** Western Colorado Beet Growers Association

Table II-29
Personal Income by Major Source--Delta County (1972)

Source	Amount (Millions of Dollars)
Farm	$4.6
Federal Civilian	1.5
Military	0.3
State and Local	3.7
Manufacturing	1.9
Mining	0.4
Contract Construction	1.2
Transportation, Communications, and Public Utilities	1.0
Wholesale and Retail Trade	4.4
Finance, Insurance, and Real Estate	1.2
Services	4.9
Other	0.7
Property Income	9.3
Transfer Payments	10.9

Source: Bureau of Economic Analysis, "Survey of Current Business," Washington, D.C.: Department of Commerce, Vol. 54, No. 5, Part II, May 1974.

4. Attitudes, Expectations, Life Styles, Social and Cultural Characteristics

The Delta County economy traditionally has been dominated by agricultural interests, although coal has been mined in the North Fork Valley since the 1890s. However, as coal mining begins to play a larger part in the county's economy, shifts in the social and cultural composition can be expected. Until as recently as 1970, the county was homogeneous, but conflicts developed as people with varied backgrounds and cultures moved into the area, even prior to major coal development. (Foundation for Urban and Neighborhood Development, Local Citizens' Participation in Coal Development, Denver, Colorado 1975) Figure II-13 shows indicators of societal change in Delta County. Many of these areas of conflict have begun to be resolved, however, as cooperation replaces confrontation.

a. Social Structure

Although agriculture dominates the basic economy of the county, it has been declining. In 1960 it was 63 percent of the basic economy, and in 1970 it was 51 percent. At the same time mining has been increasing gradually in importance, from 9 percent in 1960 to 12 percent in 1970.

Often the agricultural jobs and the energy-related blue collar jobs involve relatively well-developed skills and the utilization of moderately advanced technology. In addition, 33 percent of the local work force are self-employed, while the national average is 9 percent (1970). Moreover, the county has always attracted retired individuals because of the climate and beauty of the area.

b. Culture

The dominant culture of the county is Anglo (88 percent of the population), with 11 percent of the population being of Spanish-American descent. Thirty-five percent of the 1970 county population were church adherents (as compared to 50 percent nationally). The Catholic Church has the largest membership, followed by the Baptist and Methodist Churches.

c. Attitudes

There are strong feelings of western self-reliance and pride of ownership (85 percent of the local farms/ranches are owner-operated as compared with 60 percent nationally). A spinoff from the self-reliance and pride-of-ownership attitudes is a powerful

	Characteristics of Society - Now	Possible Characteristics of Society - 1985
Social Structure		
Economy	Total employment--4,856	
	Single industry economic base--agriculture is 51 percent of the basic employment	
	21 percent of the population is age 65 or over	Proportion of population that is retired will decrease
Technology	Agricultural technology fairly advanced; county residents employed in local mines	Advanced mining and processing technology; more specialized; more diversified and sophisticated; improved technical, educational and professional services in the area
Occupational Structure	Farmer/rancher dominated	Farmer/rancher and blue collar workers roughly equally significant
Polity		
Regulates Distribution of Power	Farmer/rancher dominated county (the 3 county commissioners are farmers and/or ranchers); county has been traditionally anti-planning, although attitudes appear to be slowly changing. State has weak legislation on planning, growth management	Changes in occupational structure, technology and economy all must be dealt with and will change constituencies; city and towns will be larger and more complex, will require more planning and administration
Adjudicates Conflicts and Claims	Legisture--metro-suburban dominated; county deals with few conflicts, largely between revenues (taxes) and expenditures (service requirements)	Increased conflicts: newcomers vs. old-timers, interindustry and environmental conflicts more common; unions could be more of an issue and possibly a political force; need for governmental intervention vs. fear of loss of independence

FIGURE II-13 INDICATORS OF SOCIETAL CHANGE TO 1985--DELTA COUNTY, COLORADO

	Characteristics of Society - Now	Possible Characteristics of Society - 1985
Culture		
Expressive Symbolism and Meanings	Christian values--Catholic, Baptist, Methodist--35.2 percent of county population are church adherents (the national average is 50 percent)	?
	Emphasis on independence and self-reliance--85 percent of the farms and ranches are owner occupied (the national average is 62 percent); 32 percent of work force is self-employed (the national average is 9 percent)	More emphasis on political, social and economic groups More wage employment, particularly in the North Fork Valley
	County residents have a great respect for the natural beauty, fertility and remoteness of their valley environment	?
Institutions		
Family	Attitude of permanence--attachment to the area	Presence of a larger population who may view themselves as temporary
	1975 divorce rate--5.7/1,000 population, an increase from the 1971 rate of 3.9/1,000 (national average is 4.0/1,000)	?
Education	Low dropout rate of 6 percent (the national average is 25 percent)	Dropout rate may come closer to the national average as the county becomes more industrial
	Interest in vocational-technical training (Delta-Montrose Area Vocational-Technical School located just outside of Delta)	

FIGURE II-13 INDICATORS OF SOCIETAL CHANGE TO 1985--DELTA COUNTY, COLORADO (cont.)

	Characteristics of Society - Now	Possible Characteristics of Society - 1985
Institutions Education (cont.)	In addition to the county seat of Delta, there are four very small service-center towns (not including Orchard City which was organized as a water and sewer district) high proportion of permanent housing	Growth, more diversity in Delta and in the smaller communities; increase in the proportion of temporary housing; possible degradation of services and overcrowding to accompany rapid growth
SUMMARY	Traditionally an agrarian society, county dominated by farmer/ranchers	More complex society, including new extractive and processing components; county now dominated by farmer/ranchers and employees of energy industry

Source: The general analytical framework used in these charts was first suggested by Daniel Bell, The Coming of the Post-Industrial Society, (New York: The Basic Books, 1973) Other sources are: Bureau of the Census, 1970 Census of the Population Characteristics of the Population of Colorado Washington, D.C.: GPO, 1972; Bureau of the Census, 1970 Census of Housing. Detailed characteristics of Colorado Washington, D.C.: GPO, 1972; Center for Social Research and Development, Colorado Socioeconomic Data for 1972 and Change Measures 1970-1972 Denver: University of Denver Research Institute, 1974; Colorado Department of Education; County Clerk of Delta County; Douglas W. Johnson, Paul R. Picard, and Bernard Quinn (eds.), Churches and Church Membership in the U.S. Blendmary Research Center, Washington, D.C.: 1974.

FIGURE II-13 INDICATORS OF SOCIETAL CHANGE TO 1985--DELTA COUNTY, COLORADO (cont.)

distaste for local, state, or federal planning, especially planning related to management of privately owned land and property. However, impending community impacts of coal development, as well as the continued influx of retirees and urban life escapees, are causing the citizenry and its leadership, to reconsider planning concepts. The trend is toward local control of planning in order to avoid control going to the state by default.

In addition to the pervasive norm of self-reliance existing in the county, norms of neighborly cooperation and respect for neighbors rights also exist. The cooperative norm is most manifest during times of crisis, i.e., family or natural disasters. In addition, the county residents have a great respect for the natural beauty, fertility, and remoteness of their valley.

d. Institutions

As throughout the nation, the institution of the family in Delta County is somewhat weaker than in the past. In 1971 the divorce rate was 3.9 per 1,000, but in 1975 it had risen to 5.7 per 1,000, an increase of 46.1 percent. The divorce rate in the county was higher in 1975 than the national rate of 4.8 but below the Colorado rate of 6.0.

e. Lifestyles

The lifestyles in Delta County are of the American rural village/open country type. Low per capita incomes and remoteness from urban areas preclude elaborate lifestyles. Day to day life revolves around the family, jobs or farms, schools, school activities, civic organizations, and churches and church auxiliary activities.

Recreational activities consist mainly of hunting, fishing, snow-mobiling, skiing; attending high school sports events; T.V. viewing, driving cars or pickups for pleasure, and attending movies.

f. Political Systems

The political power in the county has traditionally been held by the agricultural interests. The three county commissioners are ranchers or farmers. However, newcomers are becoming more vocal in expressing their opinions on planning and zoning laws and also on industrial development in the area. They have been in the forefront in organizing special interest groups such as the North Fork Valley Concerned Citizens Council and are also becoming active in such area organizations as the Western Slope Research Center and the Overall Economic Development Program.

Traditionally, local government has played only a minor role in dealing with social issues. In the past the county has been anti-planning and anti-zoning, although attitudes now appear to be changing somewhat (see section on status of planning and zoning).

g. Entities of Government

Included in the primary and secondary impact areas are the incorporated towns of Paonia and Hotchkiss, the city of Delta, Delta County, the Somerset area of Gunnison County and portions of School District No. 50(J). (School District No. 50(J) serves all of Delta County and portions of Gunnison, Mesa, and Montrose counties.) The impact area also includes numerous special districts, which handle water, sanitation, fire protection, and other services.

Some citizens of the Somerset area of Gunnison County, which includes most of the North Fork's existing coal mines, have voiced intentions to secede from Gunnison County and join Delta County. Most of the workers already live in Delta County. The switch would increase the Delta County property tax base by about $4 million (about 9 percent) and would mean additional mineral royalties and in-lieu federal payments (Grand Junction Daily Sentinel, November 26, 1976). The political feasibility of such a change is uncertain. Both counties would be required to hold elections on the secession issue. The annexation question can only be presented at a general election, and the next such election is two years away (Grand Junction Daily Sentinel, December 22, 1976).

h. Adequacy of Public Facilities

Delta County is in need of a new jail facility. The present structure is located in Delta and is used by other towns in the county. The county has also been instructed to abandon its trash dumps by the State Health Department and the U. S. Department of the Interior (Delta County Independent, September 23, 1976). Delta County has contracted with two private firms to operate three landfills to replace the trash dumps. Some problems on financing road and bridge maintenance and building have occurred with a slowdown in revenues from the Highway Users' Trust Fund. The county recently has combined the efforts of the three district road departments, including the operation of only one gravel crushing plant for the combined department instead of three.

The City of Delta's water distribution system is old and in need of repair. The city is not yet on water meters but has plans for a gradual switch to metered useage. The city is currently seeking grants for a dam on the Gunnison River, for a filter plant, and for replacement of the distribution lines and meter installation. This winter's light snowfall has made it necessary for the city to seek emergency water supplies from the North Delta Irrigation Company. Total cost is estimated at $50,000--$20,000 capital outlay for construction of the pumping works and $3,000 per month for operation. Other water measures include authorization by the city council of a 50-year commitment between Delta and Tri-County Water Conservancy District for two blocks of water from the Dallas Creek project to be purchased by the city and an increase in the water useage rates (Delta County Independent, March 10, 1977). Delta is currently completing a $1 million project separating sewerage from water drainage.

The Region 10 Planning Commission has endorsed a grant for a make-work program to continue improving Delta's streets.

City residents are facing higher electrical rates for city produced electricity because the city utility generates power at costs which are continually increasing. The plant is obsolete and operating at capacity now (Delta County Independent, September 23, 1976).

The Town of Paonia currently draws water from area springs, and useage is metered. Recent engineering estimates have indicated that the springs could potentially supply another 1,000 homes. (North Fork Times, October 15, 1976) In addition, the town recently acquired rights to water at German Creek Springs (now in litigation). The town's existing water lines, built between 1902-1904, frequently break down. Eventually the town will have to invest roughly $500,000 for new lines and storage facilities (Grand Junction Daily Sentinel, September 17, 1976).

Recently the town approved construction of a new sewer outfall line which will serve over 100 existing Paonia homes now on septic tanks, many undeveloped lots, and the Pan American development (total capacity is estimated at 800 taps). The project will be financed by revenue bonds backed by income from the town's sewage system. The council also established new uniform sewer tap rates ($600 for single units). (North Fork Times, January 6 and 12, 1977)

The Town of Hotchkiss currently has a $1 million water supply and treatment project under way, partially funded by the Farmers Home Administration. This project will rebuild the water system for the present population, but expansion for newcomers would require an additional $1.5 million. (North Fork Times, October 15, 1976)

Local Tax Structure. The county assessor's office is required to conduct a county-wide reappraisal to bring assessment rates up to the official 30 percent. Concomitant to the reappraisal is a 7 percent limit on annual revenue increases; higher increases must be approved by the Colorado Department of Local Affairs. (In 1976, HB 1139 amended CRS 1973 29-1-301 and 29-1-302 to change the annual revenue-increase limit from 5 to 7 percent. This limitation is in effect until the statute is otherwise modified.) This limit applies to all local taxing authorities other than school districts and home-rule cities or home-rule counties. Thus, it applies to property tax revenues of Delta County, Hotchkiss, Cedaredge, Paonia, and the various special districts. As the city of Delta is a home-rule city, the limit does not apply to it.

The traditional main revenue source is the ad valorem property tax. Delta has a sales tax, and Hotchkiss recently passed a referendum authorizing a 1 percent sales tax. (North Fork Times, February 24, 1977) Delta County is one of sixteen counties in Colorado that has adopted a sales tax; the rate is 1 percent. (R. M. Bolt et al., 1976, Boom Town Financing Study, V. 1, p. 34) All of the towns have already passed or are currently considering revisions in water and sewer tap fees to pay most or all of the costs associated with the service.

Status of Planning and Zoning. Historically, Delta County has shared the traditional western-rural belief that a person's property should be free from government control. The Delta County zoning referendum indicates that, as recently as two years ago, local sentiment was against even weak planning powers, although the issue was defeated by only 279 votes.

In July 1975 the Concerned Citizens for Better Delta County Government filed a notice of their intention of forcing a recall election of the three county commissioners. One of the charges was that the commissioners had spent money on land use planning even though the county had voted down the commissioners' zoning proposal. The recall election was never held.

Today, the strong probability of significant coal development may be changing people's minds. The subject of land use control was an issue in this year's county commissioner race. The new county commissioner viewed adequate local planning efforts as an alternative to increased state involvement. (Delta County Independent, October 21, 1976) Recently, the county commissioners adopted a one-page statement declaring that any industrial firm taking certain specified actions affecting certain categories of land useage must notify the county. The statement was intended as the county guideline under HB 1041 but may be challenged by state agencies. (Grand Junction Daily Sentinel, May 12, 1976)

The county does not have zoning, but does have mobile home park regulations which establish standards for new mobile home parks. However, there are strong indications that people are beginning to look more favorably towards planning and zoning as evidenced by the North Fork Valley Concerned Citizens which is trying to establish a local planning district in the Paonia area. At a

Delta County Contractor's Meeting (April 19, 1977) the building contractors in attendance voiced their support uniform building and zoning codes.

The Delta County Commissioners are presently in the process of interviewing for the position of Delta County Development Coordinator. Generally, the coordinator will oversee all development in the county.

5. Education

Public education is important within the individual communities. Each town takes pride in its own high school and the extracurricular activities offered there. The district-wide dropout rate is 6 percent, much lower than the national average of 25 percent. Many county residents are also taking advantage of the courses offered by the recently opened Delta-Montrose Area Vocational-Technical School.

In spite of the expressed pride in the schools, School District No. 50(J) does not have adequate facilities for the current enrollment. Most schools are at least 50 years old. Within the last year, the district proposed consolidating schools for four communities to fewer sites. Following the defeat of this referendum, the district proposed an $8 million bond issue which was defeated by a nearly 2 to 1 margin. The district has no immediate plans for another issue. (North Fork Times, November 3, 1976)

The Paonia elementary school consists of a metal building and three mobile units that were erected in 1947. The middle/junior high school was built in 1904, and it shares space in one of the mobile units. The high school is the newest building, and it was built in 1959. It was constructed for an optimum enrollment of 230 and at present has an enrollment of 315, more that a third over its planned capacity.

Many of the facilities in the Paonia schools are inadequate to provide satisfactory education for the students. In the elementary school the corridors are used for small groups; there are no central library, no audio-visual or media centers, no indoor physical education. In the middle/junior high school and high school, science facilities are less than minimum for adequate teaching, no art classes are offered, physical education facilities (including shower and storage facilities) are inadequate or nonexistent, media and library facilities are limited. The cafeteria and outdoor facilities are used by all the schools.

The schools in Hotchkiss are generally less crowded than those in Paonia. However, the elementary school has two grades at capacity and two over capacity, and one class meets all day in the corridor.

In the junior/senior high school the science area is inadequate, and the library facility is rudimentary. All grades from elementary through high school use the same cafeteria in the high school and the same outside play area. The Hotchkiss elementary school was built in 1959 and the junior/senior high school in 1923.

The Crawford School, for elementary grades only, was built in 1913 for 120 students and has an enrollment of 130. The first and second graders meet in one, overcrowded classroom, and all other grades are at capacity. Due to the age of the building, many of the wooden frame windows will not open; some of the electrical wiring is quite old; and outside woodwork, cement steps, and sidewalks need repair. The cesspools overflow every spring.

The Colorado School Foundation Act determines the local-state split of school district financing, based on current or historic revenue figures and a per-pupil expenditure level, established annually by the state legislature. Districts seeking high expenditure rates may seek to raise local revenues; after a year, portions of this greater local effort will be funded by the state. The Colorado School Financing Act does not provide for rapid response to sudden growth in enrollment. Foundation fund allocations are based on the previous year's enrollment. Thus school districts are subject to at least one year's lag in obtaining money for additional students currently enrolled.

The mill levy for Delta County School District No. 50(J) is 38.05, which is collected for all residents within the district regardless of which county they are living in--Delta, Gunnison, etc. Capital expansion is funded by the local district. Lease royalty and bonus money is collected for mining done on federal lands. Of the total receipts, 50 percent is returned to the state. Of this 50 percent, 25 percent is earmarked for schools, 50 percent is returned to the county of origin with a maximum return of $200,000 per year, 10 percent goes into the water conservation board construction fund, and the remaining 15 percent is allocated to the local government mineral impact fund which is administered by the Department of Local Affairs (impacted communities receive priority in the distribution of fund monies).

The severance tax will take effect in January 1978 with receipts being allocated to the state general fund, the state conservation trust fund, and the local government severance tax fund administered by the Department of Local Affairs. Each type of mineral has its own tax and allocation structure. Coal severance monies will be allocated according to the following percentages of the total coal tax receipts: 45 percent to local government severance tax fund (15 percent returned to local governments based on residence of the employees of the company paying the tax and 30 percent administered by the Department of Local Affairs with priority given to impacted localities); 15 percent to state conservation trust fund; and 40 percent to state general fund.

The debt limit of School District No. 50(J) is $8 million, with present assessed valuation. The district's debt is currently $61,000. The town of Paonia has a debt limit of $204,200; there is no outstanding general obligation debt. Debt limit has been computed as $93,800 for Hotchkiss. The county of Delta has an indebtedness limit of $555,200 and there is no outstanding debt.

6. Housing

According to the Colorado Division of Housing's publication Housing In Colorado, April 1976 there were 6,610 total housing units in Delta County in April 1976; 5,776 were conventional houses and 835 were mobile homes. Local real estate people estimate that up to 200, or 3.5 percent, of the conventional houses are for sale and up to 40, or 0.7 percent, are unoccupied.

The situation in Delta County is similar to the national situation in housing as reported recently in the Wall Street Journal: families making average incomes cannot afford the average house. Delta County real estate dealers assert that low down payment, moderately priced houses are unavailable. Because of the unavailability of new or existing housing units at affordable prices, there has been a trend toward mobile homes as an alternative housing solution, especially for low to moderate income families. In 1973, 50 percent of all new housing units in Delta County were mobile or modular units. (Rick Isom, Population and Economy, Delta County, Colorado, District 10 Regional Planning Commission, February 1977)

In general, there is limited room for expansion within the present town limits of any Delta County community. Any new development must occur on the outskirts and be annexed to the town or must attempt to be self-sufficient with the aid of county services or special districts. There are new subdivisions being built around the city of Delta (including a 75-unit, low-income housing project), along Highway 65 up to Cedaredge, on a mesa to the north of Hotchkiss, and outside Paonia.

The Hotchkiss subdivision of Willow Heights has been annexed to the town. The second phase of this development is open, with approximately 55 lots available. These lots are selling for $6,000 to $7,500, including tap fees. Homes range from $26,000 to $50,000 in price (North Fork Times, September 8, 1976). There are also plans for the Land's End Estates (approximately 50 lots) located 3 miles east of Hotchkiss (North Fork Times, March 17, 1977).

In Paonia, Pan American Properties has begun phase I of their development. The first offering will have 47 lots, most of which will be sold to construction contractors. The houses will range in price from $35,000 to $38,000. Eventually the company also plans to build townhomes, which will begin at $26,000.

In addition to this major subdivision, several other housing developments have been announced: Bonine Construction Company is intending to build 6 homes on their property northwest of town; Lamborn Hills subdivision, south of Paonia, has plans for 18 to 21 sites; and there will be 19 sites available in the Fire Mountain Estates development on Pitkin Mesa. (North Fork Times, November 24, 1976, and December 22, 1976) A new 22-space mobile home park is planned for an area north of town, and a 25-space addition to the Shady Acres Park has also been announced.

Atlantic Richfield (ARCO) recently purchased the Mott Ranch near Paonia. The purchase included water rights to be transferred to the town of Paonia in return for 400 water taps. (A water referee ruled on January 11, 1977, that the 3.95 cubic feet per second of German Creek water rights purchased can only be converted to 0.5 cubic foot per second of domestic water rights. Paonia will appeal the decision.) Development of this land is contingent upon the start of ARCO's mining activity in the area.

If all the proposed housing units mentioned earlier in this chapter are constructed--of which there would be about 720--and assuming that each lot will be about one-quarter of an acre, about 180 acres of the nonfederal land (341,192 acres) in the county will be used, or about 0.053 percent of the non-BLM, non-USFS land.

Recently the county commissioners passed a 90-day moratorium on exemptions to subdivision regulations, specifically three-way splits that appear to violate the intent of the exemption process (i.e., selling lots for housing without making improvements required of a subdivider).

7. Transportation

Delta County is served by several types of transportation. Air service is primarily provided out of Montrose and Grand Junction, although the Delta County Airport is located in Delta. Continental Trailways has bus service to and from Delta; the city itself does not have a bus line. Freight service is available through several trucking firms and the Denver and Rio Grande Railroad. There is no railroad passenger service. The city of Delta is on Highway 50, providing easy access to Grand Junction (approximate mileage, 40 miles) and Montrose (approximate mileage, 21 miles).

North Fork Valley residents must travel to Delta, Montrose, or Grand Junction for bus or major air service, although there is an airport for small craft only located near Paonia. As a result, people in the North Fork Valley are primarily dependent on private vehicles as their means of transportation.

Presently, the Denver and Rio Grande (D&RG) runs a train through the valley five days a week--one trip each way--primarily loaded with coal. The D&RG transports coal from Somerset, Tony Bear Mine and Hawksnest Mine, totaling approximately 1 million tons annually. D&RG officials have indicated they can handle an increase in production up to at least 5 million tons annually. Highways 133 and 92 are paralleled by the D&RG from above Somerset to Delta. As the valley narrows, the tracks run through the town of Paonia and cross Highway 133 near Bowie several times.

Highways 92 and 133 service the North Fork Valley (Hotchkiss and Paonia). The 1973 State Highway Sufficiency Rating and Needs study gives Highway 133 between Bowie and Hotchkiss a safety rating of 0 on a scale of 0 to 10, with 0 being the least safe, and a present serviceability index of between 2.7 and 3.6 on a scale of 0 to 5. The 1975 Sufficiency Rating Study rates the stretch of Highway 133 between Paonia junction and Somerset at 0-60 sufficiency index, the lowest rating of the State Department of Highways. Average daily traffic was 1,100 between Hotchkiss and Paonia, and 850 from Paonia to above Bowie. The safety rating for Highway 92 from its junction at Hotchkiss to Payne siding is 2 in Hotchkiss and 0 for the rest of the route. Average daily traffic varied from 2,900 in Hotchkiss to 2,050 near Rogers Mesa Community Hall, and 1,750 on to Payne siding.

Construction to improve the poorer stretches of Highway 133 is tentatively scheduled for fiscal years 1979 through 1981. (Five Year Highway Construction Program, Colorado Department of Highways, 1976). The environmental statement is scheduled to be out to the public in August or September 1977. The routing of the road through Somerset has received a great deal of publicity because of the possibility of removing some Somerset homes to make room for the road. (North Fork Times, January 19, 1977)

The role that state Highways 92 and 133 play in the life of the North Fork and the county must be fully recognized. They are lifeline roads supporting agriculture, commerce, schools, emergency traffic, commuters, and social functions. For example, these roads are used for trailing bands of sheep and herds of cattle during all seasons of the year. From mid-September to the end of October, these roads act as service roads for the fruit industry. During this six-week period truck use in the Paonia area increases by 32 trucks per day and in the Hotchkiss area by 38 trucks per day. Disruption of these lifelines would completely alter the day-to-day living of the residents of the North Fork area. (See map II-7, for State Highway Department 1974 traffic counts of roads in area.)

The Bureau of Land Management recently took a nine-day (January 20 to January 28, 1977) count of traffic going to the Orchard Valley Mine. The average daily totals for the different classifications of vehicles are as follows:

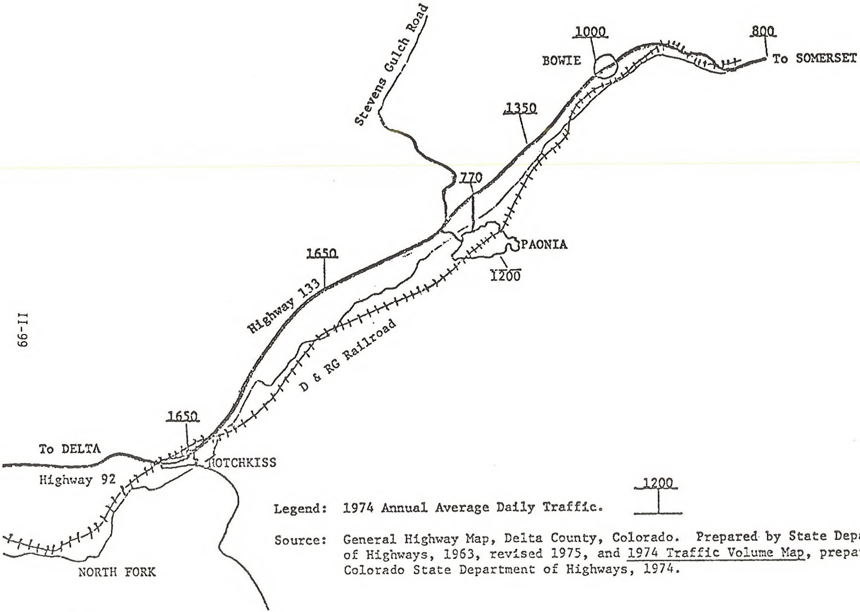
Cars	57
Pickups	129
Large trucks	28
Coal trucks	37
Heavy road equipment (not hauled)	4
Other	11
Total	266

Peak traffic times will probably coincide with shift changes at the mine. Additionally, CWI is planning to truck coal temporarily from the mine site to the loading facility along Highway 133--a distance of roughly 2 miles. Trucks will be 20-ton bottom dump trucks. Approximately 40 truck loads per day will be required in 1977 and between 80 and 95 truck loads per day in 1978. In addition, CWI's coal production will require two more trains per week--adding to the train traffic already going through Paonia as well as the rest of the North Fork Valley and the county.

At the Paonia Public meeting on May 1, 1975, Richard Prosence, State Director of Highways, said:

"People have asked me what I thought the impact of this type of coal hauling would be on our somewhat inadequate highway, and I've told them that without question we would suffer some additional maintenance expense and there would be some break-up on the road, but it would be sort of speculative to say exactly how much damage would be incurred by a truck haul of this sort. We are surviving in other places with rather heavy truck loads. There is reference to...somewhere I read about the road from Redstone down to Carbondale. We do have a lot of patching to do on that road, but those trucks have been hauling many miles for many years on that particular highway and we have managed to keep it in passable condition.

"There has been a statement or two made--why doesn't the Division of Highways do something about Highway 92 and 133. Of course, our problem is like everybody's problem, I guess--the lack of financing to improve all the highways that need to be improved in Colorado, and that picture has turned exceedingly bleak in the



Legend: 1974 Annual Average Daily Traffic.

Source: General Highway Map, Delta County, Colorado. Prepared by State Departme
of Highways, 1963, revised 1975, and 1974 Traffic Volume Map, prepared b
Colorado State Department of Highways, 1974.

Map II-7

MAP OF NORTH FORK VALLEY WITH TRAFFIC COUNTS last year. Our revenues are actually decreasing now because of smaller gas tax revenues, because of less sales of gas, and our costs have skyrocketed in the last few years. Our cost index is 225 percent of our 1967 costs this past year. So we're getting less than half the road built for the same tax dollar than we were a few short years ago, seven years ago, and we are getting less tax dollars, with the net effect that we get much less done than we were getting back in 1967, you might say. So if you'd asked for your road back in 1967 you would have a much better chance of getting it than you do today, in 1975. I saw some figures just in the last few days that indicate that if we don't get a 1-cent gas tax raise in Colorado this coming year, the Highway Department is not going to be able to even match the Federal money that is going to be offered to us out of the highway trust fund this coming year. And even with a 2-cent gas tax raise it is going to be very, very tight--very little money left over for research of projects. Most of the money would go for maintenance. Our maintenance costs have gone up about 20 percent in the past year, and the matching of Federal dollars--this is where most of our money that is given to the State Highway Department goes, for those two things--for maintenance and for matching of Federal funds for the Federally assisted highway projects that we construct. So the prospects of getting any improvements done and completed in the next few years to State Highway 133 are rather poor.

"At a meeting I attended at the park here in town last summer, in all fairness I pointed out to the people that you have to be aware of one thing--if you want your highway improved you've got to accept some social and some economic and some environmental impact. There is no way that we can improve the highway up here and just lay it on the ground and have it beautiful from the day that construction starts until construction ends. So if you're not willing as a community to accept some disruption, some social impacts and economic impacts, and some earth resource or whatever you want to call the rest of the environmental area, that type of impact, there's no use coming to the Highway Division and pleading for highway improvement."

8. Health Systems

A 32-bed hospital was built recently in the city of Delta. The hospital has ten doctors: six who live in Delta, two in Cedaredge, and two in the North Fork area. Also ten part-time doctors offer regular part-time services at the hospital. These physicians come from Montrose and Grand Junction and are available for emergencies. The Delta Memorial Hospital also has a staff of 16 full-time and 8 part-time registered nurses, plus two RNs for surgery and one RN who works as an operating room technician. The hospital administrator said that obtaining nurses has not been a problem but that the area needs more primary care physicians: pediatricians, obstetricians and internists. The hospital administration is planning to increase the number of hospital beds and to recruit more doctors.

Delta County has three ambulance services, and there will soon be a total of seven ambulances in the county.

The Delta Memorial Hospital has an arrangement with St. Mary's Hospital in Grand Junction to handle cases that it cannot accommodate. It also has an arrangement with St. Mary's to fly patients to Denver or Salt Lake City for more difficult cases. There also is an arrangement with the Fort Carson helicoptors for certain emergency services.

Delta County has three nursing homes for the elderly with about 170 beds. These homes are staffed with RNs.

Delta County's mental health needs are served by offices of the Midwestern Colorado Mental Health Center. They have an office in Delta and a part-time office in Paonia. They deal with the whole range of mental health problems, including providing group therapy and specialized services for children and the elderly.

In summary, the health system in Delta County appears to be about the average for a western rural area. Local people responsible for health services are attempting to increase them. Table II-30 shows a breakdown of medical and professional services available to Delta County residents.

Table II-30
MEDICAL AND PROFESSIONAL SERVICES

A. Hospitals

1. Delta County Memorial Hospital - an accredited community hospital with 32 beds.

B. Number and type of medical personnel:

Active staff physicians	10
General practitioners	10
Courtesy staff medical doctors	25
Surgeons	3
Ophthalmologists	1
Pathologists	4
Internal medicine	2
Orthopedic surgeons	3
General practice	1
Radiologist	2
Obstetrician-gynecologists	1
Urologists	4
Osteopathic surgeons	1

C. Nursing Homes:

1. The number of nursing homes is three.
2. The number of beds is 170.

D. Ambulance Service:

1. Available 24 hours

E. There is a county public health department and public health nursing service.

F. Pharmacies for prescriptions:

1. Three

G. Professional:

1. The number of lawyers is sixteen.
2. The number of accountants (CPA) is three.
3. The number of real estate licensed brokers is 22.
4. There are two professional engineering firms.
5. There are two land surveying firms.

Source: Delta, Colorado: An Economic Overview 1976, prepared by Economic Development Dept., United Banks of Colorado, Inc. (updated 8/19/77)

9. Crime

Adult and juvenile arrests in Delta County for Part I and II[1] crimes have fluctuated between 1970 and 1975, the years for which there are published records, but overall the number of arrests has increased at a considerably more rapid rate than the estimated population (table II-31).

Between 1970 and 1975 Delta County's population increased from 15,286 to an estimated 17,100, an 11.9 percent increase, whereas total adult and juvenile arrests increased from 79 to 543, a 587 percent increase. However, in the year 1973 when the estimated population was 16,386, total adult and juvenile arrests were 755, 105 percent more than the total of 368 arrests in the following year (1974) when the estimated population was 16,600. The 1973 arrests were 39 percent higher than the total number of arrests in 1975, which as shown above was 543. Local police officers contacted were unable to explain why arrests in 1973 were higher than 1974 and 1975 (table II-32).

Between 1970 and 1973 the increase in Part I crime arrests in Delta County was from a total of 12 to 152, a 1,167 percent increase. Part II crime arrests in the same time span grew from a total of 67 to 603, an 800 percent increase. However, the increase in Part I crime arrests between 1970 and 1975 was from 12 to 100, or 733 percent. Part II crimes in the same time period increased from 67 to 443, a 561 percent increase.

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[1] Part I Crimes include murder and nonnegligent manslaughter; manslaughter by negligence; forcible rape and attempted rape; robbery by firearm, knife, other weapons, or by strongarm; aggravated assault by firearm, knife, other weapons, or by strongarm; burglary and attempted burglary with forcible entry; larceny motor vehicle.

Part II Crimes include simple and minor assaults, resisting officers, arson, driving while intoxicated, liquor law violations, forgery and counterfeiting, fraud, embezzlement, stolen property, (buying, receiving, or possessing), vandalism, prostitution, sex offenses, narcotic offenses, and offenses against the family and child.

In summary, it can be said that arrests for all kinds of crime in Delta County have increased dramatically between 1970 and 1975, but for reasons unknown to the local police arrests were greater in 1973 than any of the six years for which records are obtainable, 1970 through 1975. It was the opinion of the police that burglary was the Part I crime that showed the greatest increase.

With regard to the nearly 500 construction workers employed by contractors for work on the Orchard Valley Mine, the Chief of Police in Paonia said that they cause very little trouble because they are older, more stable, and working. Both the Sheriff's Office of Delta County and the Paonia Chief of Police agreed that most of the crimes are committed by males between the juvenile ages (teens) and the early 20s. Both the Sheriff's Office and the Paonia Chief of Police said that total offenses, including traffic, in 1976 and 1977 were running ahead of 1975.

10. Service Industries

The smaller communities of Cedaredge, Hotchkiss, and Paonia provide limited recreational services and formal institutions for social support. Their shopping and parking facilities are limited. For major purchases, some people travel to Delta, Montrose, and Grand Junction. (Approximate mileages: Paonia to Delta, 30 miles; Delta to Montrose, 21 miles; Delta to Grand Junction, 40 miles). However, construction has begun on a new shopping center in Delta and a second one is being planned.

Table II-31
Delta County Adult and Juvenile Arrests*
Part I and II Crimes

County	1970			1971			1972		
	1	2	T	1	2	T	1	2	T
Delta	12	67	79	58	462	520	69	415	484

County	1973			1974			1975		
	1	2	T	1	2	T	1	2	T
Delta	152	603	755	77	291	368	100	443	543

Table II-32

Information is:
- based on reported crimes only
- an indication of trends only
- rate per 100,000 population

Delta County	1970	1973	1975	Colorado 1975
Total Index Crimes	876.5	1336.7	2076.6	6675.4
Murder and Non-Negligent Manslaughter	0	13.0	6.0	7.3
Forcible Rape	0	26.1	30.1	41.4
Robbery	0	0	18.1	174.2
Aggravated Assault	0	195.6	252.8	240.1
Burglary	235.5	397.8	577.8	2001.3
Larceny-Theft	561.1	515.1	1003.4	3744.0
Auto Theft	85.0	189.1	108.3	467.2

Source: Colorado Division of Criminal Justice, August 1977.

Delta County 1976

		Juvenile	Adult
Actual arrests:	Sale or manufacture of marijuana	2	0
	Possession of marijuana	1	7
	Drunkeness or driving under the influence	0	50

Source: Colorado Division of Criminal Justice, August 1977.

A. Visual Resources

The view of the Orchard Valley Mine and surrounding hills north of Paonia would remain essentially unchanged subject to the completion and acceptance of the Uncompahgre Valley Range Environmental Statement. The proposed action in this ES calls for chainings of the pinyon-juniper forest in several areas on either side of Stevens Gulch. These chainings would be visible from the valley and alter the appearance of the hills.

B. Recreation

Without the proposed action, recreation use would remain essentially the same as at present. However, private coal mined from the Orchard Valley Mine would be trucked down Stevens Gulch Road and along Highway 133 to the mine's railhead. This increased large truck traffic would conflict with present commercial and recreational uses of the roads and result in an occasional accident.

Implementation of the Stevens Gulch AMP (subject to approval of the Uncompahgre Range ES) would result in chainings which would promote increased deer, elk, and rabbit use in the area and in turn invite more hunting use. See Appendix G-1 for the location of these chainings.

C. Climate

The climate of the North Fork area is not likely to change without the proposed action.

D. Air Quality

Table III-3 (chapter III) presents projected 24-hour average levels of total suspended particulates for the North Fork Valley under "worse case" meteorological conditions omitting and including operations at the Orchard Valley Mine for 1977, 1980, and 1985. In all areas except Stevens Gulch, the levels are quite similar with or without the Orchard Valley Mine.

In all probability, air quality in the North Fork Valley would continue to decrease due to mine expansions and population increases occurring in the area. The Marlatt, et al. study shows that under worst case conditions both national and state particulate standards are likely to be exceeded in 1980 and 1985 for all parts of the main North Fork Valley.

E. Noise

CWI would operate for an additional two or three months and then vastly reduce its operations at the Converse Mine. Truck operations would continue for an additional month; then they, too, would be curtailed sharply. Other mining operations in the North Fork Valley would continue, however, and the general noise levels would remain roughly the same. U. S. Steel would still have five trains a week to and from the Somerset mine which would pass through Paonia.

Current CWI construction would be stopped and that labor force would no longer necessarily impact the area. The work force affected would be approximately 600 people. Out of an estimated total population in the Paonia area of 3,500, a 10 to 20 percent population decrease would probably not significantly affect noise levels. Ambient or L_{90} sound levels could speculatively decrease perhaps 1 dB(A) (an imperceptible change.)

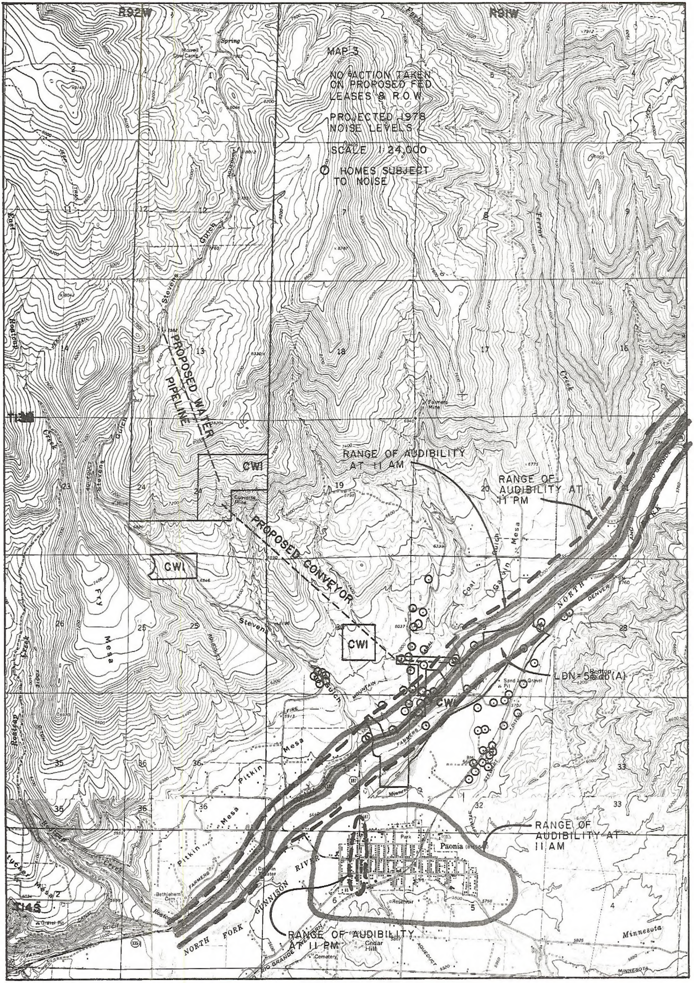
Truck noise along Highway 133 would be reduced. Sound levels along 133 would decrease perhaps 2 dB(A) as the reduction in truck density would be partially offset by a return of Highway 133 traffic to the 55 mph speed limit, up from the 40 mph average in the Paonia area. The Colorado Highway Department currently estimates the average daily traffic volume on 133 to be over 1,300 vehicles. This count increases by about 20 percent per day in summer months and decreases by about 30 percent per day in winter months due to closures of Keebler Pass and reduced vacation vehicular traffic. CWI's contribution is thus less than 10 percent of the vehicular load on about 1 mile of 133 and is limited to daylight hours during working days.

It would be likely that the CWI supply contract would be pursued by other North Fork Valley mines due to the area's coal reserves and the requirement of eastern utilities for the local low sulfur coal. A reassignment of the supply contract to other coal companies would result in the hiring of about 150 new miners and supervising personnel. Another train and a half per week would pass through Paonia, replacing the CWI train. Noise levels would in all probability rise to existing levels along the existing traffic corridors, and a new influx of people into the Paonia area would encourage urban noise levels to rise. It is estimated that by 1985, the North Fork Valley will see an additional 3,000 residents without the CWI operation. This is nearly double the current population. A doubling of people could double the noise, causing noise levels to increase approximately 3 dB(A). Increased traffic noise would impact nearly twice as much land. Map 3 shows the approximate noise contours for this situation.

F. Water Resources

1. Surface Water (Quantity and Quality)

Approximately 42 acres of private land belonging to CWI has been disturbed over the past two and a half years. The loss of this native vegetation has had significant effects on runoff-erosion processes and



R92W
R91W
MAP 3
NO ACTION TAKEN ON PROPOSED FED LEASES & R.O.W.
PROJECTED 1978 NOISE LEVELS
SCALE 1:24,000
HOMES SUBJECT TO NOISE
PROPOSED WATER PIPELINE
PROPOSED CONVEYOR
CWI
RANGE OF AUDIBILITY AT 11 AM
RANGE OF AUDIBILITY AT 11 PM
Stevens Gulch
Fry Mesa
Pitkin Mesa
Coal Gulch
Terror Creek
Paonia
NORTH FORK GUNNISON RIVER
Minnesota
Cedar Hill

slope stability. Destruction of this vegetation through mining activities and associated modifications of the land surface itself can thus have a significant impact on local hydrology. The impact of removing approximately 50 percent of the vegetation from Westmoreland Canyon has increased the runoff potential of this watershed, as seen in the water balance summary of table II-14. Disturbance has increased water yields from a baseline of less than 1 inch to perhaps 3 inches. It is estimated that minimum yields now will average 2 inches or less and maximum yields will exceed 6 inches. Whereas a negligible near-surface runoff component existed on the watershed prior to disturbance, it now will account for perhaps 13 percent (0.4 inch) of the annual yield. The remaining 2.8 inches is generated as subsurface flow and deep seepage.

With increased runoff and erosion, degradation of the water quality of the North Fork of the Gunnison River can be expected. The North Fork of the Gunnison River will experience increases in suspended sediment, conductivity, and dissolved solids. Both the North Fork of the Gunnison and Stevens Gulch will experience some deposition of sediments within their channels, and at times after heavy storms this may become so severe that unsightly mud bars will form along the stream banks.

2. Ground Water

The disturbance on the private land has caused a slight, unquantitative increase in ground water recharge. With the proposed actions, additional increases could be expected due to the detention of surface runoff in the sediment retention dam and some ponding in the diversion channel and in work areas. However, these increases are probably insignificant. The future without the proposed actions will probably cause a very slight decrease in the subsurface and deep seepage.

G. Wildlife

The wildlife resources will remain essentially unchanged except for the changes in habitat that will occur as a result of the proposed Stevens Gulch AMP. (See map in appendix G-1.) This plan calls for some chainings and a rest-rotation grazing system to increase the big game forage. The AMP would decrease habitat for species using the pinyon-juniper habitat type and increase habitat for species using the mountain shrub and transition zone types. The vegetation changes would provide for increases in deer and elk populations as required by the Colorado Division of Wildlife Strategic Plan.

H. Vegetation

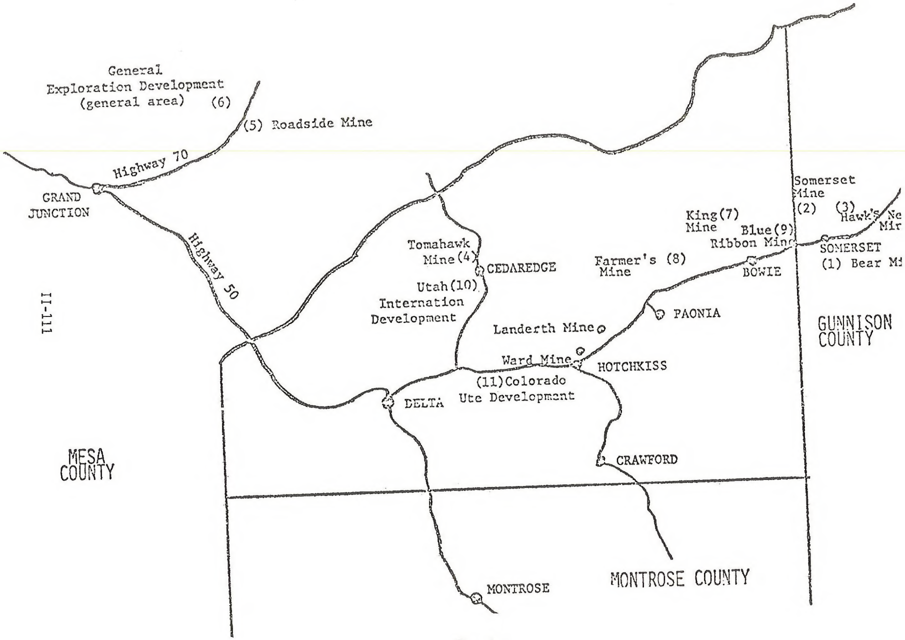
The vegetation modifications caused by the conveyor belt, waterline, diversion dam and retention dams would not be present if the short-term lease is not granted. The existing vegetation would be modified, however, by proposed chainings in Sections 24 and 25 of T. 13 N., R. 92 W., and

Mine (Company)	Location	Mining Technology and Labor Relations Status	Present Production	Future Production	Present Employment	Future Employment	Timing for Future Development	Comments
MOST LIKELY TO OCCUR								
(1) Bear (ARCO)	Somerset Gunnison County	underground union	125,000 TPY	.5M TPY by 1981, increasing by .5M tons annually until 2.5M TPY in 1986	42	450	1978-1985	Waiting on permits EIS. Have previou perienced layoffs ened work week for employees.
(2) Somerset (U.S. Steel)	Somerset Gunnison County	underground union	1.0M-TPY	1.5M-TPY	286	400-450	1978-1983	
(3) Hawk's Nest (Western Slope Carbon)	Somerset Gunnison County	underground union	250,000 TPY	1.0M-TPY	100	350	1980	Proceeding with exp incl. 6000 ton sto contract for 250,0
(4) Tomahawk (Quinn Development Co.--also known as Red Canyon Mine)	4 miles NW of Cedaredge Delta County	surface (12 year life)	(Start May 1977, 75,000-100,000 TPY)	200,000-225,000 TPY	(5? at start-up)	18	1977	Private holdings, p mine underground w life exhausted.
(5) Roadside (Cambridge Mining Co.)	NE of Grand Junction Mesa County	underground	50,000 TPY	250,000 TPY	53	125	1977-1980	
(6) Cameo Mine (General Exploration Co.)	NE of Grand Junction Mesa County	underground	---	1.0-1.5M TPY	---	100-200	1978-1980	Property consists o acres, coal reserve to GEC by group of (Rocky Mountain Ne December 2, 1976). 13M tons over next tion to 1.5 M TPY 3 yrs. Starting su
LESS LIKELY TO OCCUR								
(7) King-Bowie (Coors)	NW of Bowie Delta County	underground	---	---	2	---	---	No expansion plans at present.
(8) Farmer's (Pittsburgh-Midway)	N. of Paonia, Delta County		---	1.0M TPY	---	150-250	---	Plans indefinite, r federal leases. (Go acres leased in N. has nominated undis acres.) Have cored Farmer's Mine.
(9) Blue Ribbon (Sunflower Energy Co.)	Hubbard Creek Delta-Gunnison county line	underground	---	100,000 TPY	---	15-20	1977-1978(?)	Plans indefinite, possible start-up 1977. Road accessi problem, private h
(10) ? (Utah International)	Cedaredge Delta County		---	1.0M TPY	---	---	1977(?)	Plans indefinite. drilled.
(11) ? (Colorado Ute)	Austin Delta County	coal-fired steam generating plant	---	1500-2000 MW	---	---	1980(?)	Plans indefinite. (designated wild.) 10,000 acres in and 2500 acres in County.
(12) Landerth Mine	Hotchkiss Delta County	---	---	?	---	15-20	---	Inactive at present. Interest shown but definite.
(13) Ward Mine	Hotchkiss Delta County		---	?	---	15-20	---	Inactive at present. Interest shown but definite.

Numbers refer to Map 2-8

Sources: Bureau of Land Management, Bureau of Mines, interviews with industrial sources, various newspaper articles, Bickert, Browne and Coddington - Bank Study.

Figure 2-13 PRESENT AND ANTICIPATED AREA ENERGY DEVELOPMENT AFFECTING DELTA COUNTY AND THE NORTH FORK VALLEY (EXCLUDING WESTMORELAND)


General
Exploration Development
(general area) (6)
(5) Roadside Mine
Highway 70
GRAND
JUNCTION
Highway 50
Tomahawk
Mine (4)
CEDAREDGE
Utah (10)
Internation
Development
Landerth Mine
Ward Mine
HOTCHKISS
(11) Colorado
Ute Development
DELTA
CRAWFORD
MONTROSE
MONTROSE COUNTY
MESA
COUNTY
Farmer's (8)
Mine
King (7)
Mine
Blue (9)
Ribbon Min
BOWIE
PAONIA
Somerset
Mine
(2)
(3)
Hawk's Ne
Mir
SOMERSET
(1) Bear M
GUNNISON
COUNTY

II-111

Map 2-8

Sections 19 and 29 of T. 13N., R. 91W., as shown on the map in Appendix G-1. The areas to be chained have a relatively thick pinyon and juniper overstory. The areas would be broadcast seeded with grasses and shrubs, immediately following the chainings.

I. Range

There are several range improvements proposed within the area of the proposed action. These improvements include two chainings and seedings, one reservoir, approximately 1 mile of fence, and one cattleguard. The chainings and seedings will increase the available forage for livestock; the reservoir will provide water to help improve range utilization and livestock distribution; and the fence and cattleguard will facilitate livestock movement. (See map, Appendix G-1.)

J. Cultural

There will be no change in the cultural resources if there is no proposal, except for deterioration that might occur due to natural causes and lack of surveillance.

K. Socio-Economic Conditions

With or without the development of Westmoreland's Orchard Valley Mine, Delta County and the North Fork Valley are likely to experience some fairly major changes during the next decade. The regional economy will shift from one based upon agriculture to one where energy resource industries will play an increasingly important role. The shift is already under way and should continue. The rate of change is likely to accelerate as more energy companies announce and begin development activities in the county over the next few years. (See figures II-13 and II-14 for those developments most likely to occur.)

1. Population

Population will increase as more workers and their families move into the area. The estimated incremental population attributed to those energy developments believed most likely to occur and those attributed to the proposed highway improvement project are shown in tables II-33 and II-34. The assumptions used in these estimates are listed in table II-35. Increases in population and the number of school children are given for both Delta County and the North Fork Valley.

2. Employment

Estimates of incremental basic employment attributed to the energy developments judged most likely to occur are depicted in table II-33.

TABLE II-33

ESTIMATES OF INCREMENTAL ENERGY-RELATED EMPLOYMENT DUE TO ANTICIPATED DEVELOPMENT

	Production in TPY: Future (Timing)	Employment: Now Future	Employment Estimates--1978 Base: 1977 Construction	1977 Operating	1980 Construction	1980 Operating	1985 Construction	1985 Operating
Bear (ARCO) Gunnison County	.125M 2.5M (1978-1985)	42 450	20	40	50	250	---	375
Somerset (U.S. Steel) Gunnison County	1.0M 1.5M (1978-1983)	286 400-450	---	---	30	100	---	150
Hawk's Nest (Western Slope Carbon) Gunnison County	.25M 1.0M (1980)	100 350	30	75	---	250	---	250
Tomahawk (Quinn Development Co.) Delta County	--- .20M - .25M (1977-1978)	--- 18	20	5	---	18	---	18
Roadside (CMC & Cambridge Mining Co.) Mesa County	.05M .25M (1977-1980)	53 125	30	25	---	75	---	75
Cameo Mine (General Exploration Co.) Mesa County	--- 1.0-1.5M (1978-1980)	--- 100-200	35	25	---	150	---	200
			135	170	80	843	---	1,062

Note: Estimates are given for those energy companies which have announced plans as of March 1977. It should be noted that additional construction and development employment taking place between the years that are estimated will not be reflected in these totals.

It is further assumed that additional employees of mines listed will live in the following areas: Bear, Somerset, Hawk's Nest: operating--90 percent Delta County and North Fork Valley, construction--60 percent Delta County & North Fork Valley;Tomahawk: operating--75 percent Delta County & North Fork Valley, construction--50 percent Delta County & North Fork Valley; Roadside, GEC: operating--10 percent Delta County & North Fork Valley, construction--none.

See next page for additional footnotes.

Of the above mentioned residents, it is estimated that in 1977, 20 percent will be newcomers; and by 1985, the additional employees will be newcomers.

Assumptions concerning marital status and family size are found in Table II-35. Multiplier assumptions are found in Table II-34.

Access: Bureau of Land Management, Bureau of Mines, interviews with industrial sources and various newspaper articles.

Table II-34
ESTIMATES OF INCREMENTAL BASIC/NONBASIC EMPLOYEES RESIDING IN DELTA COUNTY AND THE NORTH FORK VALLEY (WITHOUT WESTMORELAND)

Incremental Energy-Related and Highway Project	Delta County[a]			Nork Fork Valley[a]		
	1977	1980	1985	1977	1980	1985
BASIC	154	638	735	96	472	581
NONBASIC	188	851	1,029	82	415	523
TOTAL	342	1,489	1,764	178	887	1,104

[a]The 1976 computed multipliers for Delta County and the North Fork Valley were 1.4 and .9 respectively. The multipliers applied to basic construction workers have been reduced (Delta County .7 and North Fork Valley .45) to take into consideration the less permanent nature of construction activity.

The information presented reflects various companies' plans as of March 1977.

The number of energy-related employees living in Delta County and the North Fork Valley due to these energy developments is estimated in table II-36. Also included in total basic employment are the estimated number of construction employees of the State Highway Department working on proposed realignment of Highway 133. Figures are given for incremental basic, energy-related (including construction) employment and nonbasic or local service employment resulting from the increase in the basic sector (as computed by use of the multiplier). The estimated number of new workers who will choose to live in the county or the North Fork Valley is based on past trends, travel times, anticipated availability of housing and public services, and on a synthesis of the judgments expressed by knowledgeable local observers. (It is assumed that construction on the ARCO (Mott ranch site) housing development will start during the time period 1978-1980.)

3. Income

The average income of the new population is expected to be greater than the income for the existing households. Average annual incomes for mining employees and contract construction workers are already over $16,000. (Colorado Department of Labor and Employment, Research and Analysis Section, Colorado Manpower Review, January and March 1977) These wages can be expected to rise with national productivity and increases in general wage levels. An increase in mining and construction incomes is expected to exert an upward pressure on wages for other types of employment in the area. Local employers may lose some workers to the higher paying energy industries and may thus be required to pay higher wages to replace employees or go without help.

4. Attitudes, Expectations, Life Styles, Social and Cultural Characteristics

The growth which is anticipated in energy-related development (not associated with CWI) will intensify the impact area's transition from a rural society to a more industrial one. The contrast between the recent state of society and that expected in 1985, assuming appreciable coal development in the region is summarized in figure II-13.

a. Social Structures

As a group, farmers and ranchers will no longer be the dominant work force in Delta County. Instead the agricultural interests will be roughly equal to the blue collar sector, including the majority of the mine personnel and people from the expanding service industries. As energy development takes place, job opportunities in the area will increase substantially. This could cause two important changes in the

	Head of Household[a]	Living Alone	Nonhead of Household	TOTAL
BASIC EMPLOYEES				
Energy-Related:				
Construction	0.60	0.40	-	1.00
Mining & All Others	0.80	0.10	0.10	1.00
NONBASIC EMPLOYEES	0.60	0.10	0.30	1.00
UNEMPLOYED	0.20	0.10	0.70	1.00

a/ Households are assumed to contain an average of 3.6 persons. Each family is assumed to have 1.2 school-age children.

Table II-35. Assumptions used in determining family size proportions of the future labor force in basic, nonbasic, and unemployed categories.

INCREMENTAL POPULATION INCREASES ATTRIBUTED TO
ENERGY AND HIGHWAY DEVELOPMENT

	1977 Increase in: Total Population	1977 Increase in: No. Children[a/]	1980 Increase in: Total Population	1980 Increase in: No. Children[a/]	1985 Increase in: Total Population	1985 Increase in: No. Children[a/]
Delta County	517	164	2,864	912	4,517	1,446
North Fork Valley	241	78	1,632	522	2,913	935

a/ Assuming 1.2 children per family.

TABLE II-36 INCREMENTAL POPULATION ESTIMATES--
DELTA COUNTY AND THE NORTH FORK VALLEY
(WITHOUT WESTMORELAND)

social makeup of the county. First, it will probably mean an influx of new residents from other regions, and second, it could also mean that the county will retain a larger proportion of its young adults, many of whom have left in the past in search of better jobs. These factors would in turn mean that retired individuals, as a group, will become a smaller percentage of the total population.

b. Culture

In many ways, the cultural values of newcomers to the area will over time become very similar to and compatible with existing values. For example, at first there may be a noticeable difference in the attitude of permanence. Many of the existing residents have established roots in the communities and hope to pass on businesses and properties from generation to generation. Some of the new energy-related employees may not have this same attitude of permanence, while others, particularly managerial employees, may become members of the community's social elite and power structure. These two attitudes, while representing different points on a spectrum, do not necessarily cause conflicts in the community.

c. Attitudes

Over time, some significant differences in attitudes may appear. The existing cultural norm, which emphasizes individuality, independence, and self-reliance, is fairly typical in western ranching communities. One of its manifestations is the high proportion of self-employed in the county. This will most likely change as more and more residents work for large energy companies, chain stores, and other large-scale operations that depend on internal interdependence in order to function successfully.

d. Institutions

Social institutions can be threatened by the changes occurring in the impact area. The community support facilities--hospitals, other public services, housing, and recreational facilities--could become inadequate and overcrowded due to a high rate of population growth and to the problems of financing new facilities in a timely fashion.

e. Lifestyle

Because of its isolated geographic location, the county (particularly in the North Fork Valley) will retain much of its American rural village/open country flavor. However, increased per capita incomes will permit a more elaborate lifestyle, especially in leisure time activities.

f. Political System

In the future, political power in Delta County will be shared among the old farmer/rancher group, mine personnel, union representatives, and people from the growing service industries. As political and governmental issues become more numerous and complex, the present decision-making structure--which tends to be informal and person-to-person--will be replaced by a more formal structure. Government will assume a larger role in determining the direction of local affairs. Groups and coalitions will tend to replace informal personal influence.

g. Entities of Government

Delta County. In Delta County the problem of growth connected with coal development will be compounded by the problem of jurisdictional mismatch. Many of the mines are located in Gunnison County, which receives the revenues generated by those mines. However, many of the employees live in towns in Delta County which must provide the additional services required by this population. The severity of this situation is likely to increase as production in existing mines increases and new mines are developed.

Over the next few years, demands for new services are likely to grow much faster than the local tax base for the public entities in Delta County. Local officials will be confronted with a dilemma. They will have to (1) increase local tax rates (within legally allowable limits), (2) settle for a degraded level of local services, or (3) find sources of external financial assistance, unless revenues from mining operations become substantial, and the indications are that they will. The county assessor stated that the county collects 60 mills on the assessed valuation of property which is 30 percent of the actual value. As tables II-24 and II-26 show, it is very likely that 5 mines will be started between the present and 1983 and possibly 11 to 13. Either of the first two alternatives will be unpopular and will result in a lower quality of life for both present and incoming residents. Delta County's high percentage of elderly would be especially hard hit by such a choice. It appears that, at least initially, money will have to come from outside sources.

The City of Delta. Population growth resulting from coal development will put a strain on Delta's streets and utilities, particularly the water supply system, which is old and in need of repair, and the city-owned electrical generating plant, which is operating at capacity and is obsolete. The city's seven-man unpaid planning commission is attempting to cope with the problems but thus far the only commitment of resources by the community has been the secretarial service of the city clerk.

The Town of Paonia. Paonia's existing waterlines are 73 years old and break down frequently; new lines and storage facilities will require an investment of about $500,000. The waste water problem is being solved.

The Town of Hotchkiss. Hotchkiss has reviewed its water supply and treatment problem and currently has a $1 million dollar project under way; however, population growth associated with coal development will require an additional $1.5 million.

h. Local Tax Structure

The development of coal resources will add to county and municipal property values, directly by the installation of coal mining and administrative facilities, and indirectly as the new population purchases homes and automobiles. However, much of the additional property tax revenues will serve Gunnison County where most of the expected mining activity will be located. Delta County School District 50 (J) does include this portion of Gunnison County. Delta County and the towns of Delta and Hotchkiss will also benefit from sales tax revenues. Property values will also be increased by the construction of service industry facilities.

i. Status of Planning and Zoning

Though there is a strong anti-planning sentiment among the population of the county, the transition from a largely agricultural economy to a mixed agricultural/industrial economy with consequent population growth and immigration of people with different value systems will require more attention to planning.

j. Education

The conditions and problems in the school system in the North Fork Valley were enumerated earlier and will not be repeated here. Coal development and the resulting immigration of basic and service worker families will compound the problems of an already inadequate educational system. Generally, educational systems respond slowly or in a crisis manner to rapid school population growth. The optimum rapid response to the future school system problem in the North Fork Valley would be to devise a plan to provide adequate facilities--during a summer vacation period if possible. Recently, the general dissatisfaction of the public may have resulted in the election of two new school board members. Defeated in the May election were incumbents from Cedaredge and Delta.

The school board is presently considering several options to relieve crowding of its facilities including split sessions, released time scheduling (students are allowed to leave the school during free hours), additional mobile classrooms, and curtailing of some activities and classes previously offered.

The Delta County School Board has also given final approval for a study of future building needs. The study will be done by the Educational

Planning Service of the University of Northern Colorado. The focus of study will be on which of the six communities within the school district can expect growth impacts, and whether present facilities are capable of handling growth. In addition, the study will try to come up with a financially feasible plan for solving the district's problems which will be acceptable to district residents. (North Fork Times, June 23, 1977)

k. Housing

As housing construction continues, the housing market is likely to remain steady. As of March 1977, one company contemplating energy development in the North Fork Valley had announced tentative plans to build additional housing in the area. The housing plans will be contingent on their mining activities. Rental units are likely to remain in relatively short supply.

Housing now under construction will help meet the demands of upper-income families but will do little to help lower-income groups. Pan American developers have tentatively indicated their lower range for houses and townhouses could include units priced at roughly $27,000 to $30,000.

If the amount of down payment generally required remains as high as 20 percent to 25 percent, the problems of qualifying for a housing loan are likely to continue. This is apt to be particularly true of those people working in local service industries with comparatively lower wage rates than those in the coal industry.

A resolution passed by the County Commissioners in January 1977 provided for the formation of a county-wide housing authority. The purpose of the five-member board would be to provide decent and safe housing for agricultural workers (mostly seasonal) as well as other low-income families. The communities of Delta and Cedaredge will not be represented on the authority's board.

Without zoning regulations, the possibility of developments sprawling along the highway remains. Mobile home parks continue to be an alternative to single-family units. County regulations do establish some standards for their development; however, there are presently no county regulations prohibiting the parking of one or two mobile homes on a given piece of property.

Future housing availability appears to depend on three factors:

1. The degree to which energy-related growth continues to bring new families into the area and supports a general growth in the service economy.

2. The ability of the housing developers to respond to housing demand, in view of the limits of necessary basic services (e.g., water and sewer). This will deter housing availability whenever a new service capacity threshold is reached, unless advance planning and public financing are well managed.

3. The willingness of housing developers to reduce the gap between housing need and housing availability. Until now, developers have taken a very low risk by building in a tight market. Whether developers will ever risk speculative housing is uncertain, particularly in view of the somewhat uncertain nature of employment in extractive industries.

If all the proposed housing units (about 720) are constructed--and assuming that each lot will be about one quarter of an acre--about 180 acres of the nonfederal land (341,192 acres) in the county will be used, or about 0.053 percent of the nonfederal land.

l. Transportation

All methods of transportation are likely to have increased usage. There may be enough demand for airport facilities to warrant the upgrading of either or both of the small airports at Delta and Paonia. Automobile and truck traffic will certainly increase as more people travel the highways to work, recreation areas, and shopping facilities; and as greater quantities of goods are transported, increased coal production will result in an increase in the number of unit trains moving the coal. This will add substantially to the now occasional disruption already caused by trains moving through Paonia, the North Fork Valley, and the rest of the county. It is likely that upgrading of the present rail system may be necessary to facilitate anticipated development.

m. Health Systems

The health systems in the county appear to be responding to population growth. Those people responsible for health services are aware of the potential development and are attempting to increase facilities. Refer to p. II-100 for additional information.

n. Service Industries

The service industry has responded to population growth by opening one new shopping center in the city of Delta, and it is planning to construct a second one. Gibson's has announced plans to open one of its chain stores in Delta. City Market is "rumored" to be interested in building a store in Paonia in two to three years. It is likely these trends will continue as further coal development takes place.

CHAPTER III

Chapter III - Environmental Impacts of the Proposed Action

Assumptions and Analysis Guidelines

1. High bidder for this lease, if in fact the competitive coal lease sale is held, must demonstrate that they meet the short-term criteria.

2. The life of the proposed action will be twenty years.

3. The Stevens Gulch Allotment Management Plan (AMP) will be implemented with the twenty-year period subject to modification or approval of the Uncompahgre Grazing Environmental Statement.

4. The Stevens Gulch AMP will be modified if the proposed coal leasing action is approved.

5. Delta County or other governmental agencies will not initiate zoning or planning that will cause the proposed action to be modified.

6. Construction or development of the proposed actions is technically feasible.

7. Level of mining technology will not change significantly through 1990.

A. Geology

There would be little or no environmental impact on the federal lease land resulting directly from mining-related disturbance. No surface mining is planned, and all structures, portals, shafts, etc., are located on fee land owned by Colorado Westmoreland, Inc. (CWI).

A potential impact would be subsidence, particularly after all the coal has been mined out and the mine abandoned. Where full retreat mining takes place, as is proposed by Colorado Westmoreland, rupture and collapse may reach the surface in the form of sink holes or uniform depression of the land surface, particularly at the south boundary of the lease where the shallowest overburden exists. If collapse reaches the surface, as much as 4 to 6 feet of subsidence of the ground surface could occur over the mined out areas. No buildings would be affected by this possible subsidence. However, surface water sources (seeps, springs, stock ponds, etc.) could be affected.

B. Air Quality

The only significant primary impacts to result from underground mining operations such as that of the Orchard Valley Mine would be from coal conveying, processing, loading, and storage processes that produce fugitive dust. CWI has designed their operation to employ the best practical control technology for these processes. The efficiency with which control devices (e.g., water spray and baghouses) retain fugitive dust is considered to be 99 percent or better. In order to calculate the quantity of fugitive dust per mass of coal handled, an emissions factor of 0.0025 percent is used. (Northwest Colorado Coal ES Draft, p. V-32). Thus, if the Orchard Valley Mine produces 1 million tons per year, 25 tons of fugitive dust would be emitted.[1]

In addition, during the initial 18 to 24 month construction period, emissions would be produced from vehicle exhausts, surface disturbance, and movement of material. Based on current federal and Colorado regulations governing emissions, the only significant pollutant which could be generated is fugitive dust. The operations of removing materials from the ground transporting, piling, and redistributing which are involved in construction are estimated to produce 1.8 tons of fugitive dust per acre per month of active construction. Use of the refuse piles would also cause fugitive dust at the above rate for the life of the mine.

As a result of the proposed action, daily, heavy-duty vehicular traffic on the Stevens Gulch Road would be reduced. This reduction in vehicular traffic, especially of heavy-duty vehicles, would reduce vehicular emissions by a significant amount. Table III-1 presents both present and future vehicular emissions from use of the Stevens Gulch Road as projected by Marlatt, et al., (1977).

Finally, a possible source of emissions would be the spontaneous or accidental ignition of coal fires in the refuse disposal area. If a fire should occur, clouds of smoke containing suspended particulates, nitrogen oxides, sulphur oxides, hydrogen sulfide, and hydrocarbons would result. Emissions would be substantial.

Two studies have been made to identify impacts to air quality from a mining operation located at the Converse or Orchard Valley Mine site. The first is the Kreider study found in chapter V, "Air Quality Assessment of the Impact Region," and appendix D, "Air Pollution Generation and Dispersion Model" of a report prepared for the Economic Development Administration. (Udis, Howe, Kreider, Auger et al. 1976) The second study, by Marlatt, professor of bioclimatology at CSU and consultant for Thorne Ecological Institute, is an air quality assessment and projection using a dispersion model. (Marlatt, et al. 1977)

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[1]The Colorado Department of Health estimates that, at an annual production of 500,000 tons, the Orchard Valley Mine emits 13.8 tons of fugitive dust. This is approximately 10 percent more than expected. At an annual production of 1 million tons per year, 27.6 tons of fugitive dust may be actually emitted.

Table III-1.

Emissions resulting from mine related traffic on the Stevens Gulch Road. See appendix L , table L-15 for support data.

Year	No. of Vehicles miles/day Light	Heavy	Total	Total Daily Emissions TSP - kilograms	Emissions TSP - grams/vehicle mile
1977	894.4	414.6	1309.0	76.34	58
1980	1301.2	301.7	1602.9	61.28	38.2
1985	1431.5	363.6	1795.1	81.12	45.2

The Kreider study lists four alternative growth or development scenarios for the North Fork Valley. One model, for a "Coal production increment of 2,500,00 tons per year from the Converse, Owens, and Cedaredge Mines north of the North Fork...4,252,000 TPY coal mined; all coal exported form the area...," would produce impacts comparable with those of the proposed action. By use of a simple scale factor, (the rollback model approach) the impacts predicted for the 2.5 million-ton operations at the Converse, Owens, and Cedaredge Mines can be extrapolated to predict impacts from the 1 million-ton-per-year Orchard Valley Mine. (Jan Kreider, oral communication). Table III-2 presents the impacts predicted by the Kreider model. These impacts are largely secondary in nature and are produced by increases in the transportation and household sectors.

Marlatt's dispersion model analysis is presented in appendix L. This model was used to generate 24-hour average concentrations of particulate material for 1977, 1980, and 1985, under "worst case" weather conditions as presented in table III-3. Particulate concentrations projected for 1980 and 1985 are estimated to exceed both state and federal standards in the entire main North Fork Valley if population growth and mine expansion occur as projected. In projecting mining emissions to future years, control efficiencies were assumed to remain at 1977 levels. In all probability the coal companies will institute more rigorous fugitive dust control technology. The improved control systems would have a significant impact on the ambient concentrations of suspended particulates anticipated in 1980 and 1985. (Marlatt et al. 1977) The study concludes that

> "it appears that portions of the main North Fork Valley in the vicinity of Paonia could exceed allowable particulate concentrations under nondispersive meteorological conditions. This will be particularly true in future years as mining activities in the region expand, resulting in local population increases. The Colorado Westmoreland mine will be responsible for a small decrease in ambient air quality due to activities directly associated with the mining operation. A more significant impact on air quality may result indirectly from the Colorado Westmoreland operation, as local population increases produce heavier traffic volumes and greater fuel combustion for spaceheating. The analysis also indicates that expansion of other mining activities in the region and population changes associated with these could play a major role in future air quality in the North Fork Valley."

C. Noise

Map 5 shows the proposed conveyor, access road, water line, and buried power lines in preliminary stages. Heavy equipment requirements estimated by Harrison Western Corporation for road and conveyor construction are as follows:

TABLE III-2

Direct Residuals Generation - North Fork Sub-basin as given by Kreider, 1976 and Interpolated Levels for a 1,000,000 ton per year operation at the Orchard Valley Mine. Tons Per Year.

Source or Sector	Direct Residual	1970[1]	1980 Baseline [2]	1980 Three Mine Coal [3]	1980 Orchard Valley Mine [4]
Food/Field[5]	TSP[6]	1.3	1.8	2.2	1.96
	SO_2	0.8	1.1	1.3	1.18
	NO_x	6.9	9.2	11.4	10.08
	CO	102.1	136.6	168.8	149.48
	THC[7]	17.4	23.2	28.7	25.4
Fruit	TSP	1,348.0	1,313.0	1,326.5	1,318.4
	SO_2	12.9	12.6	12.7	12.64
	NO_x	0.0	0.0	0.0	0.0
	CO	1,672.0	1,628.1	1,644.8	1,634.78
	THC	4,314.0	4,201.5	4,244.6	4,218.74
Lumber/Wood	TSP	0.0	0.0	0.0	0.0
	SO_2	0.0	0.0	0.0	0.0
	NO_x	0.0	0.0	0.0	0.0
	CO	0.0	0.0	0.0	0.0
	THC	0.0	0.0	0.0	0.0
Transportation	TSP	1.9	2.5	6.0	3.9
	SO_2	3.8	4.7	12.0	7.62
	NO_x	16.6	20.3	70.1	40.22
	CO	11.3	13.8	60.8	32.6
	THC	8.1	9.9	25.5	16.14
Electric Energy	TSP	0.0	0.0	0.0	0.0
	SO_2	0.0	0.0	0.0	0.0
	NO_x	0.0	0.0	0.0	0.0
	CO	0.0	0.0	0.0	0.0
	THC	0.0	0.0	0.0	0.0

Source or Sector	Direct Residual	1970[1]	1980 Baseline [2]	1980 Three Mine Coal [3]	1980 Orchard Valley Mine [4]
Other	TSP	4.2	5.6	7.0	6.16
	SO_2	5.4	7.2	8.9	7.88
	NO_x	26.3	35.2	43.5	38.52
	CO	3.1	4.1	5.1	4.5
	THC	1.1	1.4	1.8	1.56
Totals	TSP	1,815.0	1,937.2	2,100.6	2,002.70
	SO_2	91.0	117.2	148.1	129.52
	NO_x	279.0	252.3	3,008.5	2,821.30
	THC	4,677.0	4,446.5	4,560.6	4,492.18

[1] 1970 levels of production --

[2] Baseline growth level projected to 1980 using the 1960-1970 decade growth - 1,752,000 tons per year of coal mined. Coal transport by train.

[3] Coal production increment of 2,500,000 tons per year from the Converse, Owens, & Cedaredge mines north of the North Fork -- 4,252,000 tons per year coal mined; all coal exported from the area. Coal produced at Converse Mines transported by truck to tipple at Paonia; coal produced by Owens & Cedaredge Mines transported to tipple at Lazear by truck. All coal exported by train from tipples.

[4] Coal production increment of 1,000,000 tons per year from the Orchard Valley Mine, Paonia -- 2,752,000 tons per year of coal mined. Coal transported to tipple at Paonia by truck & by train from tipple.

[5] TSP -- Total suspended particulates -- diameter less than 20M.

TABLE III-3

24 Hour Average of Suspended Particulates (mg/m^3)
In Various Portions of the North Fork Airshed
Under Worst Case Meteorological Conditions

Resulting from all inventoried and predicted sources (excluding agriculture). Colorado Westmoreland operations not included.

Box No.	1977	1980	1985
1	274.4	469.6	839.9
2	160.6	262.6	453.9
3	176.7	282.5	479.6
4	11.0	14.9	21.8
5	208.3	330.4	558.0
6	19.6	26.4	40.1
7	358.3	557.1	922.1
8	254.5	390.1	641.8

Resulting from Colorado Westmoreland operations only. Annual production 1977 - 650,000, 1980 - 1,250,000, and 1985 - 1,500,000 tons/yr.

1	1.3	5.8	7.0
2	1.2	6.7	8.0
3	1.2	16.4	19.6
4	18.0	8.4	10.8
5	10.6	17.9	22.0
6	.5	.5	.7
7	15.6	27.1	33.2
8	10.3	18.1	22.2

Resulting from <u>all</u> inventoried and predicted sources (excluding agriculture).

1	275.6	475.4	846.9
2	161.8	269.2	461.9
3	177.9	298.9	491.2
4	29.0	23.3	32.6
5	218.8	348.3	580.0
6	20.0	27.0	40.8
7	373.9	584.1	955.3
8	264.8	408.8	664.0

	(typ) Max @50'	(est) L_{eq} @ 50'
1 D-7 tractor	88 dB(A)	76 dB(A)
1 2-cubic-yard backhoe	85 dB(A)	74 dB(A)
2 20-ton cranes	83 dB(A)	81 dB(A)
3 portable air compressors	70 dB(A)	69 dB(A)
2 welders	78 dB(A)	76 dB(A)
1 D-4 tractor	81.5 dB(A)	73 dB(A)
1 air track	98 dB(A)	95 dB(A)
2 generators	78 dB(A)	76 dB(A)
1 rubber tire scoop loader	85 dB(A)	74 dB(A)
Various concrete trucks	85 dB(A)	74 dB(A)
1 dump truck	85 dB(A)	74 dB(A)
1 concrete pump	76 dB(A)	72 dB(A)
1 helicopter (100 ops. daily)	106 dB(A)	90 dB(A)

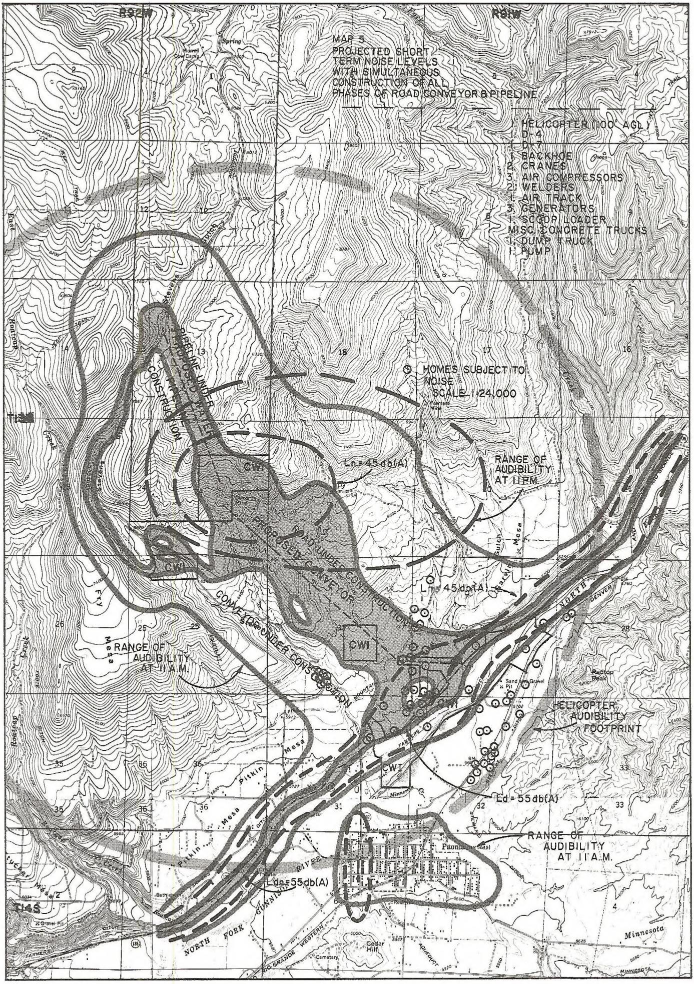
Map 5 shows the estimated construction noise contours for the road, conveyor, and waterline. The noise would be evident and occasionally intrusive to most residents in the area of the construction, and air blasts from blasting operations would be dominant though intermittant. Helicopter work would be highly visible; hence, more concern may develop over that activity.

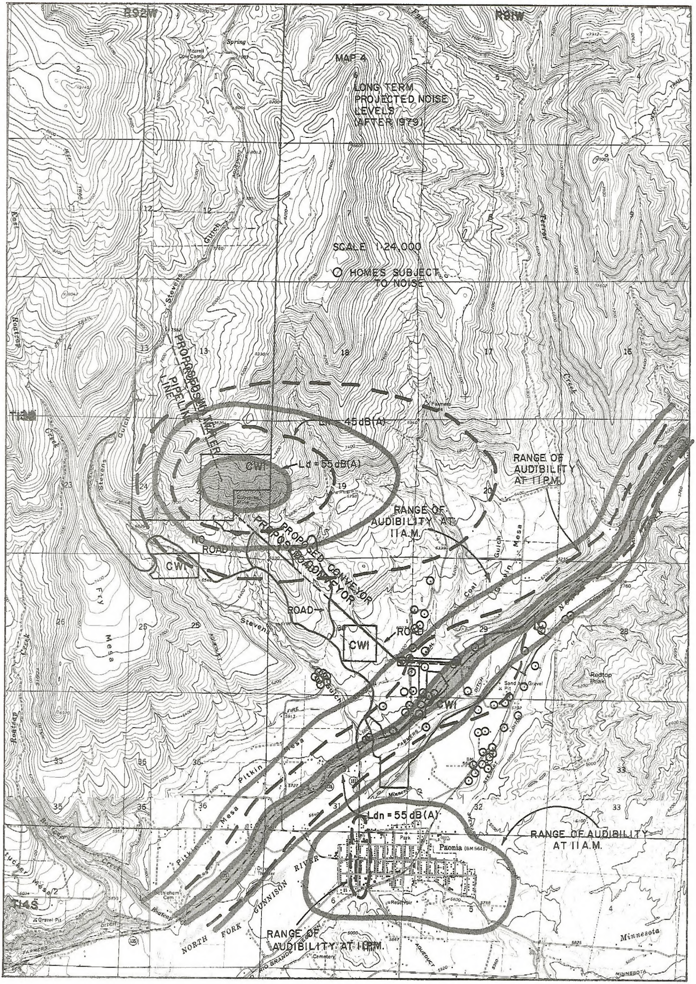
The only adverse long-term noise impacts would result from the additional train (transient and minor during the term of the lease), the mine ventilation fan, and construction of the water line and conveyor installations--significant for some periods during the 15-month construction phase. After the 15-month construction period, truck traffic on Stevens Gulch Road and between it and the load-out facility on Highway 133 would be largely eliminated. Until completion of the conveyor, trucking would remain at present levels of 100 round trips per day made by 5 trucks during a 12-to-14 hour day.

Conveyor noise has been measured at 69 dB(A) at 3 feet (open; not enclosed). The enclosed 42-inch-wide conveyor would be attenuated by a metal enclosure a minimun of 5 dB(A), and probably 10 dB(A). Some portions of the conveyor are underground for further reductions in sound levels. The conveyor would at times be audible from 25 to 50 feet away and at no time would it approach EPA recommended limits. Map 4 shows the conveyor's sound contours.

The mine ventilation fan would increase its noise level as its output is increased over the next 10 to 15 years. An additional fan is possible after 10 to 15 years. Currently, no home is impacted by the existing fan.

After construction, the operation would be very inobtrusive to the ear and would be well within EPA guidelines for noise as shown by Map 4.


MAP 5
PROJECTED SHORT TERM NOISE LEVELS WITH SIMULTANEOUS CONSTRUCTION OF ALL PHASES OF ROAD CONVEYOR & PIPELINE
1 HELICOPTER (100' AGL)
1 D-4
1 D-7
1 BACKHOE
2 CRANES
3 AIR COMPRESSORS
2 WELDERS
1 AIR TRACK
3 GENERATORS
1 SCOOP LOADER
MISC. CONCRETE TRUCKS
1 DUMP TRUCK
1 PUMP
HOMES SUBJECT TO NOISE
SCALE 1:24,000
R92W
R91W
T13S
T14S
PIPELINE UNDER CONSTRUCTION
PROPOSED WATER PIPELINE
CWI
Ln=45 db(A)
RANGE OF AUDIBILITY AT 11 P.M.
PROPOSED CONVEYOR
ROAD UNDER CONSTRUCTION
CONVEYOR UNDER CONSTRUCTION
RANGE OF AUDIBILITY AT 11 A.M.
HELICOPTER AUDIBILITY FOOTPRINT
Ld=55db(A)
Paonia
NORTH FORK GUNNISON RIVER
Pitkin Mesa
Fry Mesa
Minnesota



MAP 4
LONG TERM PROJECTED NOISE LEVELS (AFTER 1979)
SCALE 1:24,000
HOMES SUBJECT TO NOISE
R92W
R91W
T13S
T14S
Ln = 45 dB(A)
Ld = 55 dB(A)
CWI
RANGE OF AUDIBILITY AT 11 P.M.
RANGE OF AUDIBILITY AT 11 A.M.
PROPOSED WATER PIPELINE
PROPOSED CONVEYOR
PROPOSED ROAD
NO ROAD
ROAD
Ldn = 55 dB(A)
RANGE OF AUDIBILITY AT 11 A.M.
RANGE OF AUDIBILITY AT 11 P.M.
Paonia
NORTH FORK GUNNISON RIVER
Stevens Gulch
Fry Mesa
Pitkin Mesa
Minnesota
Redtop Peak
Coal Gulch
Cemetery
Reservoir

Secondary growth due to the improved local economy may increase the noise levels as discussed previously. The long-term future noise levels would be virtually the same, whether or not the federal actions are approved, due to the area's importance as a coal mining center.

D. Visual Resources

See appendix B-1 for a description of the methodology for determining visual impact and a more detailed and quantified analysis of visual impacts. See map I-4 (in chapter I), map II-2 (in chapter II), and map III-1; photos 2, 3, and 4 (in chapter II); and figures III-1 and III-2 for locations and conceptual renderings of visual impacts discussed below.

1. Conveyor Line

Most of the conveyor line lies on the ground and would be screened by trees or hills and would create an insignificant visual impact (see figure I-1).

Short sections of the line would be elevated above the trees where it passes over gullies and down the side of the hill below the tunnel. Three of these sections would be visible to residents in the valley for the life of the project. The uppermost of these three would also be partially in view for about one minute to motorists traveling down the Stevens Gulch Road in the vicinity of the switchback above the exit to the mine. The line and its supporting trusses would be visible from certain points and create a moderate visual impact for viewers in the valley due to its unnatural arrangement of vertical and parallel trusses and unpainted metallic surfaces.

The visual impact of color contrast would vary with light and snow. A daily occurrence would be a shadowy form created from backlighting by morning sun, while advancing afternoon shadows would absorb the line. At times during the middle of the day the line could reflect sunlight brightly, in which case the visual impact would be severe and would also be the only condition under which the line would be a visual impact from the Stevens Gulch Road. In the winter the line could appear as a dark form against a white background.

2. Conveyor Line Construction and Maintenance Access Road

The maintenance access road would create insignificant visual impact in areas screened by hills and vegetation but would create moderate and severe impacts as shown in map III-1. Moderate, short-term impact would also occur during the construction of this road from the appearance of heavy machinery and dust. All other impacts would be for the life of the project. The moderate long-term visual impact would occur where the road would switchback on steep grades, 60 percent on the hill below the tunnel and 100 percent in the gullies above the tunnel. These switchbacks

Orchard Valley Mine Area
from North Fork Valley
near Pan American Properties-
with proposed facilities.
Sketch is same point of
view as Photo 2.

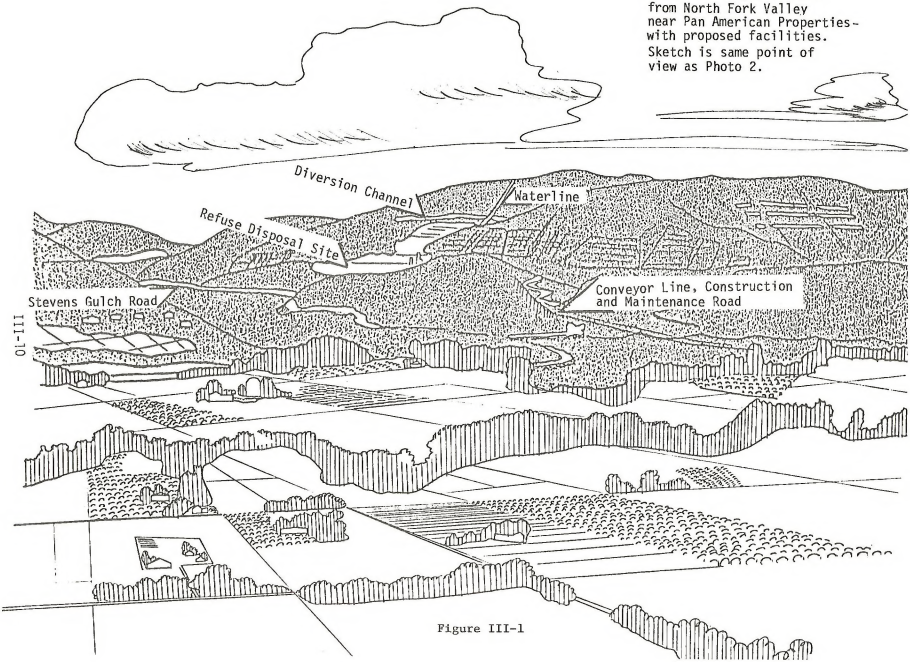
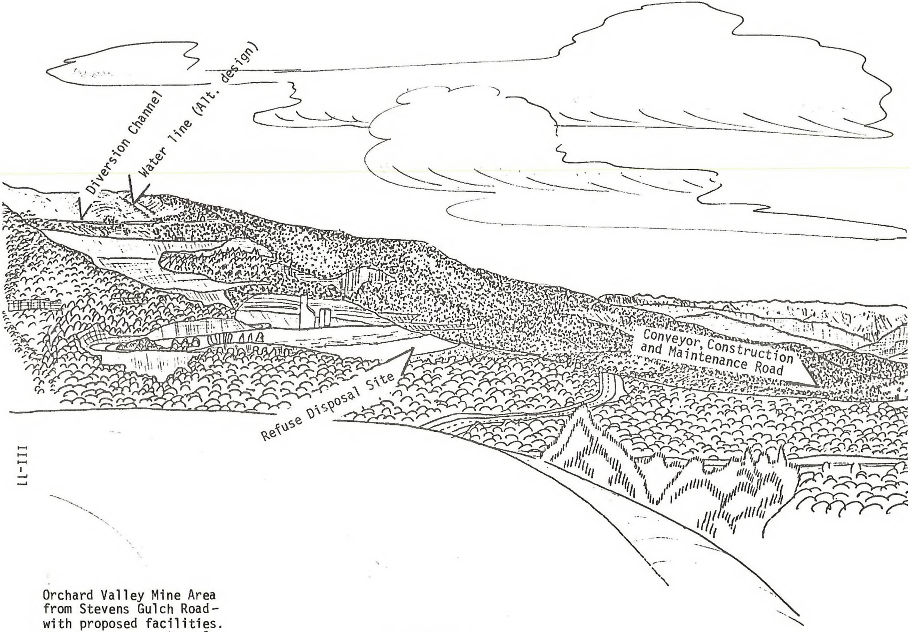
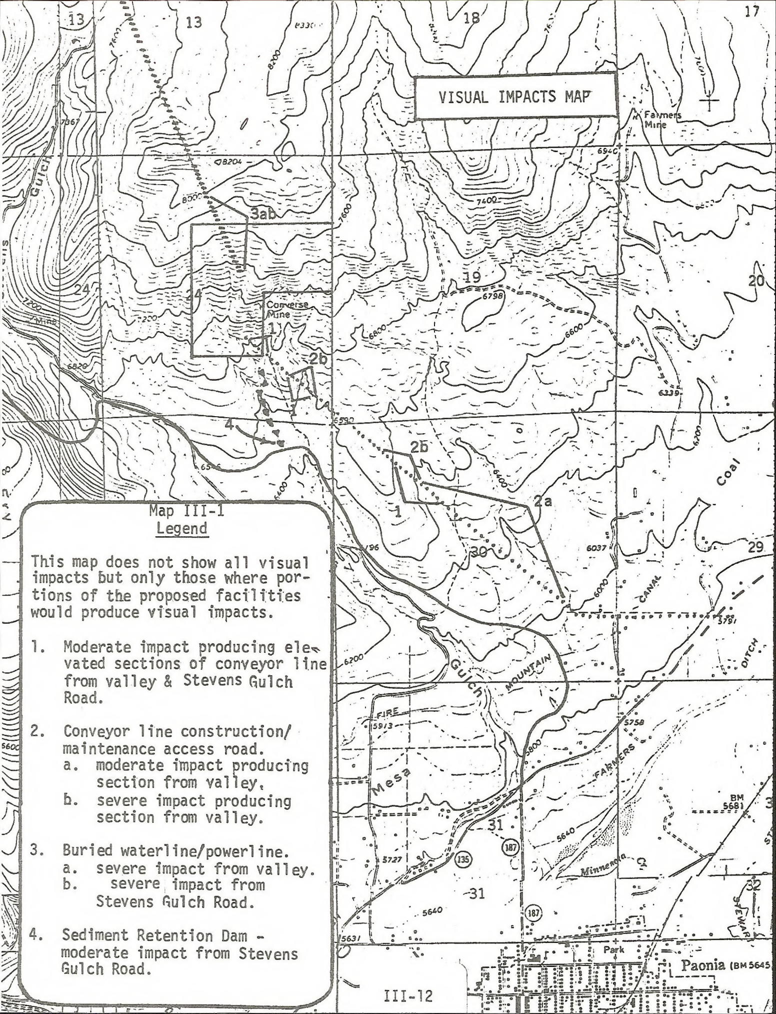


Figure III-1



Orchard Valley Mine Area
from Stevens Gulch Road-
with proposed facilities.
Sketch is same point of
view as Photo 4.

Figure III-2



Map III-1
Legend

This map does not show all visual impacts but only those where portions of the proposed facilities would produce visual impacts.

1. Moderate impact producing elevated sections of conveyor line from valley & Stevens Gulch Road.

2. Conveyor line construction/ maintenance access road.
   a. moderate impact producing section from valley.
   b. severe impact producing section from valley.

3. Buried waterline/powerline.
   a. severe impact from valley.
   b. severe impact from Stevens Gulch Road.

4. Sediment Retention Dam - moderate impact from Stevens Gulch Road.

would be visible from the valley and would result from strong form, line, color, and texture contrasts in clearing vegetation.

3. Buried Waterline/Powerline

The visual impact of the buried lines from the valley would be severe and exist for the life of the project, but it would vary with the season and would decrease somewhat over the long term. This visual impact would result from the strong contrasts of an unnaturally straight line perpendicular to the contour and exposed rock outcrops, resulting from removal of vegetation. This line would be highlighted by moderate color contrasts of exposed soils and vegetation in the growing season and in winter by strong contrasts of snow and vegetation. Over the long term, soil contrasts would diminish to insignificant visual impact during the growing season, but severe visual impact would remain in the winter. (It is not expected that vegetation would return on this harsh, rocky site to adequately reduce these strong line and color contrasts.)

Visual impacts for people traveling on Stevens Gulch Road would be the same, although the viewer would be able to perceive more detail for the line on the valley side of the slope. Impacts would be moderate and short-term on the northwest side because vegetation is more likely to return more quickly and because there are already many such disturbances on that side. Such moderate, short-term impacts still meet the requirements of the VRM class.

4. Diversion Channel

The diversion channel would be visible but would have much the same appearance as naturally exposed rock outcrops. From the valley, then, the visual impact would be insignificant. From Stevens Gulch Road the sidecasting of excavated soil and rock would be extensive, with much vegetation being buried and killed. This would create strong form, color, and texture contrast and therefore severe, short-term visual impacts.

5. Refuse Disposal Site

Use of this area as a disposal site would create an insignificant visual impact because (1) the grade of the area is gradual (15 to 25 percent) so that in combination with the viewing angle a relatively small area is visible from the common viewing points, and (2) it would be contiguous with the existing mine face (a severe visual impact itself) and be visually absorbed by it-until such time (long term) as it would become effectively reclaimed by revegetation measures. (It would be about 10 percent of the total area as viewed from the valley and 15 to 20 percent as viewed from the Stevens Gulch Road.) In addition, the site would only be in view for downhill traffic on the Stevens Gulch Road for about one minute.

A long-term moderate visual impact could occur if uprooted trees are piled in view of traffic on Stevens Gulch Road. Another long-term moderate visual impact could occur for viewers anywhere if revegetation measures fail to adequately restore the site to its approximate original vegetated condition. This would be an impact resulting not so much from direct visual contrasts but more from a realization that the land would be in a needless unproductive condition.

6. Sediment Retention Dams

The sediment retention dams would not be visible from the valley, and all but the lowermost would not be visible from Stevens Gulch Road. The last dam, if built of earth would create a moderate long-term visual impact, or moderate long-term visual impact if built of metal and not painted. This impact would affect travelers on the Stevens Gulch Road for a few seconds duration.

Impact Summary

In summary, three of the elevated portions of the conveyor line would create long-term moderate and occasionally (with light just right) severe impact. The accompanying road would create long-term severe impact where grades are very steep. The buried waterline/ powerline would create severe impact on the southeast slope year-round during the short-term and in winter only during the long-term. Sidecasting of excavated material from the diversion channel would create severe short-term impact. The lowermost sediment retention dam, if built, would create moderate long-term visual impact. Impacts from the first three facilities would be seen mostly from the valley, while the latter two would be seen only by people traveling on Stevens Gulch Road.

E. Recreation

Visual impacts in the valley would be recreation impacts for residents who hold the visual resource an important part of their living environment and for sightseers who travel off Highway 133 to drive around the valley and up Stevens Gulch Road. The significance of these impacts would be the same as indicated in the visual resources section.

F. Water Resources

1. General Drainage Plan

With the diversion of runoff flows from Westmoreland Canyon (Watershed A) into adjacent drainage systems, culverts beneath the Forest Service access roads would have new discharge requirements. Ponding behind current culverts after large storms would occur. The discharge flow at node 24 would increase from 36 cfs to approximately 79 cfs from a 100-year (1 percent probability) one-hour storm (OPP) under the proposed drainage plan. At node 22, OPP peaks would be reduced from 233 to approximately 91 cfs as the result of diverting storm runoff upstream. At node 17, it is estimated that OPP peaks would be increased from 114 to 201 cfs.

2. Diversion Channel

Although the diversion channel would reduce runoff flow through Westmoreland Canyon (Watershed A), it would cause significant increases in runoff flow through the adjacent watershed drainages. Watershed D (west) would receive approximately 399 cfs of additional runoff flow from Watershed A after storms equivalent to the probable maximum one-hour storm and approximately 43 cfs after the 100-year, one percent probability, one-hour storm. Watershed C (east) would receive approximately 590 cfs and 61 cfs from the respective storm sizes at node 13. It is not considered realistic to hope to completely control runoff from the probable maximum thunderstorm because extensive damage would occur anywhere from a storm of this magnitude. However, the construction of this channel would minimize the destruction as much as possible. In addition, a total of 26 cfs of water would be added to Watershed B below the diversion channel and 36 cfs to Watershed D resulting from a 100-year, one-hour storm within the mining area.

With the exception of the probable maximum thunderstorm event, the adjacent drainage basins that receive the diverted runoff water are considered to be stable enough to handle the extra water flows. However, to insure that an accelerated erosion condition is not initiated in these drainages due to an exceptionally large storm, mitigation should be considered for the adjacent Watersheds B, C, and D.

3. Sediment Retention Dams

The sediment retention dams would retain surface runoff from the mine waste pile, causing a loss in kinetic energy from the water flow allowing the suspended sediment to settle out and be deposited within the reservoir. These dams would help protect Stevens Gulch and ultimately the North Fork of the Gunnison River from detrimental effects on the water quality, specifically sediment.

The dams themselves may become an erosion and sediment problem if constructed of earth material. The maintenance crews would also have a problem distinguishing between the earth dam and sedimentation when cleaning.

4. Coal Lease Tract

The major water pollutants from coal mining activities are sediments and acid mine drainage. The sediments would be controlled through the use of sediment retention dams. The presence of acid leachate discharges from mine waste piles, from tailings ponds, and in tunnel drainages is common but does not occur in all coal mining operations. Acid mine drainage causes degradation of water systems by the formation of sulfuric acid and increasing concentrations of heavy metals (necessary ingredients for this reaction to occur are not evident in this area). Thus, the toxic products in mine drainage are the results of natural metals oxidizing in the mine. While persistent runoff is not the case in Westmoreland Canyon (Watershed A), acid mine drainage is nevertheless possible. This possibility--coupled with increased salt uptake from the waste piles and possible pathogen contamination from rehabilitation efforts using sewage effluent that would be delivered to Stevens Gulch--justifies consideration of mitigating measures. The sediment retention dams would help minimize some of the effects of these pollutants. Also, the penetration of water into mine waste piles is very minimal (Burton 1976). So, excessive watering of these rehabilitated areas would cause the water to flow along the mine waste pile as subsurface flow causing unstable soil conditions.

Impact Summary

In conclusion the impacts of the proposed action on water resources are in fact mitigating measures to the mining operation. The diversion channel diverts surface runoff around the disturbance area. The sediment retention dams retain sediments from the mining area within the immediate area of the operation. Both impacts are measures to maintain the local environmental condition of the water resources.

G. Soils

1. Coal Lease Tract

Underground mining as proposed would result in minimal disturbance to overlying soils. There exists, however, the possibility of subsidence following removal of coal seams. Depending on the degree and location of any subsidence, surface soil characteristics could be altered as could surface drainage patterns. No apparent subsidence has resulted from previous coal mining efforts in the area. Nevertheless, the probability and overall effect of such subsidence is nearly impossible to predict.

2. Waterline/Powerline

The proposed route for the combined waterline/powerline includes a slope of over 50 percent (2:1). Any linear disturbance across contour lines would increase erosion susceptibility and encourage channelized flow and gully formation. Machinery traffic would compound the erosion hazard by compacting surface soils and underlying clay layers, thereby decreasing permeability and increasing surface runoff. Soil stabilization efforts would be complicated by the steepness of slopes.

3. Conveyor

Construction of the conveyor and access road would produce soil disturbances on an estimated 10 to 11 acres. To the extent that helicopters could be used for transport and placement of conveyor parts, disturbance would be reduced in difficult access areas such as steep sideslopes and canyon bottoms. Nevertheless, erosion susceptibility and sedimentation would increase during construction. Without surface rehabilitation, accelerated soil losses would continue after construction is completed.

4. Diversion Channel, Mine Waste Disposal Area, Sediment Retention Dams

Principal soil impacts within the 200-acre proposed right-of-way would result from construction operations on approximately 10 acres. The diversion channel would occupy nearly 6 acres. Compaction from machinery traffic during construction would encourage runoff and thus increase the potential for erosion and sedimentation. Several exploration roads now exist upslope from the immediate area of the proposed channel. Any such roads remaining after construction would serve to increase soil movement into the channel and ultimately into adjacent natural drainages.

Assessment of impacts from the disposal of mine wastes is complicated by the lack of long-term data on the relationships between mining and erosion and sedimentation. Under natural conditions, source-area and channel erosion rates in Westmoreland Canyon appear low (Leaf 1977). Much of this type of activity results from short-duration thunderstorms. Assuming construction of the proposed drainage control measures, average annual sediment yield from combined private and public disturbed areas has been estimated at approximately 0.03 acre-foot per year after initial reclamation (clearing and benching) and 0.02 acre-foot per year once revegetation is completed. These values compare with an estimated long-term norm of 0.04 acre-foot per year from the entire watershed under natural conditions (Leaf 1977).

Additional erosion and sedimentation would occur prior to initial reclamation. The actual magnitude of soil loss from the disposal site would depend on the length of time between clearing and reclamation.

Summary

Considering the proposed actions collectively, principal soil impacts would stem from erosion and sedimentation due to surface disturbance.

H. Wildlife

The proposed action would temporarily remove the following approximate number of acres of wildlife habitat:

1.	Conveyor	10.0	acres
2.	Pipeline	1.5	
3.	Drainage system and disposal area	10.0	
4.	Coal Lease	None	

The increased activity associated with the proposed action may also reduce the use of the area by some species. This disturbance would most likely affect the following species:

1. Golden eagle and other raptors (most critical in the spring prior to hatching of the young)
2. Large mammalian predators, e.g., mountain lion, bobcat, coyote
3. Elk and deer

The golden eagles nesting in the area may abandon the nest (Rich Olendorff, personal communication), the predators may cease to use the den or hunt in the area, and deer and elk may be restricted in their use of some winter range areas. The Stevens Gulch Road would remain open to the mine access road during the winter which would add to the disturbance of deer and elk. There may also be an increase in poaching during this period. None of these impacts can be predicted with certainty.

If deer use is completely eliminated in the area between Stevens Gulch and the conveyor and south of the mine, it would be equivalent to the loss of approximately 300 acres of winter range or 143 deer. The loss from the destroyed habitat shown above would be equivalent to 10 deer. Both of these computations are based on the average of 43 deer days per acre use for 90 days. If this occurs, even partially, increased agricultural damage could result if deer populations are not reduced or additional forage provided. The loss of habitat would eliminate use of the area by the other wildlife species but densities have not been measured. However, it is not probable that use of the area would be completely eliminated. Deer and elk would be physically able to pass under and over the conveyor at several locations which conform to portions of their normal routes.

The potential impacts on aquatic and riparian habitats are probably not significant if the proposed actions on public lands are successfully implemented (see Water Resources). However, the sedimentation of aquatic habitat and erosion of riparian habitat could be substantial if the engineering, design, and construction of the drainage system, sedimentation dams, sewage treatment plant, and soil stabilization should be inadequate, fail, or be subjected to unforeseen conditions. It is probable that one or more of these situations would arise in an action of this magnitude, but severity of impact could not be predicted. The impact would also be substantial (sediment and debris) if a heavy storm occurred before the drainage system is installed.

The potential subsidence due to the coal extraction could alter drainage patterns and cause increased sedimentation on Stevens Gulch. (See Water Resources.)

During construction of the conveyor, pipeline, and drainage-diversion structures all wildlife species would be subject to additional stress and disturbance. This would be significant for the golden eagles during nesting period (March 1 to July 1) and wintering deer and elk (December 1 to April 15).

In addition, the harvest of big game from the area would be hampered if construction, operation and maintenance activities are carried out during the hunting season. These activities, particularly off the mine site, would keep big game out of the area where the hunting takes place. Elk will generally remain one-half mile from heavy activity and one-fourth mile from roads (A.L. Ward, 1976).

Increases in the local human population would result in greater hunting and fishing pressure on local wildlife populations. Two primary sources of noise, the conveyor and heavy trucks and machinery, would cause disturbance of deer, elk, raptors, mammalian predators, and some small mammals and birds (see Noise, chapter III). The noise of the conveyor is not likely to cause significant disturbance; however, the heavy trucks and machinery would cause wildlife to avoid the mine site and Stevens Gulch road, due to the noise itself and the presence of people.

The potential problem of raptor electrocution could be increased if additional powerlines are constructed similar to the one along the tramroad which was not "raptor proofed." This is a particular problem for young eagles after they leave the nest. The poles are presently being modified to correct the problem. The poles, if properly constructed, add perches for birds of prey where none were available.

Impact Summary

The impact of the accompanying actions on private lands and secondary impacts should also be mentioned. The loss of additional terrestrial habitat due to construction of homes and service industries would add to the impacts mentioned above. The inceased number of residents and access roads would result in additional disturbance of wintering big game, raptorial birds, and large predators. The conveyor, construction activity, and other structures may aggravate the problem of deer and elk harassment by dogs because the deer may not be able to move as freely to escape. They may also be subjected to additional stress situations due to human activity. At the same time, the increased human population may facilitate the control of the deer population at or near its present level (as desired by DOW) by supplying more hunters in the area.

The additional truck traffic from the mine area to the silos (100 trucks per day) would cause added stress on big game for a period of 18 to 24 months. Heavier mortality due to road kills and stress would result for big game, particularly deer, as well as smaller mammals, e.g., rabbits, ground squirrels, skunks. The additional worker traffic along Highway 133 and Stevens Gulch Road would result in road kills and additional stress on wintering big game, as well as some other species, e.g., bobcat, fox, golden eagles.

The major impacts of the proposed action would be the disturbance and loss of habitat for big game, disturbance and possible loss of a golden eagle nesting area, and an uncertain degradation of aquatic habitat.

I. Vegetation

The conveyor belt would disturb approximately 10 acres in the pinyon-juniper/mountain shrub transition and pinyon-juniper zones. The waterline, mine waste disposal, and diversion channel would disturb 10 acres in the transition zone. Damage to the natural vegetation from the detention dams would be minimal (less than 0.1 acre). Unsightly landscape scars and increased soil erosion would result from these vegetation disturbances.

J. Range

The proposed actions (construction phase) may have minor adverse impacts upon the amount of forage available to livestock. These impacts would be temporary, however, and would reverse themselves to a point that only the areas disturbed by the conveyor, dams, etc., would be removed from forage production.

K. Cultural Resources

The location of the archeological and historical sites would not be affected by any of the proposed actions; therefore, no impacts would occur to the sites.

L. Socio-Economic Conditions

Seven-tenths (72 percent) of the 107 workers currently employed at the Orchard Valley Mine were hired locally (table III-4), and a similar proportion of the 143 additional workers needed for the proposed project is expected to be hired from within Delta County. If the same proportions are maintained when hiring the new workers, 43 will come from outside the county. If the average size family of the new workers is 3.6 persons and if they all locate within the county, the county population will grow by 155, or an increase of 0.82 percent over the estimated 1977 population of 18,939. Therefore, the impact on population growth would be minimal. Also, it is probable that the service industry would significantly respond to a population increase of 0.82 percent (e.g., addition of new employees likely to be in the range of 10 to 50 depending on existing lack in service industries).

TABLE III-4

COLORADO WESTMORELAND INC. AUGUST 5, 1977

EMPLOYEE RESIDENCE INFORMATION AS OF JULY 8, 1977:

		Number	Percent of Total
I.	Residents of Delta County before filing application at Colorado Westmoreland Inc.	79	72%

	Number	Percent
10 yrs or more	24	22%
5 to 10 years	11	11%
4 years	1	1%
3 years	6	5%
2 years	8	7%
1 year plus	10	9%
1 yr or less	19	17%

		Number	Percent of Total
II.	Residents of other Colorado counties before filing application with Colorado Westmoreland Inc.	11	11%
III.	Out of state applicants now employed	19	17%
	TOTAL	109	100%

TABLE III-5

DELTA COUNTY ASSESSOR'S OFFICE

Respondent - Dick Helmick, County Assessor

CWI Capital Investment

1. $35,218,000 as of July 31, 1977

2. $37,918,000 as of October 31, 1977

3. Investment for proposed project:
   $9,000,000 additional

4. Total investment with the proposed project:
   $46,915,000

5. Assessed Valuation:
   $46,915,000 x 0.03 = $14,074,500 x 0.06 (60 mills) =
   $844,470 in taxes

6. Also a tax on the coal mined:
   $8.50 (price per ton) x 0.3 (30 percent assessed valuation) =
   $2.55 (assessed valuation) x 0.06 (60 mills) =
   $.15 tax per ton x 1,000,000 tons =
   $153,000 annual tax on coal mined

7. Total estimated taxes collected by Delta County from CWI:
   $844,470 on assessed valuation of the capital investment
   153,000 property tax on coal dug mined.

   $997,470 Total taxes annually from CWI to the county

8. In 1976, CWI had a capital investment of about $5,333,333 in the Orchard Valley Mine.

   Assessed valuation: $1,600,000 x 0.06 (60 mills) =
   $96,000 in taxes

In the event that no workers for the proposed project can be hired locally, and all 143 workers come from outside the county, the estimated population increase would be 515 people or 2.7 percent. Unless existing slack in the service industry has been eliminated, it is unlikely that it will add many new workers for a population increase of this magnitude.

The 1976 estimated unemployed labor force within the county of 7.1 percent, or 454 workers, could be directly, or indirectly, reduced since the company intends to hire about 100 workers from Delta County for the proposed project. The company should experience no difficulty hiring qualified local workers, since its principal requirement is a minimum of a high school education. The company has a three-week training program to further qualify workers for work both above and below ground.

The total net payroll introduced into the county would be $3,680,451. The gross annual income for project employees would range from $16,640 to $17,680, while the range in take-home pay per worker would be from $12,247 to $13,012.

The shift from a social system primarily based on an agricultural economy to a more mixed rural-industrial economy would continue, likely resulting in several cultural changes (see chapter V). Over time, the existing cultural norm emphasizing individuality, independence, and self-reliance is apt to change as more and more employees work for large energy companies, chain stores, and the like. Emphasis on social, political, and economic groups may increase. Increased incomes would perhaps allow a more elaborate lifestyle, including more emphasis on leisure time activities (recreation, eating out). Guaranteed annual incomes may tend to stabilize marriage and family relationships.[1] The American rural village/open country flavor of the lifestyle is likely to continue, but many social, political and economic relationships would possibly become more formal.

Delta County would receive an estimated $997,470 annually from the proposed project when it is in full operation producing one million tons of coal a year (table III-5). The value of CWI's 1976 investment was

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[1]In his review of the literature on divorce and socio-economic status for his book, The Family in Perspective, Dr. William F. Kenkel found that: (1) "Research consistently has discovered that divorce varies inversely with occupational prestige"; (2) "Studies by the United States Bureau of the Census have found that more divorced men, as opposed to married men, are found in the low-income segments of society"; (3) "Terman discovered that insufficient income was the most frequently mentioned grievance of both husbands and wives in his sample"; and (4) "...Harmsworth and Minnis found that a sample of lawyers considered financial problems as the most frequent real cause of divorce, regardless of the statutory grounds used in the cases."

about $5,333,000, assessed valuation $1,600,000, on which CWI paid $96,000. When the project is completed and in full operation, it would represent nearly a $47,000,000 investment (including the proposed project). The County Assessor said that this amount would have an assessed valuation of a little over $14,000,000, on which CWI would pay $844,470 in taxes. In addition, the company would pay an estimated annual property tax of $153,000 on the one million tons of coal mined annually. The estimated $997,470 in property taxes received from the proposed project would represent a 220 percent increase in Delta County's present property taxes.

The county would also benefit from taxes on increased valuations of mine workers' properties and from sales taxes on a portion of the $3,680,451 take-home pay spent in the county. The county would also receive about $130,680 over a 2½-year period in Colorado severance taxes. Delta County will also receive an estimated $200,000 annually for schools and roads; planning, construction, and maintenance of public facilities; and provision of public services.

The proposed project would provide an estimated $740,000 annually to the state, which would be its portion of the federal royalties collected from the proposed project. The state severance tax could increase state revenue by $290,400 annually, and income tax payroll deductions would add an estimated $200,000 annually (appendix I).

The principal impact of the proposed project on the status of planning and zoning would be to alert local leadership to plan for impending development of coal mining in Delta County (appendix I).

A possible negative effect of the project would be the combining of local inflation, resulting from the additional payroll and taxes, with national inflationary trends. This inflationary effect would impact the 28.5 percent of the population over 60 years of age as well as other members of the population whose incomes are relatively unresponsive to inflation (see chapter V). However, the convenient and common propensity to shop in Delta, Montrose, and Grand Junction substantially limits the prospective price increases for goods and services sold in the North Fork area. Additional large retailers, e.g., Gibson's or City Market, would probably reduce prices below levels existing prior to recent coal development.

A more likely source of continued inflation is in housing prices, including rentals, as more people move into the area for mining jobs or in continuation of recent trends of immigration for nonjob reasons. New subdivisions are bringing new houses into supply, easing price pressures on old houses. However, available mortgage financing requires relatively high down payments.

Since the United Mine Workers of America (UMWA) has, over the past four decades, organized all the other mines of the North Fork Valley, the probabilities are high that it will attempt to organize the workers at CWI's mine. In view of CWI's union-free policy, confrontations and, therefore, negative social impacts can be anticipated.

There would be a minimal negative direct impact from the proposed project on the school system, since CWI intends to hire a substantial proportion of its workforce from the local labor force, whose children are already in the county or in school. However, as pointed out in chapter II, the school system in the North Fork Valley is already old and heavily impacted and both students and faculty are functioning under less than ideal conditions. In the event that royalty, severance tax, and company property tax money is allocated to the school system, the impact of the proposed project would be decidedly positive.

The impact of CWI's proposed expansion on housing would be minimal because of the company's policy of hiring local people, although the component of secondary employment needing housing may have an impact. (See chapter II for housing developments either under construction or being planned.) In addition, in order to aid its employees in obtaining housing, CWI had instituted a two-year lease purchase plan. The plan allows employees to lease a house with an option to buy in two years. The maximum purchase price presently allowed by CWI is $45,000; the lease payments are applied to the down payment. CWI currently has five such houses.

The proposed action would result in an increase in vehicle traffic on Highways 92 and 133 and on Stevens Gulch Road, particulary during shift changes (50 per shift). Traffic within the communities would also increase. The two additional trains per week would make movement in the valley on those two days more difficult than at present. Overall, the increased traffic would place an additional strain, burden, and safety risk on all who depend upon the present transportation system.

Although the Paonia sanitary treatment plant may be able to handle all increased sewage from additional populations, the secondary treatment facilities will not reduce the amount of nutrients discharged to the river below Paonia, and these will increase with increased loading. Increased nutrient loads could result in heavier algal growths and lowered oxygen levels downstream of the treatment plant. This could be especially important during low flow periods when discharges from the treatment plant may make up a significant portion of the river flow. At present, data are not available on water quality in this section of the North Fork to quantitatively determine effects of the relative increase due to mine-related population increases.

For a further analysis of socio-economic impacts, refer to appendix I-1.

Impact Summary

The principal impacts of the project are positive: jobs with much higher than average pay, over $3,500,000 annually net payroll, and over $500,000 to the county in company property taxes. The two major adverse impacts would be the possiblity of increased inflation, which would adversely impact the over-60 population, and increased traffic on Highways 92 and 133 and on Stevens Gulch Road.

M. Overall Summary of Impacts

Review of the first three chapters, describing the proposed lease and mining operation, the existing environment, and the impacts of the proposed, shows that the proposed lease would have no significant effect on the human or natural environment. Paonia and its surrounding area are basically small towns with considerable existing development. Almost all housing, commercial facilities, railroad facilities, and the mine site itself already exist. Except for the removal of the coal itself, in these circumstances alterations of the environment would principally affect local water, air, landuse, and socio-economic conditions. Impacts on water, air, and landuse would be reduced to an insignificant level by mitigating measures. Socio-economic effects would be beneficial, and would be limited in impact by the fact that the proposed operation would principally take up existing slack in the local socio-economic situation.

Other anticipated coal operations cannot be considered as fairly attendant on or in any way related to the present actions. Inasmuch as no new transportation access or other mining infrastructure would result from the CWI mine, approval of this lease would not trigger or influence other applications, nor would it in any way influence BLM's decision with respect to any such application. Each can and will stand on its own merits in light of the facts and public policies as they exist at the time. Since these projects are not cumulative, it would be inappropriate to characterize or evaluate their impacts on a cumulative or aggregate basis.

In summary, expansion of this existing underground mine in an established community primarily utilizing local employment would have only insignificant local environmental effects. Use of the coal by NIPSCO to replace high sulfur coal would contribute some benefit to the national policies promoting clean air and domestic sources of safe energy fuels.

CHAPTER IV

Chapter IV - Mitigating Measures Not Included in the Proposed Action

BLM will require a number of measures which were not originally proposed by CWI in its lease and rights-of-way applications to be implemented if a lease is to be offered. Also, if a lease is offered, any successful bidder must obtain further permits and approvals. A lessee must also comply with existing state and federal laws and regulations which regulate and require mitigation of the environmental impacts of the proposed actions.

Before extending mining operations into federal coal, the successful bidder must submit a complete mining plan application to the U. S. Geological Survey (USGS) and obtain approval of the plan. Under state law, a federal lessee must also obtain approval of a mining plan from the Mined Land Reclamation Board of the State of Colorado for both fee coal and federal coal operations.

Any mining operations which would be conducted by Colorado Westmoreland, Inc. (CWI), or any other successful bidder must be conducted pursuant to the permit requirements and the standards of performance set forth in the current Geological Survey Mining Regulations. Any mining operations will also be subject to new standards of performance and mining permit requirements to be established for underground coal mines pursuant to the Surface Mining Control and Reclamation Act of 1977, which was signed into law by President Carter on August 4, 1977.

The current mining regulations administered by the USGS require all operations involving the discovery, testing, mining, preparation, and handling of coal, and the reclamation and abandonment of affected lands, to meet certain specified performance standards and to comply with all other applicable laws and regulations, including effluent and emission limitations, the terms and conditions of the lease, the requirements of an approved mining plan, and any orders issued by the Mining Supervisor. Operations are subject to inspection and record keeping requirements, and operations may be halted for violations.

Operations must be conducted to extract the maximum amount of the coal resource which may be recovered so as to achieve maximum use of the resources and prevent future environmental disturbances through the resumption of mining operations. USGS also requires operators of mines to take such actions as may be needed to minimize, control, or prevent (1) soil erosion; (2) pollution of air; (3) pollution of surface or ground water; (4) serious diminution of the normal flow of water; (5) adverse impacts upon fish and wildlife and their habitat; (6) permanent damage to vegetative growth, crops, or timber; (7) creation of unsafe or hazardous conditions; (8) damage to improvements; (9) damage to recreational, cultural, scientific, historical, and known or suspected archeological values of the land; (10) adverse impacts upon adjacent land uses; and (11) unplanned or uncontrolled subsidence of surface lands.

The proposed rights-of-way, if granted, would be easements issued pursuant to P. L. 94-579 (October 21, 1976), Title V, 90 Stat. 2743. The following would be applicable:

1. The Secretary of the Interior, or his lawful delegate, reserves the authority to issue rights-of-way or permits for compatible uses on, over, under, or adjacent to the lands involved in the proposed grants. (43 USC 1763)

2. The proposed grants would be subject to renewal. If renewed, the rights-of-ways would be subject to regulations existing at the time of renewal and such other terms and conditions deemed necessary to protect the public interest. (43 USC 1764)

3. Abandonment of the proposed rights-of-way or noncompliance with any provision, condition of the grant, or applicable rule or regulation of the Secretary of the Interior, or his lawful delegate, may be grounds for suspension or termination of the grant. (43 USC 1766)

4. The proposed grants would require compliance with state standards for public health and safety, environmental protection, and siting, construction, operation, and maintenance of or for rights-of-ways for similar purposes if those standards are more stringent than applicable federal standards. (43 USC 1765)

Right-of-way compliance inspections would be performed by the Bureau of Land Management's authorized officer to assure compliance with item #3 above.

Mine and related facilities for safety and operation would be monitored and regulated by Mine Enforcement, Safety Administration (MESA), United States Geological Survey, and applicable state agencies, i.e., Bureau of Mines, etc.

In addition to the codes previously quoted, there are a number of non-permissive federal, state, and local laws which will apply to the environmental aspects of development on the Westmoreland coal lease tracts and right-of-way sites.

The following public laws, U. S. codes and federal regulations are applicable to the proposed coal lease tracts, industrial development, and rights-of-way involved with the CWI, Orchard Valley Coal Mine:

1. United States Statutes at Large:

a. Act of October 21, 1976 (90 Stat. 2743) - an act to establish public land policy

b. Act of June 8, 1906 (34 Stat. 225) - an act for the preservation of American Antiquities

c. Historic Sites Act of 1935

d. Act of July 9, 1956 (70 Stat. 498) - Federal Water Pollution Control Act

e. National Historic Preservation Act

f. Act of July 20, 1961 (75 Stat. 204; P. L. 87-88) - Federal Water Pollution Act Amendments of 1961

g. Act of October 2, 1965 (79 Stat. 903; P. L. 89-234) - Water Quality Act of 1965

h. Act of 1969 (83 Stat. 742; P. L. 91-173) - Coal Mine Health and Safety Act

i. Act of January 1, 1970 (83 Stat. 1073) - Declaration of National Environmental Policy

j. Act of October 18, 1972 (86 Stat. 816) - Federal Water Pollution Control Act Amendments of 1972 (See Section 400 - Pollutant discharge permits program under the National Pollutant Discharge Elimination System; Section 404 - Permits for discharged or fill material. See also Section 208 - Areawide waste treatment management)

k. Act of December 28, 1973 (87 Stat. 884) - Endangered Species Act

l. Archeological and Historical Preservation Act of 1974

m. Noise Control Act of 1972 (P. L. 92-574; 86 Stat. 1234)

n. Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181-287)

2. United States Code:

a. 7 U.S.C. 135 - Insecticide, Fungicide and Rodenticide Act

b. 33 U.S.C. 466 - Federal Water Pollution Control Act, as amended

c. 42 U.S.C. 1857 - Clean Air Act, as amended

3. Code of Federal Regulations:

a. Executive Order 11514, dated March 5, 1970 - Protection and Enhancement of Environmental Quality

b. 30 CFR 211 - Coal Mining Operating Regulations

c. 40 CFR 120 - Water Quality Standards

d. CFR 50 - National Primary and Secondary Ambient Air Quality Standards

e. 43 CFR 2800 - Use; Rights-of-Way

f. 43 CFR 3000 - Minerals Management

g. 43 CFR 1725, General Management of Public Lands

h. Executive Order 11593 dated May 13, 1971, "Protection and Enhancement of the Cultural Environment"

The Colorado statutes and regulations with which a successful lessee must comply to conduct mining operations include the following:

1. Article 32, Title 34, Colorado Revised Statutes (1973) - Colorado Mined Land Reclamation Act of 1976, (and implementing regulations)

2. Article 7, Title 25, C.R.S. (1973) - Air Pollution Control Act of 1970, as amended (and implementing regulations)

3. Article 8, Title 25, C.R.S. (1973) - Colorado Water Quality Control Act, as amended (and implementing regulations)

4. Article 20, Title 30, C.R.S. (1973) - Solid Waste Disposal Sites and Facilities Act (and implementing regulations)

5. Article 12, Title 25, C.R.S. (1973) - Noise Abatement Act

6. Article 92, Title 37, C.R.S. (1973) - Water Right Determination and Administration Act of 1969, as amended

7. Articles 20 through 30, Title 34, C.R.S. (1973) - Colorado Coal Mine Safety Laws

A. Geology

Subsidence markers (stations) surveyed and installed at predetermined intervals will be monitored semi-annually. Should surface subsidence be detected, increased rock stability control will be implemented to prevent underground rock disturbances from reaching the surface. This may be accomplished by limiting pillar recovery until such time as the overburden depth is sufficient to prevent rock movement from reaching the surface. Other mines in the North Fork Valley coal field, with similar strata formations and depth for active mining panels, have observed little or no subsidence at the surface.

B. Air Quality

A major mitigating measure for the control of fugitive dust produced during construction activities will be rapid reclamation of disturbed areas. Reclamation by chemical stabilization, grading, and vegetation planting following construction is estimated to cut wind erosion from this source by 80 percent.

The most effective method of dust suppression during construction will be a watering program during periods of heavy activity. Such a program could reduce dust emissions up to 50 percent. In addition, use of existing roads during construction will restrict wind erosion to already disturbed areas.

Regular inspection by local officials of air pollution devices on all vehicles using federal, state and county roads in the area will reduce their emissions. Hydrocarbon (HC) emissions devices will be required on heavy duty vehicles, railroad locomotives, and off-road vehicles.

C. Noise

In order to ensure compliance with the Environmental Protection Agency (EPA) noise regulations and guidelines, CWI will

1. Quarterly assess community noise during construction and semi-annually thereafter until the noise appears to stabilize statistically

2. Assess dominant noise sources if significant changes occur in the operations

3. Periodically measure dominant noise levels of major components of the facility subject to wear, induced noise fluctuations (i.e., crusher, conveyor, loadout facility, etc.)

4. Furnish quarterly assessment to BLM within 30 days of data gathering

Should the sensitive noise receptors or the monitoring program indicate sound levels approaching or exceeding EPA standards for speech or sleep interference, the following steps must be taken to rectify the noise levels as appropriate:

1. Use of barriers or noise control methods as needed
2. Enclosure of conveyor belt drive stations
3. Expediting construction of the conveyor
4. Staging of helicopter operations from CWI mine operations area
5. Stringent maintenance of the belt and conveyor system, crusher, loadout facilities to minimize noise which might develop with wear
6. Full enclosure of the water/pipeline pump house
7. Application of control measures to ventilation fan installation as it is increased in flow or size
8. Requiring train crews to minimize warning whistle usage

D. Visual Resources

1. Conveyor Line

All parts of the line and its support truss structure will be painted appropriate camouflaging colors. This measure would reduce color contrast, which in turn would reduce form and line contrast to levels below the limits for the VRM class. It would therefore eliminate visual impacts except for the morning backlighting conditions and winter snow conditions mentioned in chapter III. These conditions would affect only the lowermost of the three sections. Under these conditions, the visual impacts would be moderate for this elevated portion of the line. It would disturb only those people viewing from the valley.

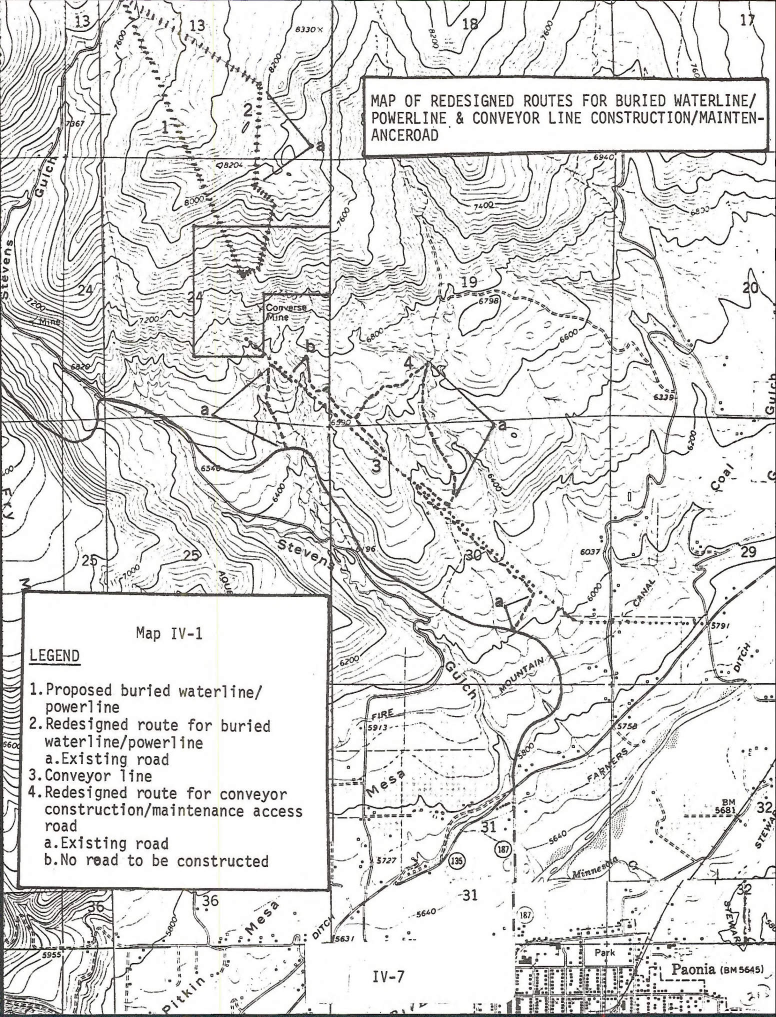
2. Conveyor Line Construction/Access Road

The road system will be redesigned as shown in map IV-1 and photo 12 and conform to the engineering standards outlined in appendix H-1. The new road system will meander through pinyon-juniper trees as much as possible. Access along the entire conveyor line will not be possible because of the steep grade in the gulley located in the southeast corner of Section 24. These measures along with those outlined in the soils section will reduce visual contrast so that, from the valley, the road would become virtually unnoticed.

3. Buried Waterline/Powerline

The waterline will be realigned as shown in map IV-1 and photo 12. A portion of this new design will make use of an existing primitive road which is screened from the valley and Stevens Gulch Road by landform and vegetation. Between this road and the destination, the line will

MAP OF REDESIGNED ROUTES FOR BURIED WATERLINE/ POWERLINE & CONVEYOR LINE CONSTRUCTION/MAINTEN-ANCEROAD



Map IV-1

LEGEND

1. Proposed buried waterline/ powerline
2. Redesigned route for buried waterline/powerline
   a. Existing road
3. Conveyor line
4. Redesigned route for conveyor construction/maintenance access road
   a. Existing road
   b. No road to be constructed

Photo #12 Proposed Facilities with Mitigating Measures (See Photo #1)

Key to reference numbers:

1. Conveyor line (remains the same)
2. Conveyor line construction/maintenance access road
3. Buried Waterline/Powerline

lie near the bottom of a swale which is screened from the valley. Thus, it will not be seen and therefore not create a visual impact for people in the valley. With this new design, and the mitigating measures outlined in the soils section, visual contrast as seen from Stevens Gulch Road will not be impacted.

4. Diversion Channel

Excavated material will not be sidecast but will be removed from the channel for an appropriate use on or off the site. This measure would eliminate the strong form, and color contrasts produced by burying and killing of vegetation below the channel and thus eliminate any visual impacts.

5. Refuse Disposal Site

Trees cut down during development of the refuse lifts will be removed from the site. This will eliminate vegetation debris which creates strong visual contrasts and would become a visual impact for people traveling the Stevens Gulch Road.

The mitigating measures outlined in the soils section will ensure the site is adequately revegetated.

6. Sediment Retention Dams

The lowermost dam will be painted to blend with the surrounding soils and vegetation. This measure will eliminate excessive visual contrast and any visual impact for people traveling the Stevens Gulch Road.

E. Recreation

See mitigating measures outlined in Visual Resources for visual and sightseeing aspects of recreation.

F. Water Resources

1. General Drainage Plan

Table IV-1 summarizes proposed control structures in the lower basin of Westmoreland Canyon. The existing culverts have adequate capacity; some inlet structures may have to be redesigned to accommodate the design flows. Adequate energy dissipation should be provided at all culvert outfalls.

Sediment retention dams will be constructed of metal bin and rock dam material based on specifications of figure IV-1. Sediment retention dams will be constructed on a schedule such that two dams will be completed before the first mine waste embankment is started and two additional dams will be added prior to the completion of the first

Table IV-1

Design Flows and Proposed Controls for Storm Runoff, Orchard Valley Mine

Node	Design Flow (c.f.s.)	Proposed Control(s)	Design Flow Criteria	Culvert Size and Minimum Grade[1/]
11	399	Plate 1 (Detail C)	PMTS	
12	590	" "	"	
13	827	" "	"	
15	1,117	None	"	
1	36		OPP	
2	22	Drop Structure	"	
3	18	Drop Structure (Existing?)	"	15 c.f.s. assuming adequate inlet
4	13	Drop Structure	"	24 inches
7	26	Gabion Spillway	OPP	
14	42	None	"	
5	9	Culvert (Existing?) &	"	24 inches @ 0.4%
6	8	Culvert (Existing?)	"	24 inches @ 0.3%
8	17	Gabion Spillway		
9	20	Drop Structure & Dissipator	"	30 inches
10	25	Drop Structure & Dissipator	"	30 inches
18	9	Ditch & Riprap	"	
19	8	Ditch & Riprap	"	
20	11	Culvert	OPP	24 inches @ 0.6%
21	18	Culvert	"	30 inches @ 0.5%
22	95	Culvert (Existing)	"	
23	57		"	
13	843		PMTS	
14	42		OPP	
15	1,117		PMTS	
16	172		OPP	
17	201		OPP	
24	79		OPP	

[1/]Assuming Free Outlet with Water Surface at Inlet Same Elevation as Top of Pipe and Outlet unsubmerged. $n = 0.021$

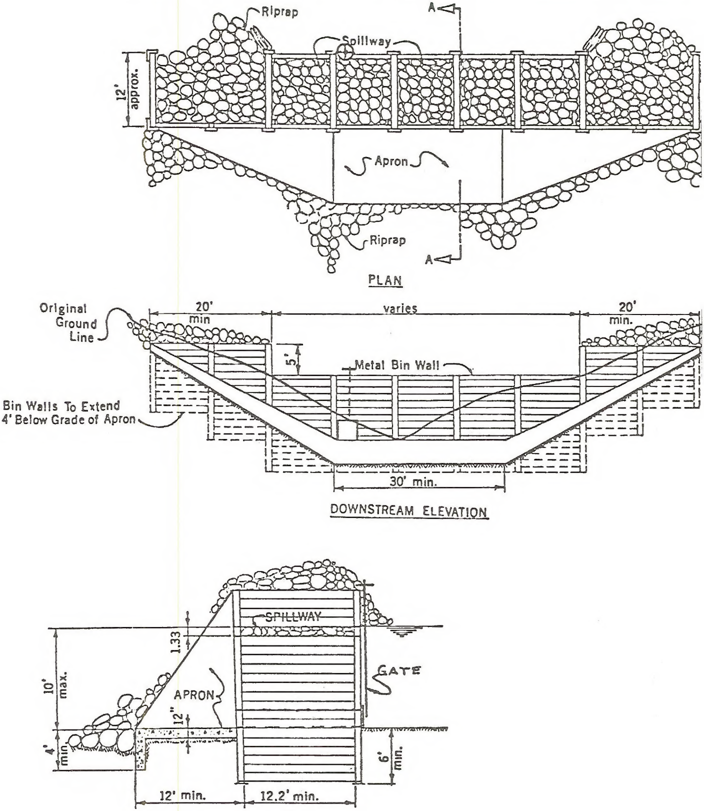


Figure IV-1 . Sediment Retention Dams design and specifications.

embankment. A total of four more dams will be constructed during the development of a second mine waste embankment.

G. Soils and Vegetation

1. Coal Lease Tract

Due to the unpredictability of the nature and extent of subsidence, no specific mitigating measures, aside from monitoring, are warranted initially. However, if subsidence occurs, particularly if bare soil cuts are exposed, grading and revegetation will be necessary to reduce erosion and control soil slumping. In appendix C, a section entitled "Operational Hydrology" outlines several water monitoring programs being established by CWI to identify effects of coal mining on water systems.

Excessive watering of rehabilitated areas must not be allowed. Only enough water to meet the consumptive use of the vegetation should be applied. Careful watering practices will eliminate or minimize salt pickup and acid drainage. It will also prevent surface runoff due to irrigation application, which may carry fecal coliform, pathogens, and viruses, and help maintain soil stability.

2. Waterline/Powerline

The waterline/powerline will be routed as described previously (map IV-1). This alternate route makes use of existing exploration roads, thereby minimizing areas of new surface disturbance. In addition, this route is less steep than that originally proposed, thus decreasing erosion susceptibility during construction.

To further control erosional impacts, revegetation of disturbed areas will commence during the late fall or early spring period immediately following construction. Selected species must include a diversity of grasses, forbs, and shrubs native to the area or with proven adaptability. The plants chosen must be capable of sustaining and regenerating themselves under existing soil and climatic conditions, although supplemental moisture and nutrients may be used during initial establishment.

To facilitate revegetation, existing topsoil will be restored to the surface when the trench is backfilled. In previously undisturbed areas (i.e., not on exploration roads), vegetation clearing will be limited to the width of the trench plus small adjacent openings for stockpiling soil. Whenever possible, machinery traffic will merely ride over existing vegetation to minimize root damage; this practice will encourage subsequent root sprouting by the native oakbrush. Woody vegetation which must be cleared will be scattered over the disturbed right-of-way to provide protection for emerging seedlings.

3. Conveyor

Erosion and sedimentation along the conveyor right-of-way will be minimized through revegation of disturbed areas. Revegetation will commence during the late fall or early spring period immediately after construction is finished. If construction is completed in stages, revegetation efforts will follow a similar pattern. Criteria for species selection will be the same as for the waterline/powerline. Further measures include the restoration of any displaced topsoil, minimal clearing of vegetation, and the scattering of cleared vegetation over disturbed portions of the right-of-way.

The access road will follow the route described in Visual Resources, making use of existing roads over approximately 40 percent of its length. New road construction and any necessary upgrading of existing roads will conform to BLM district standards (see appendix H-1, engineering specifications for roadbuilding), unless otherwise approved by the District Manager.

4. Diversion Channel, Mine Waste Disposal Area, Sediment Retention Dams

The alternate route for the buried waterline/powerline (map IV-1) decreases steep slope disturbances above the diversion channel, thus reducing soil movement into the channel. To further decrease upslope erosion, channel construction will incorporate current roadbeds whenever feasible; when not, upslope roadbeds will be revegetated. Criteria for revegetation will be the same as for the waterline/powerline. Topsoil removed during construction phases will be returned to those surfaces to be revegetated. Unused subsoil materials will not be sidecast but instead will be removed from the site.

The channels in the adjacent watersheds (B, C, and D) are probably stable enough to withstand most storm runoff flows. However, all adjacent watersheds receiving imported runoff flow will be riprapped to prevent incipient erosion from an unusually large storm. This measure will insure the preservation of these watersheds.

Clearing and development of the waste disposal site will occur in stages to minimize the amount of bare soil exposed at any one time. An acceptable plan for incremental development is depicted in figure I-3.

As stated in the proposed action, "refuse will be covered by at least 15 to 18 inches of topsoil and seeded with the aid of mechanized equipment." However, the existing surface in the area cannot supply that much topsoil. Furthermore, the available topsoil is stony, which would make seed drilling very difficult or impossible. For these reasons, additional topsoil will be obtained from off-site sources as necessary. The selection of species for revegetation will include grasses, forbs, shrubs, and trees based on those criteria outlined for the waterline/ powerline.

Sediment retention dams will be constructed of metal bin and rock dam material based on specifications of figure IV-1. Sediment retention dams will be constructed on a schedule such that two dams will be completed before the first mine waste embankment is started and two additional dams will be added prior to the completion of the first embankment. A total of four more dams will be constructed during the development of a second mine waste embankment.

Reclamation efforts in all areas will be monitored periodically to determine their adequacy in terms of both plant density and species composition. If wildlife activity should prove to be an undue hindrance to revegetation, fencing or other appropriate measures will be required until vegetation becomes established.

H. Wildlife

Construction activities (heavy equipment, helicopters, blasting, etc.) will be prohibited within 1,000 feet of the golden eagle nest during the nesting period (March 1 to July 1). The eagles nested successfully this year within 1,000 feet of the heavy machinery and intensive human activity, indicating that 1,000 feet is an adequate buffer zone. This measure will provide a reasonable chance for reproductive success for the eagles. The use of the nest will be monitored by BLM and DOW.

Cutting of snags will be prohibited except those within the actual disturbed area required for construction. This measure will minimize the loss of perches and nesting trees for raptors, insectivorous birds, and cavity nesters.

Public use of access roads and trails will be prohibited when big game are concentrated in the winter (December 1 to April 16). This measure will minimize disturbance during critical wintering periods.

Construction activity will be prohibited within the critical wintering area during the period when deer and elk are concentrated (usually December 1 to April 15). In light winters, this will not be necessary and the authorized officer will grant permission to work after consultation with DOW. The limitation on activity will minimize disturbance of big game.

To mitigate the loss of 20 acres of big game habitat due to construction, the applicant will modify 25 acres of pinyon-juniper woodland to mountain shrub community. This will be done in area number 1 shown on the accompanying map IV-2. This modification will consist of removing the pinyon and juniper by hand clearing and reseeding the area with an appropriate seed mixture as specified by the authorizing officer. This modification will be done as part of the construction of the conveyor line.

The DOW and BLM will monitor deer and elk use between the conveyor and Stevens Gulch Road to assess the "loss of habitat." The applicant will be required to run pellet group plots on either side of the conveyor line between April 15 and May 15 each year with a representative of DOW or BLM. A map showing the pellet group plot locations will be furnished by the BLM authorizing officer. The applicant will also be required to carry out vegetative treatment (or contribute funds) to increase forage on public lands within the critical winter range area, if the loss of available forage (as measured by DOW and BLM) exceeds 10 percent. The maximum acres of treatment required would be 110 acres, assuming a threefold to fourfold increase in available big game forage following treatment (map IV-2 and 3 show potential treatment areas). If the 10 percent loss occurs, the construction of an additional big game passage under the conveyor will be analyzed as an alternative to the vegetative treatment. If the passage is determined to be appropriate, the applicant will be required to construct the passage (or contribute funds).

After the conveyor, waterline, and diversion channel are installed, activities other than on the mine site itself and major access roads will be limited to the period from sunrise to sunset between December 1 and April 15 except for emergency situations. This limitation will minimize the disturbance of concentrated deer and elk. Activity may be authorized after consultation with DOW if animals are not concentrated.

Where natural terrain does not allow for movement of big game animals at least every quarter mile above or under the conveyor belt, then an anrtifical passage will be constructed. Such passages must be a minimum of 8 feet high and 12 feet wide.

DOW and BLM will monitor road kill losses to big game (deer and elk) along Stevens Gulch Road. If the losses exceed 10 animals per winter, the applicant will be required to implement some combination of the following mitigating measures:

1. Reduce traffic on Stevens Gulch Road during the problem period (dusk to dawn) through busing or adjustment of work shifts

2. Reduce speed of trucks and workers on the road

3. Light the problem areas along the road (lights would be designed to minimize visibility from Highway 133 and Paonia)

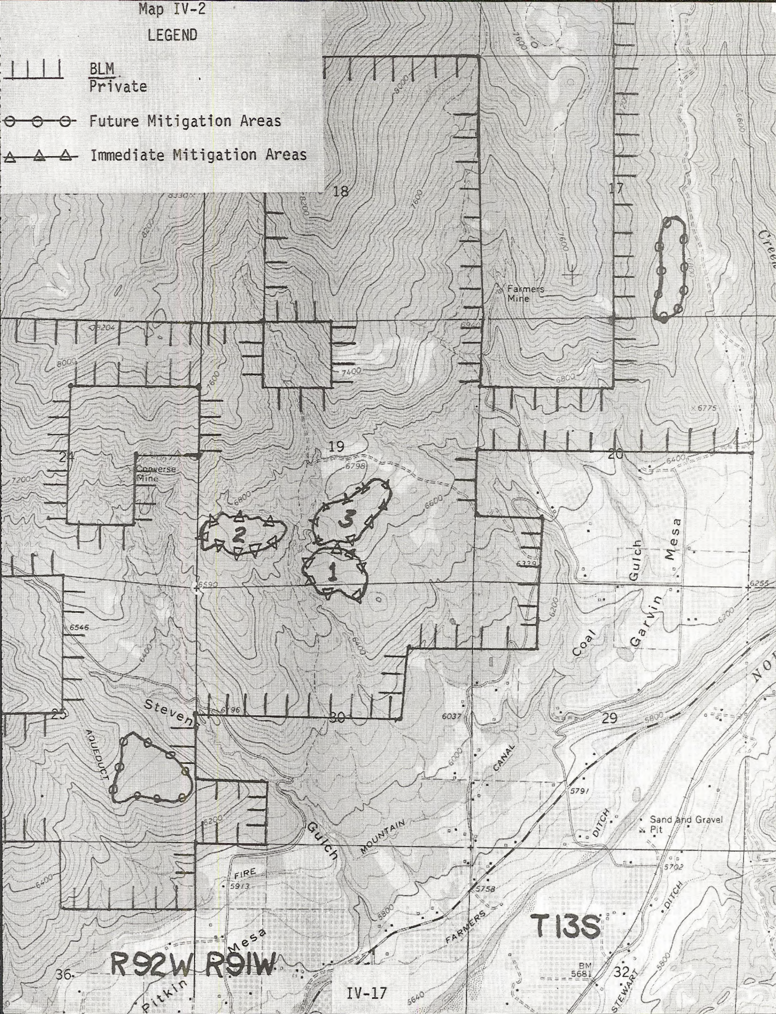
These mitigating measures would only be required during winters when big game are concentrated in the area.

I. Range

Reference Soils, chapter III.

J. Cultural/Historical

Cultural/historical resources will not be impacted; therefore mitigation measures will not be discussed.


Map IV-2
LEGEND
BLM
Private
Future Mitigation Areas
Immediate Mitigation Areas
18
17
Farmers Mine
19
20
24
Converse Mine
1
2
3
Coal
Gulch
Garvin
Mesa
25
30
29
Steven
AQUEDUCT
Gulch
MOUNTAIN
CANAL
DITCH
Sand and Gravel Pit
FIRE
FARMERS
Mesa
Pitkin
T13S
R92W R91W
36
32
STEWART
BM 5681


Map IV-3
LEGEND
BLM
Private
Future Mitigation Areas
R. 92 W.
T. 13 S.
West Long Draw
Roatcap
Creek
The Basin
East
Roatcap
Fitzsimons Mines
DITCH
JEEP TRAIL
TRAIL
10
15
16
17
20
21
22
27
28
29
8030
8370
8082
8225
8197
8173
8041
7076
7820
7800
8000
8200
8400
7600
7400
7200
7000
6800
6600

CHAPTER V

Chapter V - Adverse Impacts Which Cannot Be Avoided Should the Proposal Be Implemented

A. Geology

Some subsidence may occur, but because of the overlying characteristics of the strata and their thickness, the subsidence is expected to be minor.

B. Air Quality

Although CWI is currently complying with the appropriate federal and state emissions standards and has employed best practical control technology to suppress pollutant emissions, some degradation of air quality would still result from their mining operations. Best estimates are that from 25 to 30 tons of suspended particulates would be produced annually from a one million ton per year operation. This quantity of particulate material would not have a significant impact on the air quality of the main North Fork Valley (Marlatt et al. 1977); and in the future as mine expansions upvalley and population growth continue, it would constitute smaller and smaller percentages of emissions in the valley.

Rapid reclamation, use of dust repressing chemical agents, and active watering programs at the mine site, at refuse storage areas, and at construction sites can reduce dust emissions from disturbed areas. However, there would be some unavoidable impact to air quality from wind erosion and vehicle traffic on disturbed areas. The impact which the fugitive dust generated by these sources will have on air quality in the North Fork Valley is probably insignificant (Marlatt, oral communication).

Secondary impacts to air quality which might result from transportation and population increases associated with the Orchard Valley Mine will contribute by a small proportion to the degradation of air quality in the North Fork Valley.

C. Noise

Long-term growth predictions indicate that noise levels could double (an increase of only 3 dBA) in less than ten years without the CWI operation. The major impacts of CWI's proposed actions would include the additional trains through Paonia and construction noise. Transportation corridor noise would also increase.

Additional population growth in the area would also increase ambient noise levels regardless of the result of CWI's application. Additional CWI production would add less than 10 percent to the employment situation; therefore, its secondary impact would be negligible.

D. Visual Resources

The lowermost of the three elevated sections of the conveyor line would remain as an unavoidable adverse moderate visual impact only when backlighted by early morning sun and when a blanket of snow covers the ground in the winter. The line would appear as a dark form against a dark yellow-green or white background. This impact would remain for the life of the project. It represents about 14 percent of the total length of the line.

The significance of this visual impact varies with the attitudes of viewers. It would probably be more significant for visitors and residents who have come to the valley for its scenic, pastoral setting. It would be less significant for residents of the valley who are directly or indirectly dependent upon development of coal or other natural resources. A majority of the people in the North Fork Valley seem to favor controlled resource development and would therefore be willing to accept some impacts. Some people, tourists and residents alike, find coal development facilities in the area a fascinating characteristic of the valley in spite of how unnatural these facilities are. As a final note, a wooden trestle and iron rail existed, with about the exact alignment as the proposed conveyor, for several years in the early 1900's. A photo of this trestle appears on the cover.

E. Recreation

Adverse impacts on recreation in the area would be directly related to the extent of impacts on the visual resources of the area (see "D" above) as sightseeing of the natural environment is the prime recreational activity in the area.

F. Water Resources

The one water quality parameter which cannot be mitigated is dissolved solids. Dissolved solids enter the water system either by leaching, thus affecting the ground water, or directly, associated with surface runoff, entering the stream and river systems. There are no available data which suggest any consistent significant changes in the water quality of ground water from coal mining areas. When changes are found, they are usually related to acid mine drainage. The sediment retention dams would minimize the effects of dissolved solids entering the North Fork of the Gunnison River through overland flow.

G. Soils and Vegetation

A temporary loss of vegetative cover would be unavoidable during construction phases. The accompanying increase in soil erosion would also be unavoidable. The actual magnitude of soil loss would depend largely on the frequency and intensity of thunderstorms during the periods when bare soil is exposed.

H. Wildlife

The construction activities would cause disturbance and stress to nearly all wildlife species for 18 to 24 months. Some individual animals may be lost if they are unable to escape, and some nests or burrows would be destroyed during construction. This impact would affect approximatley 22 acres directly. The resident deer population (estimated to be 10 per square mile) of 30 to 50 animals would be most affected. Development of the waste disposal area would continue for the life of the project but would affect only 4 acres.

The intensity of the impact which may result from the accidental pollution of the aquatic habitats due to structure failures or unpredictable weather cannot be predicted but could be significant.

After initial construction is completed, there would be 15 to 20 acres of habitat partially removed or altered by the proposed action. Most of this acreage would be at least partially available to wildlife as revegetation progresses. Operation and maintenance of the facilities would continue to disturb some individuals and may exclude some species from the area, e.g., mountain lion, bear, bobcat, eagles.

The growth of the community would cause a loss of some wildlife habitat. However, the amount and location of this loss cannot be predicted. The primary loss would result from new dwellings in the pinyon-juniper habitat type and the impact of additional free-roaming pet dogs on big game.

Increased traffic on Stevens Gulch Road by mine employees, as well as increased traffic on other area roads and trails, would cause additional losses and disturbance.

I. Range

There would be a temporary loss of livestock forage (between 10 and 20 acres) due to surface disturbance. Livestock may have to be excluded from revegetated areas to allow for seedling establishment. These impacts would be temporary. (See mitigating measures for vegetation in chapter IV.)

J. Socio-Economic

There may be some adverse impact of local inflation resulting from the project's injection of a net payroll of over $3,600,000 and nearly $1,000,000 in property taxes, unless the service and supply industries respond rapidly to increased demand created by the additional money circulating in the county, or unless recipients of this income spend it with retailers with slack capacity or with retailers outside the immediate impact area, e.g., Grand Junction.

There would be adverse socio-economic impacts on people or incomes that respond slowly to inflation, such as the aged, retirees, public assistance families, farmers and ranchers, education personnel, and local government employees.

As pointed out in chapter II, a substantial proportion of people in the county (28.5 percent) are over 60 years of age, and 21.4 percent are over 65. In addition, 13.8 percent of the population receives some form of public assistance; over 850 people receive old age pensions, over 620 persons receive aid-to-families-with-dependent-children, over 140 receive aid-to the needy-disabled, and over 600 receive food stamps.

Agriculturalists and their families constitute a substantial proportion (an estimated 20 percent) of Delta County's population. They would be affected adversely by any local inflation caused by the proposed project. However, the problems of agriculturalists in the USA are more related to the competitive conditions within their own industry than to the development of the energy industry. The recent closing of the Holly sugarbeet plant is an example. Competitive conditions within the industry have driven thousands of people out of agriculture since the end of World War II. One positive aspect of the project is that it will offer some farmers and ranchers forced out of agriculture an opportunity to obtain a job without moving out of the county or supplement farm incomes by employing members of farm families. Twenty CWI employees are farmers or ranchers supplementing their income by mining employment.

It can be seen from the foregoing that more than half the population of Delta County might, at least initially, receive unavoidable adverse impacts from any local inflation caused by the proposed project. The population in the above social categories is almost certain to be impacted adversely by any local inflationary effect of the proposed project. Public assistance recipients are almost invariably on annual incomes below those designated as the poverty level, as is a substantial proportion of the elderly population, and therefore any stimulant to inflation affects them adversely. The net result of inflation upon this segment of the population is to reduce a marginal standard of living to a lower level. However, mitigation of this impact, obviously, is not the responsibility of the proprietors of the proposed project; the responsibility lies with the legislative branches of the local, state, and federal governments, which will receive positive impacts from the proposed project, as will their constituencies.

The policy of hiring local people is a practical partial solution to the local unemployment/underemployment problem. However, since the proposed project involves federal public land that has been managed for decades at the citizen/taxpayer's expense, there may be an equal employment opportunity question involved in the policy. It would appear that nonlocal citizens who qualify for jobs may have to be given an equal opportunity to work along with local citizens and should not be discriminated against because of their place of residence.

CHAPTER VI

Chapter VI - Relationship Between Local Short-term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

A. Geology

Short-term use of the environment would be for production of coal by underground mining methods, during which nonrenewable coal resources would be permanently removed. Actual long-term productivity with respect to coal would depend on whether or not mining takes place in the long term. Potential long-term productivity, however, would be reduced by the amount of coal removed plus the amount of coal not recoverable by present underground mining methods.

B. Air Quality

Assuming that land surfaces are reclaimed and returned to an equivalent of the pre-existing vegetative cover and general contours, air pollution resulting from mining activities would be short-term, that is, it would occur only during active mining. Air pollution from vehicle exhausts and fugitive dust after mining has been completed would also depend on the subsequent use of the land.

The amount of long-term air quality deterioration due to increased urbanization is difficult to determine. If the labor force remains in the Paonia area after major coal mining operations are completed, urban background pollution will not recede. Furthermore, reemployment might be linked with new sources of industrial emissions.

C. Noise

Short-term impact of the construction would increase the sound levels in the mine area and along the rights-of-way. However, the long-term impact of this lease would be to reduce current noise levels by sizeable amounts. In relation to short-term noise levels, the conveyor and waterline would replace 120 round trips by trucks daily, thereby reducing traffic corridor noise along Highway 133 and Stevens Gulch Road. In addition, efficient loading operations would minimize the length of time coal trains are at the loading facility.

D. Visual Resources

Except for the lowermost elevated portion of the conveyor line, all aspects of the proposed action as mitigated would create visual contrast within the limits of the visual resource management (VRM) classes for the area. Therefore, except for this one instance, the integrity of the visual resource would be maintained.

In addition, the cumulative visual contrast of this proposal combined with the possible implementation (of chainings) of the Stevens Gulch Allotment Management Plan (AMP) should not result in visual contrast exceeding the limits of the VRM classes. The chainings in the AMP will have to be redesigned so that they do not conflict visually with portions of this proposed action.

E. Recreation

If the Stevens Gulch AMP is implemented, the benefits to deer and elk should enhance the quality of hunting in the area and more than offset any lowering of the quality of hunting due to the proposed action.

F. Soils and Vegetation

With adequate revegetation and reclamation efforts, no long-term adverse soil impacts will occur. Long-term vegetative production on disturbed areas may actually increase over the current level.

G. Wildlife

There would be a short-term reduction in the productivity of the impacted area in terms of wildlife population levels (see Impacts). However, in the long term, productivity can probably be restored to near its present levels when the structures are removed and the mine closed. The off-site impacts due to housing, etc., will not likely be reversed and therefore will result in a permanent reduction of the wildlife productivity of the area.

H. Range

There would definitely be a short-term loss of vegetation, resulting in less forage for both wildlife and livestock. However, with proper revegetation, the disturbed areas should eventually be restored to a condition better than what existed before the surface disturbance.

CHAPTER VII

Chapter VII - Irreversible and Irretrievable Commitment of Resources

The major irreversible and irretrievable commitment of resources by the proposed and possible future mining activities would be the production for consumption of about 40 million tons of coal.

Removal of soil by erosion constitutes for practical purposes an irretrievable loss of the soil resource from the area. Loss of vegetative production during construction and initial reclamation will also be irretrievble. Both erosional and productivity losses are reversible.

The accelerated change in life-style of people in the development area is an irreversible and irretrievable commitment of resources.

All the social and physical energy and materials committed to the construction and maintenance of the project will be irreversible and irretrievable. Translated into dollars according to CWI sources, this amounts to $9,357,000 initially and $7,648,569 annually for 50 years. Of the latter, $2,646,298 would be for capital investment and $5,002,271 would be for labor.

CHAPTER VIII

ALTERNATIVES

Chapter VIII - Alternatives

There are five alternatives to the proposed action.

A. <u>Alternative One</u>

One alternative is "no action;" i.e., do not offer the lands for coal leasing or right-of-way purposes. This alternative would prevent the disruption of about 20 acres, the problems with big game migration along the overland conveyor belt, and the visual impacts as seen from the area adjacent to Paonia which would result from the proposed action. It would have the following additional impacts.

If this alternative of "no action" is recommended by the Bureau of Land Management, Colorado Westmoreland (CWI) would be forced to consider one or more of the following actions:

1. Negotiate a cancellation or delay of the existing contract and await recommendations from the West Central Regional Coal Environmental Statement as to whether leasing should continue.

2. Close the Orchard Valley Mine by the first of the year (1978).

3. Mine out the three seams located on their present leasehold.

The Orchard Valley Mine is producing 1,500 tons per day from the private coal lands. Due to the limited reserves of private coal on this land (about 48 acres), this production may be halted as soon as January 1978. There are several important aspects of mine closure that should be discussed.

First, there are three minable coal seams on Westmoreland's private coal lease. If the lower two seams are mined prior to full development of the uppermost "D" seam, including the federal portion of the "D" seam, it would probably destroy the existing access to that seam from the Orchard Valley Mine and ruin the existing mine for future production. In addition, if the three existing seams are mined, the mine would be forced to close by December 1980.

Second, if the mine closes down, the existing mine facilities would be maintained to prevent deterioration until further coal is available. Chances are that the reclamation plans for the existing disturbances would also be delayed, thus continuing the visual scars on the private coal lands on and adjacent to the Orchard Valley Mine. There are approximately 35 acres of land cleared for the mine and its associated facilities. This area is highly visible from the town of Paonia.

Third, if the mine is forced to shut down, there would be higher unemployment rates, decreased revenues to Delta County, less spending in the local communities and probably a reduction of goods and services offered in the local communities. Fewer direct employment jobs would mean fewer auxiliary jobs, less cash flow, smaller tax base, etc., and therefore, decreased opportunity to increase standards of living in the immediate area.

It should be noted, however, that some citizens in the North Fork region are opposed to the economic growth associated with implementing the proposed action and view the reduced growth as beneficial. They argue that the traditional measure, "standard of living," perhaps cannot be equated with "quality of life." Increased standard of living created by economic growth can reduce quality of life. The argument continues that unrestricted growth is impossible in the long run because of limits on resources, and, therefore, steps should be taken now to change to a widely acceptable social and economic pattern that does not rely on economic growth for success.

The lay-off of 109 workers by the Orchard Valley Mine would increase the unemployed population of Delta County by 27.5 percent and bring the unemployed labor force to 9.0 percent from the 1976 average of 7.1 percent. In addition, the ex-employees' $1,600,000 net payroll would no longer be injected into Delta County's economy.

During the period of unemployment, especially if it lasts long enough that unemployment insurance payments run out (26 weeks), the probabilities are high that there would be increased emotional stress in the unemployed workers' families. As a consequence of this stress, there is very likely to be an increased number of divorces and increased emotional and mental ilness among unemployed worker family members, including the children.

One further impact of not leasing the land is a further delay in the national objective of energy self-sufficiency and the President's call for immediate increased coal production.

B. Alternative Two

The second alternative is to lease 1,040 acres of the uppermost "D" seam in order to satisfy Westmoreland's contract needs with Northern Indiana Public Service Company (NIPSCO). The contract calls for a maximum of 700,000 tons of coal per year to be loaded in a unit train at the tipple (silos) for a minimum of fifteen years. However, during years sixteen through twenty, NIPSCO has the right to require CWI to supply a maximum of 700,000 tons per year. Consequently, alternative two should be based on a twenty-year contract. This would also coincide with the twenty-year minimum leasing period provided by the Mineral Leasing Act of 1920, as amended.

From what is presently known about the federal coal, approximately 1,040 acres of the uppermost "D" seam would be needed to fulfill Westmoreland's contract with Northern Indiana for twenty years. The calculations made in deriving the acreage estimate are as follows:

Assume:

Mine production rate = 700,000 tons/year maximum
"D" seam = 27 feet thick, only 12 feet minable under present technology.
1,740 = tons of coal/acre/foot
33 percent = recovery of coal on the advanced phase of mining.

An additional 32 percent of the coal will be recovered through the removal of pillars and main barrier pillars during the retreat phase of mining.

$$1{,}740\ \frac{\text{tons}}{\text{acre foot}} \times 12 \text{ feet} \times 0.65 \text{ recovery} = \text{recoverable } 13{,}572\ \frac{\text{tons}}{\text{acre}}$$

$$700{,}000\ \frac{\text{tons}}{\text{year}} \times \frac{1 \text{ acre}}{13{,}572 \text{ tons}} = 51.57\ \frac{\text{Acres}}{\text{year}}$$

$$52\ \frac{\text{acres}}{\text{year}} \times 20 \text{ years} = 1{,}040 \text{ acres}$$

The 1,040 acres is based on the extraction of 12 feet of coal. The exact acreage needed will not be known until an analysis is made of the drill data that CWI will submit to U. S. Geological Survey (USGS) near the end of July 1977.

CWI holds under lease 120 acres of private land, of which there are only about 48 acres of workable fee coal reserves. A significant portion of this seam has been burned-out and, consequently, may adjust the 48 acre estimate upwards or downwards, depending on the exact location of the burn line.

CWI's first production came on December 13, 1976, and as of June 15, 1977, its cumulative production was 100,000 tons, ±5,000 tons. Accordingly, from June 15, 1977, it will take approximately 9.5 months for CWI to extract the minable coal from the 48 acres of private land (or until about April 1, 1978). This estimate is calculated as follows:

$$13{,}572\ \frac{\text{tons}}{\text{acre}} \times 48 \text{ acres} = 651{,}456 \text{ tons (total recoverable fee coal in "D" seam)}$$

Since 100,000 tons have already been mined, the total recoverable fee coal in the "D" seam is now about 551,456 tons. CWI, at NIPSCO's request, will be mining about 58,333 tons per month (700,000 tons/year ÷ 12 months).

$$551{,}456 \text{ tons} \times \frac{1 \text{ month}}{58{,}333} = 9.5 \text{ months}$$

However, prior to the 9.5 months (April 1, 1978), development must begin in the federal coal to sustain the required production levels. This development, according to USGS, will be needed by the first part of January 1978.

The disadvantages of leasing only the 1,040 acres are as follows:

1. Maximum economic recovery of the "D" seam from the existing surface facilities would not be possible if the coal beyond the needed 1,040 acres is blocked off.

2. Retreating the panels on each side of the main entries throws excess pressure onto the mains. Therefore, safety is jeopardized.

3. If water is encountered with advance mining, it will continuously run toward the faces. If excessive, it would have to be pumped.

4. Should a fire occur in a panel on advance, it means that mining must progress towards the working face or interior of the mine which is a more dangerous situation than containing a fire behind retreat mining.

Should the lease be issued under this alternative the physical environmental impacts, as described in the proposed actions, would be the same. The conveyor belt and other rights-of-way would still be needed.

Westmoreland now has 109 employees and they are producing about 1,500 tons per day at 320 days per year. Under this alternative the employment is expected to increase to 150. This means a net gain of 41 employees. As of June 23, 1977, CWI had approximately 1,300 applications from prospective employees on file, two-thirds of which are from the Delta-North Fork Valley area.

C. Alternative Three

Alternative three involves leasing the maximum length of the uppermost "D" seam as is deemed technically feasible in the interest of maximum economic recovery and safety. This feasibility determination will be made by USGS only after an analysis is made of CWI's coal data from its exploration drilling program currently under way. (The location of the exploration holes can be found on map I-1, in chapter I.)

This alternative may provide up to an estimated 2,500 acres of minable coal in the "D" seam. The amount of recoverable coal would be impossible to determine without drill data, but, from what is known about the coal in the area, 40 million tons would be a reasonable estimate. In CWI's short-term application, it was stated that up to 1.25 million tons of coal would be mined annually if additional contracts could be obtained. At this rate of production there may be adequate coal reserves for about 32 years. To obtain this production there would ultimately be 250 employees.

Under this alternative the main entries are advanced to the northern boundary of the minable "D" seam. Then the panels, chain pillars,* and barrier pillars** are all retreated.

The advantages of this alternative include:

1. It allows access to the entire length of the "D" seam with sequential advance and retreat, thus maximizing the economic recovery of the coal from the existing surface facilities.

2. It provides for greater safety in that all pillaring progressed up-dip, allowing the overburden weight to be thrown away from the mining activity and into the mined-out area.

3. It provides greater flexibility since all panels are accessible at any time for starting up a section.

4. If water is encountered, it will collect in the mined-out area, and percolate into the ground water.

5. It provides better containment of possible fire hazard. It will be better to contain the fire behind mining rather than have to mine past it in the case of a panel fire on advance.

Should the lease be issued under this alternative the physical environmental impacts would be the same as described in the proposed actions, as would the social and economic impacts.

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* Chain pillar is a pillar left to protect the main haulways and airways.

** Barrier pillar is a large block or rib of coal left around a property to protect it against water and squeezes from adjacent property.

D. Alternative Four

Alternative four involves leasing only as much of the "D" seam as is necessary to satisfy CWI's present contracted needs with NIPSCO (700,000 tons per year) for eight years. This alternative is consistent with the Secretary of Interior's proposed new short-term leasing criteria in that it would be an eight-year lease to an operating mine, contiguous to federal coal, with a contract to supply coal to an existing power plant presently using coal. CWI would be required to obtain an amendment to its existing contract with NIPSCO, which now provides that NIPSCO may at its option cancel the coal supply contract if CWI does not obtain a federal coal lease of coal reserves sufficient to supply the first 15 years of coal deliveries.

The leasing of a tract for eight years with a production rate of 700,000 tons per year would result in leasing an area containing 5,600,000 tons of recoverable coal. The exact acreage needed and method of mining would be determined by USGS prior to formulation of a lease schedule for the Secretary. The method of mining which USGS would approve would assure development would proceed in such a manner as to allow future access to all recoverable coal on the north, east, and west of the lease tract. This is important to assure maximum future recovery of the federal coal reserve in the "D" seam and to provide for better mine safety.

Should a lease be issued under alternative four and should CWI be the successful bidder, physical environmental impacts would possibly be the same as those described in the proposed action with the following probable differences. Impacts from an eight-year operation would occur over a more limited period of time than that contemplated in the proposed action. The extent of the commitment of the federal coal resources would be reduced, although (as pointed out above) future recovery of those resources would not be impaired by implementing an eight-year mining operation as outlined by USGS. In addition, as described under alternative two, increasing production from the present level to 700,000 tons per year would require an increase of employment from 109 to 150. Therefore, impacts on the area infrastructure would be different from those described under the proposed action.

Furthermore, should CWI determine that this rate of mining (700,000 tons per year) would not financially support installation of the conveyor belt system, then the impacts on the environment would be substantially different. Assuming installation of the conveyor system would not occur, the following impacts could be anticipated.

1. The resource impacts caused by the conveyor belt as described under the proposed action would not occur.

2. The impacts of the additional construction work force on the infrastructure as described in the impact chapter under the proposed action would not occur.

3. The trucking of coal would continue through the entire eight years rather than the initial 15 to 18 month construction period.

4. The impacts on noise, air and the transportation network described under the proposed action would be carried through an eight-year period rather than the initial 15 to 18 month construction period (see chapter III).

5. Revenue to Delta County and impacted communities from property tax, federal royalties, state severance tax, etc., would be less than under the proposed action.

Implementation of this alternative would be consistent with the new short-term federal coal leasing criteria as proposed by the Secretary of the Interior on July 25, 1977. A full environmental and policy analysis of the Department's leasing activities in West Central Colorado and elsewhere could be undertaken before any additional commitments of coal to this particular area were allowed.

E. Alternative Five

Alternative five involves leasing only as much of the "D" seam as is necessary to meet CWI's anticipated production rate of 1 to 1.25 million tons per year for eight years. CWI's original lease application stated it would continue negotiations with coal users to obtain contracts sufficient to increase its production to approximately 1 to 1.25 million tons per year. CWI is presently continuing to pursue additional contracts; therefore, this is a viable alternative to the proposed action. This alternative is also consistent with the Secretary of Interior's proposed new interim short-term leasing criteria in that it would be an eight-year lease at the higher of contracted-for or expected rates of production for eight years. Under the proposed new short-term criteria, should a lessee not obtain contracts for the anticipated production level of 1.25 million tons per year within six months of the time of a lease issuance, its lease would be subject to forfeiture or cancellation. Under the proposed new leasing criteria a company may not obtain a lease for coal which is not contracted for or covered by letters of intent prior to the time of lease issuance.

The leasing of a tract for eight years with a production rate of 1.25 million tons per year would result in leasing an area containing 9,750,000 tons of coal. The exact acreage needed and method of mining would be determined by USGS prior to formulation of a lease schedule for the Secretary. The method of mining which USGS would review and approve would assure development and would proceed in such a manner as to allow future access to all recoverable coal on the north, east and west. This is important to assure maximum future recovery of the federal coal resource and to provide for greater safety.

Should a lease be issued under alternative five the physical environmental impacts would be the same as those described in connection with the proposed action. The conveyor belt and other associated rights-of-way would still be needed. Impacts from an eight-year operation, however, would occur over a more limited period of time than that contemplated in the proposed action. The extent of the commitment of the federal coal resources would be reduced, although future recovery of those resources would not be impaired by implementing an eight-year mining operation as outlined by USGS which would assure maximum future recovery of the federal coal reserves.

CWI would be required to obtain an amendment to its existing contract with NIPSCO, which now provides that NIPSCO may, at its option, cancel the coal supply contract if CWI does not obtain a federal coal lease of coal reserves sufficient to supply the first 15 years of coal deliveries.

Implementation of this alternative would be consistent with the new short-term federal coal leasing criteria proposed by the Secretary of the Interior on July 25, 1977; and a full environmental and policy analysis of the Department's leasing activities in West Central Colorado and elsewhere could be undertaken before any additional commitments of coal to this particular area were allowed.

COMPARISON OF ENVIRONMENTAL IMPACTS OF ALTERNATIVES

If the "no action" alternative were chosen, the environmental impacts described in this final EAR as resulting from issuing a 2,230-acre lease and approving CWI's right-of-way applications for a twenty-year mining operation would not occur. These impacts include the disruption of about twenty acres, impacts on wildlife from conveyor belt construction and operation, and the visual, socio-economic, air quality, water quality, land use, hydrologic, and other impacts described in chapter III. Choosing the "no action" alternative would preclude employment of the 141 additional employees by CWI required for full production and would reduce the supply of low sulfur, high-quality coal available to NIPSCO and other users.

The "no action" alternative would have the following additional impacts:

- Current production from CWI's private coal lease on the "D" seam could be halted as soon as January 1978, and CWI's current labor force would be laid off. If this occurred CWI could produce additional "D" seam coal and maintain existing employment levels for a longer period of time, but this would involve removal of main and barrier pillars on a retreat phase of mining within the private fee coal areas. Such a retreat would preclude future access to the federal "D" seam reserves from CWI's existing mine. CWI could also seek to stay in production by mining the lower seams under its private leased lands, but this would also preclude future access to the federal coal in those seams and in the "D" seam as well.

- Unit train operations from CWI's mine would cease.

- Coal and water truck operations would continue until the fee seam mining was halted.

- Unemployment would increase in the areas from which current CWI employees are drawn.

- CWI's payroll would cease to be a factor in the local economy.

- Severance tax revenues generated by coal mining would cease. Federal royalties (1/2 of which is returned to the State of Colorado) would not be generated.

- Local ad valorum taxes based on capitalized leasehold production value would not increase further, and would drop significantly after production halted.

- Local taxes based on the assessed valuation of mining property would not increase further if additional facilities are not constructed, and these tax revenues would cease if CWI dismantled its mining facility.

The "leasing" alternatives discussed above would all reduce the amount of coal reserves being leased below the amount CWI originally applied for and (in the case of Alternatives 2 and 4) would limit production rates to a maximum of 700,000 tons per year, either over the life of the NIPSCO contract or for eight years. Alternatives 3 and 5 would permit the current mining rate to increase. Under Alternative 3, the rate of mining could increase to meet CWI's future sales commitments for "D" seam coal, limited only by the capacity of the mining operation. Under alternative 5, the rate would increase to a maximum of 1.25 million tons per year for eight years to meet CWI's contracted-for and expected levels of production at the time of lease issuance.

Limiting the amount of the coal resource to be leased would correspondingly reduce the amount of leased acreage and the extent of the commitment of federal coal resources. The amount of the reduction would depend not only on the amount of coal underlying the potential leasing acres, but on the degree of coal recovery which is deemed both to be safe and to allow maximum future recovery of the federal coal resource. If the recovery rates proposed by CWI in preliminary mining plans are not ultimately accepted, a larger "D" seam coal acreage would be required in order to lease the same amount of recoverable reserves. The choice of any "leasing" alternative would maintain or increase local and state tax revenues, proportionate to the amount of production and additional investment by a successful lease bidder.

CWI has stated to BLM that any lease which freezes its coal production at existing levels of 700,000 tons per year would not produce sufficient revenues to CWI to support installation of the conveyor system or drainage diversion ditch, but would in all likelihood support installation of the water pipeline and sedimentation dams as proposed, thus reducing sedimentation and runoff from their existing levels. Offering such a lease could mean continuation of the coal trucking operation with the attendant dust, noise, and other impacts over an eight-year period or until additional coal becomes available. Water trucking, consisting of approximately one truck per twelve-hour day, would cease. The other physical impacts of mining would remain constant, while construction impacts would be substantially reduced. With a lease limited to production of 700,000 tons per year, CWI's existing employment levels would probably increase from 109 to 150, and this would add proportionately to socio-economic impacts. The additional impact of 41 employees is likely to be negligible, however, since this group of employees could almost certainly be hired locally.

The physical environmental impacts of issuing a lease for production of 1.25 million tons per year would be the same as those described in connection with the proposed action. Although CWI would receive a lease for federal coal reserves which are smaller than those it applied for under the 1973 short-term criteria, CWI has indicated that it would be able to justify and would make the financial investments required to install the coal conveyor system, the water pipeline and power line, the diversion ditch and sedimentation dams as originally proposed in its pending right-of-way applications. As was discussed above, CWI has advised BLM that a lease for reserves smaller than eight years at a production rate of 1.25 million tons per year would not justify such a commitment.

Impacts from an eight-year lease coal operation, however, would occur over a more limited period of time than that contemplated in the proposed action. The extent of the commitment of federal coal resources would be reduced, although future recovery of those resources would not be impaired by implementing an eight-year mining operation under an appropriate mining plan. CWI would also be required to obtain an amendment to its existing contract with NIPSCO if an eight-year lease were offered.

CHAPTER IX

Chapter IX - Public Interest and/or Controversy

Public interest and controversy on Colorado Westmoreland's Federal coal leasing application and the permitting of associated facilities on public lands are extremely widespread throughout the North Fork Valley. In July of 1973, Delta County, BLM, and the U.S. Forest Service initiated development of land use plans involving private and public lands throughout Delta County and portions of Gunnison County up the North Fork of the Gunnison River. During the initial development of these plans, numerous meetings involving local officials, social clubs, concerned citizens, coal companies, and the public at large were held to gather information from the public as well as to discuss and clarify various points of interest and concern. As a result of the cooperative effort and of the public involvement, BLM developed the North Fork management framework plan (MFP). This was completed in the spring of 1974 and presented to the public for their comments. At that time, the Delta County residents supported the recommendations of the North Fork MFP.

Since that time the Montrose District Office has completed three environmental assessment reports (EARs) related to coal development in the North Fork Valley. These are (1) #50-74, Federal Coal Leasing in the North Fork Valley, (2) #05-030-5-48, EAR on Colorado Consolidated Coal Company Tramroad Right-of-Way, and (3) #50-74, The Twenty-Year Readjustment of Coal Leases, Supplemental. Each of these environmental reports have been subjected to public review and comment.

The Delta County 1041 survey of 1974-75 (a community-by-community survey conducted under the provisions of Colorado Land Use Legislation House Bill 1041 by the County Land Use Administrator); the newspaper poll on coal development sponsored by the Citizens For a Stronger Delta Economy, February 1974; and the FUND report, March 1975, substantiate the interest in coal development in the North Fork. A copy of the newspaper poll is made a part of this report (appendix J-1.) The results of the 1041 survey indicated that 69 percent of the people favored coal development to improve the overall economic base of Delta County.

Montrose District Office has received numerous letters, both pro and con, on the leasing of Federal coal as well as on the associated facilities such as roads, tramroad rights-of-way, powerlines. This office has welcomed comments from citizens of the North Fork Valley pertaining to the actions taken by BLM involving the public lands in this area. To date we have received numerous letters and resolutions from county commissioners, city councils, mayors, school groups, clubs, special interest groups, and private citizens; many news articles and editorials from the press on both the local and state level; and numerous comments made during and after meetings held with local citizens in the valley. There have also been a number of studies conducted by various groups such as the Foundation for Urban and Neighborhood Development, the Bureau of Economic Research; there have been polls taken by the Colorado Land Use Planning Commission and Citizens for a Stronger Delta County Economy.

From all of these sources, the attitudes and expectations of residents of Delta County have been well defined. Some of these are: maintenance of agriculture and a quiet rural atmosphere, continued controlled underground coal mining with increased job opportunities, self-determination with preference for local government over local, regional, state or Federal control.

During the spring of 1974, Delta County residents began to use repeatedly the phrase "orderly growth" in attempting to describe the type of industrial development they favored for the North Fork Valley. The Grand Junction Daily Sentinel, on April 12, 1974, reported that main concerns expressed by the meeting group were for orderly growth and the effects of future coal development on the environment, particularly air and water quality, should the future development include power plants.

The Board of County Commissioners for Delta County in a letter, dated April 18, 1974, supported the concept of orderly growth when they state, "Prime concern should be given to the protection of the environment and to the existing enterprises in the area. We recommend leasing with the following provisions. As leases are granted, county and local officials should be notified that leases have been granted and the grantee should notify said local officials of their intentions of operations and intentions regarding operations so that local officials can prepare for local impact of these operations."

A letter by Gary Sparkman, Mayor of Hotchkiss, dated December 26, 1974, expanded on the theme of orderly development. It stated, "As pointed out by others, we are not against growth in this area; however, we would like time to prepare for it so it can take place in an orderly fashion and not have an adverse effect on the environment, social structure and economy of this area."

As the orderly development of the North Fork Valley's coal resources became a major theme, residents began to evaluate the ability of their area to deal with the growth associated with coal development. The University of Colorado study, the FUND study, and public meetings held by BLM record the concerns of many citizens. In the summer and fall of 1974, representatives of coal companies, particularly Atlantic Richfield and Adolph Coors, acknowledging the community's concerns, began projecting major coal development in the North Fork Valley beginning in 1977 and

1978 (see "Coal to be Developed," Delta County Independent, September 19, 1974; "1977 Earliest New Coal Growth," Delta County Independent, September 16, 1974; and "New Large North Fork Coal Leases Years Away BLM Says," Montrose Daily Press, August 20, 1974). At that time the need for planning was officially recognized as critical to the area ("Planning Key To North Fork Future," Daily Sentinel, September 16, 1974). Editorials encouraged residents to be aggressive in insisting on improved public services, adequate water, sewer facilities, planning and zoning.

As Delta County residents proved less than aggressive on these issues, the editorials also accused them of sticking their heads in the sand. Since 1974 Delta County has continually voted down zoning resolutions and school bonds. As a result the situation in Delta County which crystallized in mid-1974 is essentially the situation which exists today. Although limited attempts have been made to deal with future coal-related impacts (most notably in the city of Paonia) and although coal companies appear to have excellent relations with local officials, the area has made little progress in improving its ability to maintain its present lifestyle in the face of projected coal-related development. Recognizing this, people express the same fears today as they did in 1974. A massive letter-writing campaign is being conducted by concerned groups and individuals in the North Fork area as this EAR is being prepared. The letters BLM has received to date differ very little from the comments received in 1974. Some of the comments being received are as follows:

> "North Fork citizens are concerned that coal development might create a short-term boom which brings in a large transient population, crowds schools, public services, and destroys the quality of our air and water. We seek development which will provide slow improvement over a number of years, provide employment for the people of the Valley rather than outsiders, and maintain the quality of our environment and scenery."

> "Are you not aware of the multitude of problems that large, unchecked coal development will cause? How are we to deal with the circumstances that a sudden influx of people will cause, especially in relation to schools, traffic, water, housing, not to mention wildlife and the quality of recreation areas?"

> "I've lived in the North Fork area for some time and I'm concerned for my family, friends, and surroundings. I really cannot agree with your hurryup policies and refuse to stand by while you let this type of irresponsibility go on."

> "We as a community need time and knowledge to prepare for an onslaught of new folks and businesses coming here."

"We're land owners having chosen to make our homes in this area for its natural beauty. We value the North Fork Valley's clean air and its abundant wildlife, both flora and fauna. We value the area for what it has provided our children for the past three years and know from personal experience what can happen to schools when rapid, unplanned growth occurs in an area. We are most concerned for other areas which provide for the quality of life in this small community."

"i.e., water, sewage, medical facilities, etc. At the same time we do recognize the need for the planned development of coal. It must be stressed, however, that we feel coal must be developed at a reasonable rate so as to protect the fragile environment"

"I'm all for development which I know we have to have, and it's going to come. But do we need so much all at once. I realize we've known for two years it's coming and had time to get ready and didn't. But let's absorb one mine at a time instead of letting leases to all of them at once."

In summary, a few Delta County residents completely oppose coal development. Most feel that the coal resources of the North Fork Valley should be developed to supply needed energy both locally and nationally. They agree that priority must be given to maintaining the existing rural lifestyle despite any coal-related growth, but they are largely divided on when, where, and how fast orderly growth can occur and are uncommitted as to the best method of dealing with the impacts growth will produce. Again, the concerns of today are the same as those expressed in 1973 and 1974: "Give us more time to plan; we realize development is coming but we need additional time to anticipate and prepare for the impacts that will occur through increased coal development."

Comments on Draft EAR

The purpose of this section of Chapter IX is to address those comments received from the public (both oral and written) which pertain to the technical adequacy of the draft environmental assessment report prepared for Colorado Westmoreland's Coal Lease Application. No attempt will be made to categorize statements into "support" or "nonsupport" of coal leasing.

Furthermore, each individual comment concerning a particular point will not be addressed specifically, but rather comments will be summarized and addressed by discussion topic as they were outlined in the body of the EAR. Thus, all comments concerning geology will be summarized and answered in one section and so on through socio-economics.

A. Procedurial

1. Comment: The EAR does not document that the lease application meets the short-term leasing criteria. There is not a need for the coal to maintain an existing mining operation because little coal had been mined when the application was filed. CWI is seeking a lease for more reserves than it needs for its existing contract production.
Response: This comment raises arguments that misconstrue the 1973 criteria. The final EAR, as did the draft, fully documents that the CWI application meets the 1973 short-term Federal coal leasing criteria that (a) the coal is needed to maintain an existing mining operation, or (b) the coal is needed as a reserve for production in the near future. Under BLM procedures (Instruction Memorandum 73-231) the "need" for coal under the 1973 criteria was shown if the applicant had a coal sales contract and would begin its operations in 3 years. Under these criteria, if the applicant would begin mining in 3 years, the department could grant a lease of any size appropriate under the Federal Coal Leasing Amendments Act of 1976, which requires extraction of the recoverable reserves under lease at a rate sufficient to deplete them in 40 years. CWI had begun mining operation and had a producing mine at the time it filed its application, and it proposed to begin producing from Federal coal as soon as a lease could be issued and a mining plan approved, at a rate which was adequate to satisfy the production requirements. As is shown in the final EAR, the CWI application also meets the proposed new leasing criteria announced by the Secretary on, July 25, 1977, whether it is considered to be for an existing or a new mine.

2. Comment: MFP recommended 480 acres under short-term criteria. Why has this now been changed to 800-1,000?
Response: That MFP recommendation is still in the North Fork MFP and has not been changed. As noted in the EAR, the MFP sets guidelines for management actions.

3. Comment: The coal resources in the lease area should be analyzed further before any leasing decision is made.
Response: As the final EAR explains, CWI has submitted additional drilling results and these will be further analyzed by USGS and BLM before any lease tract recommendation is made and the fair market value of the coal to be leased is determined.

4. Comment: The EAR should discuss the compatibility of current and near-term levels of coal production in the North Fork Valley with other land and resource uses, including land use impacts of identified hydrologic effects, water consumption effects, and any possible impacts of subsidence on pre-mining land use. Post-mining land use and removal of mining facilities should be addressed as well, and a plan required.
Response: The final EAR discusses potential land use impacts of the proposed action, including the potential impacts of water withdrawal and consumption, possible subsidence, disturbance of surface for mining facilities, and mitigating measures such as subsidence monitoring and control and reclamation of disturbed areas. In order to obtain approval of a mining plan a successful bidder will be required to provide for reclamation of all areas disturbed during mining (including pipeline and conveyor construction areas on both private and public lands) as soon as practicable and for removal of mining facilities after the mining operation is completed.

5. Comment: The EAR should identify other permits and approvals which will be necessary for mining to proceed, and should give timetables for obtaining them.
Response: The final EAR sets forth the permit requirements and states CWI will apply for the permits as soon as a lease is issued if it is the successful bidder at the lease sale. It is not possible to state when all necessary approvals will be obtained.

6. Comment: Granting a lease to CWI would set a dangerous precident for future dealings with energy corporations, who would seek to find "loopholes" in the leasing rules.
Response: No such precident is in fact created, and CWI did not seek any improper advantage. Each application for an energy-related permit or right-of-way, each lease sale decision, etc., is now analyzed and will continue to be analyzed and acted upon by BLM on its own merits pursuant to the laws and regulations in effect at the time the action is taken. Approving the CWI project does not make more likely any future short-term criteria applications, and no other short-term criteria lease applications are now pending in the North Fork Valley. BLM intends to apply the revised short-term leasing criteria to CWI's lease application, and will apply those criteria to any future short-term applications which it receives.

7. Comment: The CWI-NIPSCO coal contract does not contain penalties for nonperformance. Can it be considered truly binding to qualify CWI under the revised short-term criteria?
Response: The CWI-NIPSCO contract requires CWI, if it obtains a Federal coal lease as applied for, to deliver stated amounts of coal of specified quality at specified times at specified prices. It also requires NIPSCO, if CWI obtains a lease, to accept deliveries and pay for the coal. CWI and NIPSCO agreed to the contract, and neither party can breach the contract once a lease is issued and mining plan approved without incurring a liability to the other. The contract is therefore considered to be binding.

8. Comment: May CWI obtain a lease under the revised short-term criteria for more than 700,000 tons of coal per year for eight years, based on the NIPSCO contract?

Response: The proposed new short-term criteria provide that BLM may offer a lease to provide eight years of reserves to meet contracted-for or expected levels of production, whichever is higher. Expected levels of production means a letter of intent or similar commitment to deliver coal from the short-term applicant to a buyer. If a lease is issued on the basis of expected levels of production, the lessee must obtain a contract conforming to the letter of intent within six months after the lease is issued or forfeit the lease. Therefore, CWI may obtain letters of intent or similar commitments and obtain a lease based on additional expected production beyond the coal contracted for now.

9. Comment: A condition of the lease should require acceptance and compliance with provisions for mitigation of impacts identified in the regional coal ES to be prepared for West-Central Colorado.
Response: This is a policy decision, and will be addressed at the proper time.

10. Comment: A reclamation plan should be included with the description of the proposal on page I-3.
Response: It is standard procedure that reclamation plans go with mining plans.

11. Comment: Alternative routes for the conveyor system should have been addressed.
Response: Alternative routes for the conveyor were discussed with CWI and analyzed independently and no feasible alternative route for the conveyor itself was found to exist. BLM has determined that an alternate route for the conveyor access road was available and has required that route to be implemented to reduce road construction.

12. Comment: Environmental impacts which have already occurred on private lands should be discussed because they came about in anticipation of receiving a Federal lease.
Response: The existing mining operation initiated by CWI is described in the EAR as a part of the environment in which the proposed action would take place. The mining operation was placed in production on fee coal without any prior Federal approval required. Accordingly, the existing private lands development is not a part of the proposed action or subject to Federal approval so as to require analysis in the EAR to comply with the National Environmental Policy Act.

13. Comment: Potential secondary impact of population growth on public services resulting from other potential energy development. Projects in the area should be considered in the EAR in connection with the proposed action.
Response: The potential population growth impact resulting from implementing the proposed action have been assessed in the EAR. Other projects are not functionally related to and will not be triggered by implementing the proposed action. No resources committed through implementing the proposed action represent a Federal commitment to allow other mines, which will be analyzed in terms of the conditions and public policies existing at the times they are considered for approval.

14. Comment: The EAR does not indicate what measures are to be taken to require CWI to carry out mitigating measures and to correct violations.
Response: The final EAR indicates the regulatory measures requiring mitigation of environmental impacts. These include Federal and State environmental statutes and regulations which are enforced by a number of independent government agencies through on-site inspecitons and reporting requirements. A number of the Federal laws (e.g., the Clean Air Act, the Federal Water Pollution Control Act, as amended, the Surface Mining Control and Reclamation Act of 1977) contain "citizen suit" provisions by which individuals can bring suit to require regulatory agencies to enforce the statutes if they unfeasonably fail or refuse to do so.

15. Comment: The proposed action would have many significant, long-term effects on the human environment, and there is a high level of controversy over the proposed action. An environmental impact statement must therefore be prepared on the proposed action.
Response: The final EAR indicates that the short- and long-term effects of issuing a lease which would allow the CWI mine to continue production will not have a truly significant effect on the qulaity of the human environment. Most impact have been shown to be minor; moreover, the overall impact of the mining operation will be slight. Most of the controversy referred to is controversy over the general idea of increased mining and potential changes which might come about if other mining operations should occur later. There is not a truly high degree of controversy concerning the environmental impacts of the CWI mining operation, in and of itself, although there is a high degree of interest in the subject of mining generally. BLM is now holding hearings on EMARS leasing and is aware of public expressions on the subject in the North Fork Valley.

B. Geology

1. Comment: There does not appear to be any discussion of benefaction of the coal beyond the crushing stage. If coal does not require further processing for shipment beyond crushing, this should be made clear.
Response: The coal would require no further processing before shipment, except that the railroad cars and stockpiles would be sprayed with Analco 88-20 Product, a chemical binding agent, to keep down the dust.

2. Comment: Will the proposed action require a lime supply? If so, will it have to be furnished locally or will it be brought in from outside?
Response: Yes, lime will be required. The present supply will be from out of the area. However, there is a possibility that in the future it may be supplied locally.

C. Air Quality

1. Comment: Additional baseline data on existing air quality, based on data gathered in the study area, should be provided in the EAR. The air quality impacts discussion should be improved, with utilization of area source emissions inventories and other predictive measures. Estimates of emission levels should be quantified, and additional documentation should be provided in support of the conclusions reached.
Response: Air quality data and analyses, including study area atmospheric modeling have been included in the final EAR. These data were not available when the draft EAR was prepared. The final EAR now sets forth an inventory of air pollution sources with quantities of emissions from each, the levels of increases and decreases to be expected from these sources in the future, and the air quality impacts of various levels of coal production and various levels of secondary development due to future growth. The methodologies used are set forth in the appendix L, and the presentation of air quality data has been improved.

2. Comment: Baseline data on air emissions are totally unquantified. There is no air modeling whatsoever.
Response: Please refer to appendix L.

3. Comment: The statement that agriculture produces large quantities of fugitive dust, sulfur oxides, and carbon monoxide should be backed up with the credentials of the individual quoted.
Response: This has been done.

4. Comment: The EAR needs to address the load-out facilities and how they affect air quality.
Response: Please refer to chapters II and III.

D. Noise

1. Comment: The noise analysis presented in the EAR is insufficient to describe existing sound levels or potential noise impacts. The methodology should be described, the impacts of construction noise assessed, and mitigating measures identified.
Response: Additional noise monitoring was performed and the results are presented in the final EAR. The monitoring assesses true baseline conditions, noise sources and noise sensitive receptors at representative sites, impacts and mitigation measures. Methodologies used are described in appendix M, construction impacts were identified.

E. Visual Resources

1. Comment: Is it possible to include a cross-section of the typical conveyor configuration along the natural ground line, showing how the height and density of the pinyon-juniper combined with rolling topography will obscure most of the conveyor line from the valley/Paonia area?
Response: Yes, see figure I-1 in chapter 1.

F. Water Quality

1. Comment: The EAR should indicate how much water CWI intends to transport in its well-to-mine site pipeline, whether CWI has legal rights to that water, and how much water CWI will use for the entire operation. Also, baseline data on ground water quantity and quality are needed.
Response: See Chapter II and Appendix C.

2. Comment: The EAR should evaluate the amount of water that would be required to mine the proposed lease tract and the availability of suitable supplies to meet water needs at all levels of production.
Response: The final EAR includes an analysis of water requirements for the mining operation, and addresses both water availability and the impacts of withdrawal. The water requirement addressed in the EAR was for the maximum proposed mining rate of 1.25 million tons per year, and any lesser requirements resulting from lower production rates would require proportionately smaller amounts of water.

3. Comment: There is no mention of the fact that the Town of Paonia does not have enough water to supply itself properly now.
Response: According to Jim Cheney, Paonia City Manager, Paonia does have water to supply its present needs. Paonia has applied for a Farmers Home Grant to augment present supplies, which would supply an additional 400 to 600 people.

4. Comment: Have we considered coal slurry pipelines, the associated water use, etc.
Response: Yes. No slurry pipeline is planned.

5. Comment: The potential water quality impacts of leaching and seepage from the proposed project should be addressed more thoroughly in the EAR, including the possibility of increases in salinity and other water quality problems (e.g., metals and acid formation) and resulting long-term effects.
Response: The final EAR discussion of water quality impacts has been expanded to address these particular potential impacts. Potential seepage or encountering water during mining appears unlikely, based on available hydrologic data, and existing conditions also appear to make acid drainage conditions highly unlikely. The possibility of subsidence-related water quality impacts has also been addressed in the final EAR.

6. Comment: The EAR should present information about the nature and composition of the wastes to be deposited in the mine waste disposal area and the design of the waste disposal area regarding control of runoff and drainage.
Response: The final EAR discusses both the nature of wastes to be deposited and the design of the mine waste disposal facility. Potential water quality impacts and mitigating measures to reduce these impacts are identified. The facility has been designed to provide maximum stability.

7. Comment: Paragraph 7 on page A-2 somewhat overstates the capability of the existing 0.011 MGD package plant at the mine. The effluent from this facility is somewhat less than "clarified water," and the disposal of this effluent either in a watercourse or on the land may cause problems.
Response: The State of Colorado has issued the permit and they are the regulating agency.

8. Comment: Runoff from the upper diversion structure may require adequate control measures in the receiving watersheds to prevent erosion, and these measures should be identified in the final EAR and be required as lease stipulations. The final EAR should identify flows to the receiving watersheds on both the east and the west.
Response: The final EAR discusses the effects of runoff, the need for control measures, and identifies flows from the diversion channel. Both BLM and U.S.G.S. will require appropriate measures to be taken to control runoff and sedimentation.

9. Comment: The design and capacity of the proposed sediment retention structures is not clear in the draft EAR, and should be specified. Water discharge permits will be required for these structures.
Response: The final EAR provides additional information on the proposed location, design, capacity, and operation of the sediment retention basins. CWI has met with officials of the Colorado Department of Health to discuss permit requirements, and design capacity and ultimate operation of these facilities will be approved by the State of Colorado.

G. Wildlife

1. Comment: Nongame species are not adequately treated in the EAR: (a) only about half the species of the site are listed; (b) aquatic birds are not discussed; (c) this is one of the last strongholds of the peregrine falcon.
Response: Species lists have been developed through joint cooperation with Division of Wildlife and others; they are available in the North Fork URA. The area covered by the EAR does not have a notable waterfowl population. There have been no peregrine falcon sightings in the study area; the nearest habitat is Gunnison Gorge.

2. Comment: Human activity around the mine will cause harassment to wildlife.
Response: Certain reduction in wildlife habitat will be experienced due to human activity in the mine area. This is discussed in the EAR. It is anticipated that the conveyor itself will have a very slight effect upon wildlife movement. Human activity around the conveyor will be restricted to one vehicular inspector daily. Access to this service road will be restricted by chain and lock so as to prevent any unauthorized travel.

H. Socio-Economic Conditions

1. Comment: The citizens of Paonia and Delta County should not be forced to cope with unplanned expansion.
Response: That is the purpose of this report, to project impacts and compose mitigating measures to lessen these impacts.

2. Comment: Numerous studies of communities such as Gillette and Rock Springs, Wyoming and Craig, Colorado, have documented the devastating effects of the change from an agricultural to an industrial economy in Western areas impacted by energy development: expotenial increases in alcoholism, divorce, delinquency, mental disturbance, alienation, prostitution, and so on. In addition, statistical studies done by numerous governmental and private agencies indicate that divorces increase when families shift from uncertain or low incomes to steady or middle-level incomes. Yet the EAR glosses over or denies such adverse impacts, without presenting convincing evidence to demonstrate that the North Fork area would be exempted from these impacts.
Response: This situation is not comparable with Craig, Rock Springs, or Gillette with regard to the magnitude of the projects involved. Westmoreland's application calls for an additional 141 people, not several thousand. If approximately 70 percent come from within Delta County as in the past, the county population would increase by approximately 150; if all new workers come from outside the county, the estimated population increase would be 500 people. Please refer to Chapter III, Socio-Economic Conditions.

3. Comment: There is disagreement as to whether the economy will change from a heavily agricultural economy to a mixed rural-industrial economy (p. III-16). The Paonia area already has a mixed rural-industrial economy.
Response: We agree that this is true, but not to the extent that it will be changing if the lease is granted. There will be 150 additional miners in the area, some of whom will come from the agricultural sector, thus creating a heavier mix than exists now.

4. Comment: The EAR does not indicate that any measures are to be taken to bind the applicant, Colorado Westmoreland, to carry out the proposed mitigating measures. First, we are told that the company intends to hire local people, or that the company's policy is to hire locally, but there is no indication that the BLM will require CWI to hire local workers. What will happen if they do not? If they do not hire locally, all of the BLM projections about the minimal impact of population growth will be invalidated, the valley will be inundated with new people, and we will be able to do nothing about it. This is an example of the way in which the EAR engages in "best case analysis" and fails to warn the public of possible "worst case" consequences. It can only be considered irresponsible to fail to let people know what they can expect if the "dam breaks", so to speak, and to take measures to insure that it will not.

The EAR assumes that some severe impacts to be generated by coal development can be avoided or are the responsibility of the applicant. "It does not appear that the adverse impact of local inflation resulting from the project's injection of $4,200,000 annually into the local economy can be avoided. There would be adverse socio-economic impacts on people of fixed incomes, the aged, retirees, and public assistance families, "it is stated (V-3). This is approximately 40 percent of the population of the county! To it should be added the population engaged in agriculture, which is relatively unresponsive to inflation. Thus about 60 percent of the county's people, conservatively estimated, will be adversely affected by the development of coal resources, including the proposed action. Yet "mitigation of this impact, obviously, is not the responsibility of the proprietors of the proposed project; the responsibility lies with the legislative branches of the local, state, and federal governments, which will receive positive impacts from the proposed project, as will their constituencies," the EAR assumes.

I submit that it is the responsibility of the applicant to take steps to mitigate this tremendous impact, and the responsibility of the BLM to insure that the applicant takes such steps. For example, the BLM should require CWI to hire a certain percentage of workers with incomes below the poverty level. It should require CWI to hire local subcontractors where possible, and local construction workers. Currently a large proportion of the construction workers hired by CWI subcontractors are from out of state, although the EAR does not mention any impending population increase due to the construction projects.

Response: The purpose of an EAR is to assess the proposed action as it is outlined in Colorado Westmoreland's application for lease to the Bureau of Land Management, and are real, reasonable, or committed alternatives, and associated impacts. The Bureau can, within the law, require certain mitigating measures to be incorporated into the stipulations for leasing. It cannot, however, set Westmoreland's employment policies. In addition, the Bureau has to assume that Colorado Westmoreland has enough integrity to carry out the proposal with regard to the hiring policy that was outlined in their application for lease. In Chapter IV are outlined all the various laws, stipulations, etc., that will have to be complied with if Westmoreland is to lease coal. These stipulations are above and beyond those that would come from this EAR. One must also remember that, with the exception of rare instances, no impact can be fully mitigated. Socio-economic impacts are no different.

If the decision is made to lease coal, there will undoubtedly be inflation, etc., that will follow. As such, this statement can be used as a planning tool to guide the area in planning for future development that would lessen the "blow" of these impacts.

5. Comment: "Local" hiring should not include hiring persons who lived in the area only a few weeks before they were hired, and residence information concerning CWI's current labor force should be included in the EAR.

Response: With Delta County addresses at the time of initial hire, CWI did not ask its present employees how long they had lived in the locale when they filed their employment applications. CWI has now polled its existing employees concerning their personal residence histories, and the results are presented in the EAR.

6. Comment: There is no indication in the EAR that BLM will require CWI to hire local workers. If BLM does not do so, the Valley will be inundated with new people.
Response: A local hiring requirement cannot legally be imposed on CWI or any other company by the United States Government. CWI's commitments have been made publicly and CWI says it intends to honor them to the extent it may do so and also comply with the requirements of State and Federal Equal Employment Opportunity laws. Presumably, CWI will fully honor this commitment to maintain good relationships with the community in which it does business. CWI's file of 1,300 employment applications contains the names of enough local residents to completely fill all jobs which will become available if a lease is issued and mine employment increases.

7. Comment: The discussion of increased revenue fails to address public and private spending.
Response: Please see chapter II.

8. Comment: Mill tax levy would bring in $96,000 instead of $520,000.
Response: This has been corrected.

9. Comment: The EAR makes a number of incorrect assumptions regarding federal mineral leasing revenues available to Delta County. On page I-9 there is a reference to $92,500 per year which will be available in addition to the $200,000 per year maximum to each county available under current state law. There is no provision under state law which would pass through more than $200,000 per year to any one county. There is also no longer any provision that a part of the $200,000 mineral royalty money must be used for school purposes.

The state share of mineral lease revenues generated in Delta County in 1976 amounted to only $73,000. From that the county received about $49,000 in return based on state distribution formula. If the CWI proposed action does increase the state share by $740,000 as indicated in the EAR, then Delta County will receive $200,000 per year. This level will not be reached, however, until the first year after the year in which one million tons of coal is extracted from the Federal portion of the tract. This introduces a lag time between the time when the population growth occurs and the finances are available.
Response: These sections have been revised. Please see chapter II and appendix I.

10. Comment: There is an error in the assumption on page I-9 that 45 percent of all state severance taxes will return to Delta County. Most of that revenue will be placed in the Local Government Severance Tax Fund and the Local Government Mineral Impact Fund (created by Senate Bill 35. 1977) will be available to provide assistance to local governments experiencing adverse impacts from mineral resource development. It is clear from the fiscal analysis presented in the EAR that very little

direct revenue from coal mine facilities will accrue to the municipalities in the area, and consequently, they will have to rely on outside assistance to cover the costs of expansion needed to accommodate population growth.
Response: The error in the assumption on page I-9 has been corrected.

11. Comment: The annual county property tax revenues are overstated in the EAR. They will be $96,000, not $520,000.
Response: This error has been corrected in the final EAR, and the tax revenue impacts of mine development have been stated more clearly.

12. Comment: It is implied that "it is abnormal to be self-employed and married only once."
Response: This was not intended; the final statement has attempted to correct this.

13. Comment: Traffic volume figures in section II.h.7. (transportation) are difficult to analyze because they represent three different years. Estimates of truck, commuter and secondary travel on state and county highways in the area are needed.
Response: This has been corrected as far as data are available in chapter II.

14. Comment: The discussion on municipal sewage systems (pages II-46 and II-68) is weak. Granted, this may not be so important if most of the additional workforce will be obtained from existing residents of Paonia, Hotchkiss, and Delta. However, if a large influx of new residents occurs as a result of this project, the sewage treatment systems of all towns could become overloaded rapidly.
Response: This was discussed in chapter II. The State's impact fund is available for this type of action.

I. Future Environment Without the Proposed Actions

1. Comment: Page II-57 addresses a 7800-megawatt powerplant. Four pages later a plant, less than one-third the size previously mentioned, is said to be unlikely to occur.
Response: This has been changed in the final draft.

J. Alternatives to the Proposed Actions

1. Comment: Alternatives fail to list both advantages and disadvantages which will result.
Response: This has been corrected.

K. General

1. Comment: A bibliography and better source documentation are needed.
Response: This has been done.

2. Comment: Newspaper articles, etc., need to be included.
Response: These are on file in the Montrose District Office as part of the record. Copies are available to the public on request.

APPENDICES

APPENDIX A

BACKGROUND

APPENDIX

Present Development by Westmoreland on Private Land

Following acquisition of the property, Colorado Westmoreland undertook an initial period of drilling and evaluation, followed by an accelerated program to develop the Orchard Valley Mine and to construct modern coal handling, storage, and rail loading facilities. These development activities included:

1. Paving the Stevens Gulch Road from its point of intersection with State Highway 133 to the junction of the Orchard Valley Mine access road--a distance of approximately 3.2 miles. Further paving with the application of an additional two inches of bituminous asphalt paving material will be completed in June 1977 in accordance with the provisions of the agreement between Colorado Westmoreland, Inc., and the U.S. Forest Service.
2. A paved mine access tramroad has been constructed from the Stevens Gulch Road to the mine site itself.
3. Approximately 35 acres have been recontoured at the mine site itself to provide an access road from approximately 6,800 elevation to 7,450 elevation and to provide four horizontal benches to facilitate construction of the mine facilities.
4. At the uppermost bench (7,421 elevation) two 30-foot diameter, 240-foot deep air ventilation shafts have been constructed. The west shaft will provide fresh air into the mine and also accommodate an emergency escape hoist from the mine. Discharge air will leave the mine through the east shaft. At this elevation Westmoreland has also erected a 300,000-gallon water storage tank to provide water for the mine site facilities.
5. Two mine access portals are located at the 7,215 elevation. A bathhouse and a bulk rock dust storage bin have also been constructed at this elevation. A garage facility for an ambulance will soon be constructed adjacent to the bathhouse. The west mine portal will provide an accessway for personnel, equipment and materials entering the mine and the east access portal will house a conveyor which carries the coal from the mine to the coal crushing and screening facilities. The main electrical substation is located adjacent to the mine portal area at 7,190 elevation. At 7,050 elevation, the elevation of the lower coal seam, an office-shop-warehouse facility has been constructed. Offices for mine management and engineering staff, warehouse storage for numerous small mine supply items and a mine maintenance facility are included in this structure. Just opposite this facility is a ground storage area for large mine machinery and supply storage. Immediately to the east is a 2,000-ton coal storage bin. This bin will allow for short operating interruptions at the coal crushing and screening facility without requiring the mine to shut down. In addition, this bin will accommodate surge production from the mine without affecting the normal operation of the coal crushing and screening facility.

6. At approximately 6,900 elevation the main coal crushing and screening plant and truck loading facilities are being constructed. Coal, after having passed through the 2,000-ton surge bin, is fed into a hammermill to break the coal to a maximum 4-inch size and to separate any rock material from the coal. The discharge from the hammermill is screened to remove material of 3-inch or less diameter which is conveyed directly into the truck loading bin for transportation to the coal storage silos. The 3- by 4-inch stream coal passes through a final crushing mechanism to reduce it to 3-inch top size. This material is conveyed to the coal loading bin for transportation to the coal storage facilities. The processing circuits in this plant will provide for the segregation of a 3- by 4-inch lump coal as well as a stoker coal product for supply to the local market if needed. All coal handling, crushing and screening facilities are equipped with dust suppressing systems to control emissions.

7. The mine waste treatment facility is located on the lower bench. All sewage from the mine facilities is processed through the waste treatment plant. This package aeration plant will reduce the sewage to a clarified water and sludge. The clarified water will be chlorinated and finally used for dust control and to support revegetation at the mine site. Approximately 1,000 gallons of sludge per year will be disposed of through the city of Paonia sewage treatment plant.

8. The initial coal produced from the mine during the early development stages (from December 1976 to July 1977) is being trucked from the mine portal location to the temporary coal crushing and storage area immediately opposite the mine access road. Included in this production is the 37,516 tons that was shipped to the customer in March of 1977 for an initial test burn program. Initial development coal is crushed at the temporary storage location and stored in a compacted storage pile for subsequent truck transfer to the coal storage silos. When the storage silos and rail loading facilities have been completed, this coal pile will be removed and trucked to the truck dump for subsequent trail loading and shipment to the customer. Following the removal of this coal pile, the area will be regraded for subsequent use as a storage and parking area.

9. At the coal storage and train loading site adjacent to Highway 133, a truck access loop and truck dump station have been completed. This station is equipped with automatic controls to assure that the truck is completely within the building and the doors are closed during the actual discharge of the coal from the trucks. The doors remain closed until such time as photoelectric cells detect no dust in the truck station, then the exit doors open and the truck will leave the truck dump station, proceed around the truck access loop, and return to Highway 133 for the trip back to the mine site. The truck dump station, as well as the connecting enclosed conveyor from the truck dump station to the coal storage silos, is equipped with a negative pressure bag house dust collecting system to control all coal dust emissions. The coal is conveyed from the hopper under the truck dump station up into one of three 7,000-ton silos.

10. Three 7,000-ton-capacity reinforced concrete coal storage silos, approximately 70 feet in diameter and 110 feet high, have been constructed to store the coal until it is conveyed into the unit train loading facility. Each silo is equipped with seven vibrating feeders to feed the coal from the silo onto conveying systems for movement to the train loading facility. An office-laboratory and a warehouse facility have been constructed immediately east of the coal storage silos.

11. For loading into unit trains, the coal is conveyed from the feeders under the coal storage silos a distance of approximately 370 yards east along the railroad spur to the unit train loading facility. This facility is designed to provide for continuous flood loading of 10,000 tons of coal in approximately 2½ hours as required under the railroad tariff. A dust suppression spray system is included in the unit train loading facility to control fugitive dust emissions during loading.

12. A railroad spur approximately 2½ miles long, including the railroad bridge over the North Fork of the Gunnison River, has been constructed. When the mine reaches design capacity of approximately 1.0 million tons per year, two trains per week will be shipped.

Surface excavation, for the development of flat surface areas for building and mine portals, as well as air shaft benches, has been limited to Colorado Westmoreland's fee land. Reclamation and revegetation of all areas which have been disturbed in the course of developing these facilities will be initiated following the completion of construction activities. New mine openings or other disturbance will not be required on the Federal lease.

States of Implementation

Mining Procedures

Colorado Westmoreland proposes to extend their present underground workings in the "D" coal seam from a 120-acre private coal block to the north into the Federal coal lease application tract. Only about one-third of the 120 acres of fee land held by Colorado Westmoreland contains coal of economic importance. The "D", "C", and "B" seams outcrop on the land and are recoverable. The Orchard Valley Mine is operating in the uppermost "D" seam at this time. Approximately 80,000 tons of coal have been mined to date. The fee coal reserves will allow the mining of only one room-and-pillar panel in the "D" seam (see Mine Layout Map, Figure 1, A-5). The "C" seam and "B" seam, which are beneath the "D" seam, cannot be mined without seriously damaging the mine workings in the "D" seam. Ground disturbances or subsidence from the lower seams would extend into the "D" seam ventilation air shafts and main entries, seriously damaging these workings. The workings in the "D" seam must be kept stable for the life of the mine.

Multiple seam mining is possible, but good mining practice necessitates the advancing of the "D" seam workings beyond the current fee coal property boundaries before mining in the lower "C" or "B" seams commences. The pillar stability of the main mine entries and air shafts at all seam levels must provide a safe roof, rib, and floor condition, otherwise access to mine workings may be lost. Premature mining in the "C" or "B" seams would seriously jeopardize and/or destroy the access to the "D" seam mineral reserve and render it unmineable.

Colorado Westmoreland is at present mining by the room-and-pillar system using continuous mining methods. Figure 2, A-6, is a sketch of the Orchard Valley mine plan indicating the room-and-pillar method of extraction from the main underground passageways and from a series of rooms during the initial mining operation. As each major panel of rooms is completed, a portion of the pillars is extracted during the retreat from the panel. The degree to which pillars are extracted is dictated by the safety of the operation and the number of pillar support columns which must be left intact to assure subsidence control.

All coal mined from the Orchard Valley Mine will be removed by underground mining methods only. Both continuous and conventional underground mining equipment will be used. On the continuous mining sections, a large continuous mining machine with a multi-tooth rotating head is used to break the coal loose from the mining face. Gathering arms then deposit the loosened coal on a short conveyor which conveys the coal into a diesel-powered haulage unit. The haulage unit transports the coal to the feeder located either along or at the end of the underground conveyor belt. From this point, the coal is fed onto the conveyor and transported out of the mine. After each twenty feet of advance by the continuous miner, roof bolts and steel mats are placed in the roof of the mine to secure a stable roof.

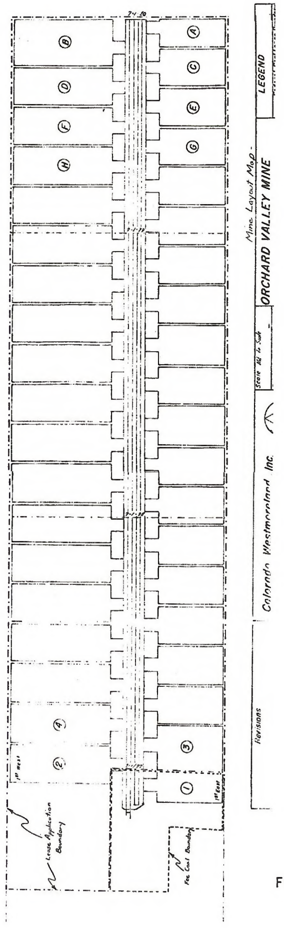
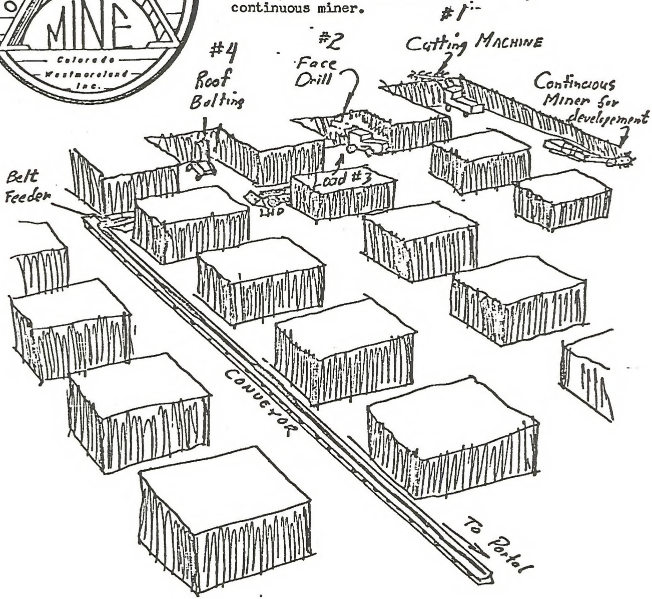

Mine Layout Map -
ORCHARD VALLEY MINE
Colorado Westmoreland Inc.
LEGEND
Revisions
ONE MILE
Lease Application Boundary
Fee Coal Boundary
1st West
1st East
A
B
C
D
E
F
G
H
1
2
3
4

Figure 1

MINING SEQUENCE

1. Cut and Shear
2. Drill and Shoot
3. Load Coal with Load-Haul-Dump
4. Bolt Roof

Developement of other areas is done by continuous miner.



ROOM AND PILLAR MINING CONCEPT

CONVENTIONAL MINING

Figure 2

In the conventional sections, a large coal cutting machine shears the top, bottom and both sides of the block of coal to be removed. Holes are then drilled into the coal block on a predetermined pattern and charged with a light permissible explosive. The explosive is detonated to break the coal loose from the sheared block. Front end loaders then scoop up the loosened coal and transport it to the belt feeders. The 1st East Panel in the fee coal will be mined conventionally.

After the coal is fed onto the conveyor belt underground, it is conveyed through the east portal into a 2,000-ton raw coal surge bin (Figure 3, A-8). From this bin the coal is conveyed into the coal crushing and screening facility where it is reduced to a maximum size of three inches and conveyed into the truck loading bins. The coal conveying facility and the crushing and screening facilities are equipped with dust suppression systems to control dust emissions. Once these facilities are in operation, each will be monitored by Colorado Westmoreland, Inc., and by representatives from the Colorado Air Pollution Control Commission to assure that emission controls are adequate. Should additional emission control facilities be required, they will be installed.

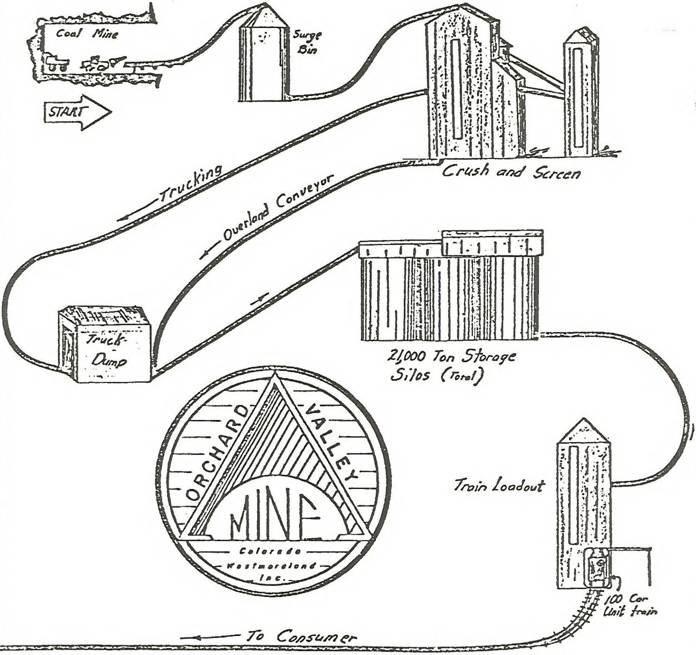
Coal is loaded from the truck loading bins into the bottom dump semi-trailer coal hauling trucks and transported to the truck dump station. During the period that the coal is being extracted from the private leasehold, approximately 100 truck loads of coal per operating day will be trucked from the processing facility to the truck dump station.

From the receiving hoppers in the truck dump station, coal is fed onto an enclosed conveyor and conveyed into the coal silos. When a sufficient quantity of coal has been accumulated in the coal storage silos, a unit train will be scheduled for loading. The coal is then again fed onto a conveyor and conveyed from the closed storage silos to the train loading facility and loaded into the train. The Denver & Rio Grande Railroad will transport the coal to NIPSCO and other markets.

The layout map (Figure 1, A-5) shows the orientation of the main slope entries, cross main entries, and the panel sections running northward from the fee coal to the Federal coal lease. As can be seen from the map, only one room and pillar panel can be mined within the fee coal in the "D" seam. The bearing of the six main slope entries is N. 2°6'56" E. The cross entries and panels are at right angles to the main entry. Coal cleavage in the "D" seam runs northeast while the mine workings are turned to nearly 45 degrees from the cleavage. This provides the pillars with maximum stability, with respect to the coal cleavage, and minimizes roof and rib spalling.

Main slope pillars are on 100- x 100- and 100- x 160-foot centers. Cross entry pillars are on 120- x 80-foot centers.

Panel pillars are on 80- x 80-foot centers. Entries and rooms are 9 to 12 feet high and 18 feet wide. Only the upper 12-foot portion of the



COAL FLOW DIAGRAM

Figure 3

seam is mined because of expected severe rib and roof conditions when higher rib walls are left as mining advances (the "D" seam averages 25 feet thickness in the fee coal). Alternative methods of extracting the "D" seam bottom coal are being evaluated. A longwall system is one such alternative.

The service and belt (haulage) entries will be in the #2 and #3 main slope entries. The belt will traverse the middle cross entry, and supplies and men will be taken in on either side of the belt entry, in the intake air, to the panels. Water and high voltage cable lines will be hung opposite the belt conveyor.

Ventilation and Escapeways

The Orchard Valley Mine will be ventilated by an exhausting ventilation system. Intake air will enter the mine through one of the air shafts 240 feet deep and 30 feet in diameter. Return air will exit the mine through the second air shaft, same dimensions, after the air has circulated through the mine workings. The main fan, at the collar of the upcast air shaft, is an 8-foot diameter Joy M96-58D axial vane type. The layout map shows the air flow directions and the air shafts.

The intake airways and the belt entry will be used as escapeways for all underground employees in the advent of an emergency.

Water lines and fire fighting equipment will be in the haulage entries and fire hoses will be spaced no more than 300 feet.

Based on data from a drilling program conducted on the private leasehold, three apparently minable seams, referred to in descending order as the "D", "C", and "B" seams, of coal underlie the private leasehold and it is assumed these seams continue as minable seams throughout most or all of the lease application area. The drilling program on the private leasehold showed the following average thicknesses for the seams:

F - No apparent occurrence
*E - 3 feet
D - 26 feet
C - 13 feet
B - Split into a 6.2 foot and 4.5 foot seam

The "B" seam lies directly over the Rollins Sandstone. Seventy-five to eighty-five feet of interbedded sandstones and shales separate the "B" and "C" seams, while the "C" and "D" seams are separated by eighty to 100 feet of similar material. When including the "E" seam the interval between the upper and lower seams is approximately 325 feet of interbedded sandstones and shales. The sandstones are light to dark grey, fine to medium grained and generally cross-bedded. The shales are generally grey to dark grey, silty, and carbonaceous near the coal seams.

All the seams outcrop on the Orchard Valley fee lands and appear to be oxidized near the surface. All of the seams are burned or absent near the east line of Section 24. In addition to the four major seams, numerous thin seams occur throughout the section.

The coal in this area varies from high-quality subbituminous to medium-quality bituminous. It is low in sulphur, ash, and moisture and varies in as-received samples from 10,000 to 13,000 Btu. The following are as-received analyses from various beds in the fee property:

Seam	No. of Samples	Moisture	Ash	Volatile Matter	Fixed Carbon	Btu	Sulphur
D	5	10.66	8.41	36.10	44.83	11,259	0.46
C	6	10.18	7.82	36.88	45.12	11,489	0.62
Lower B	6	9.26	14.00	36.01	40.72	10,587	1.06
Upper B	6	8.0	13.04	36.67	42.37	11,191	0.61

*The "E" seam was encountered in only one hole near the northern boundary of the fee property during the exploration drilling program. The extent of this seam in the lease application area is not known. The "E" seam is not thought to be continuous and therefore, not economically minable in the application area.

The depth of overburden at the top of the Rollins Sandstone varies from 0 feet on the fee coal land to a maximum of 2,000 feet at the northwest corner of Section 1 of the lease application tract. A drainage divide occurs near the middle of the application tract and therefore, the northern (down-dip) end of the tract has much less overburden than one would expect. The Rollins Sandstone dips approximately 3° to the north-northeast in this area.

The shale top and bottom surrounding D, C, and B seams is of a soft, plastic nature which readily flows under great pressure, especially where water is present. This will create an expected weak roof with increasing overburden and heaving of the floor strata can be expected. The first panel to be mined in the D seam lies under 400 to 500 feet of overburden. The roof control plan outlines the operational safety procedures that will be followed for stabilizing the roof, rib, and floors of rooms and entries.

Igneous sills have moved along, and cut out or coked, parts of the "B" and "C" beds, to the east of the application area. The westward extent of these intrusions is unknown and could affect the northern part of the application tract.

Potential landslides are present all along the steep hills present over the application area. However, since access to the coal under the subject tract will be underground through an existing mine, this will not be a serious problem.

There appears to be sufficient coal reserves on the tract for a 40-year mine life. Because of the uncertain nature of the coal seams present on the application tract, a gross value of the deposit cannot be computed at this time.

Initial drilling on the fee land has not disclosed the presence of any ground water systems. Other mines operating in the area have encountered only small amounts of ground water. The presence of any major ground water aquifers on the application area is not anticipated.

APPENDIX B
METHODOLOGY FOR DETERMINING VISUAL RESOURCE MANAGEMENT CLASSES, VISUAL IMPACTS AND IMPACT MITIGATION MEASURES

Determination of Visual Management (VRM) Classes

VRM classes are the management goals for maintaining the visual resource in particular degrees of present character. These classes are determined from a consideration of the Scenery Quality, Visual Sensitivity Levels and Distance Zones.

The Scenery Quality of an area is an assessment based upon quantified scenic evaluation criteria. Three quality ratings are possible: Outstanding (A), Characteristic (B) and Minimal (C). The Scenery Quality rating for the hills around the proposed action is Minimal (C) and for the postoral valley bottom is Outstanding (A).

The Visual Sensitivity level is an index of the relative importance of visual response to an area. Three levels are possible: High, Medium and Low. Criteria considered include:

1. Traffic and user counts for roads and use areas
2. Types of recreation uses and significance (local, regional, national)
3. Community attitudes
4. Land use relationships

The Sensitivity Level of people living in and touring through the valley is high, while the level for people using Stevens Gulch Road is low.

The Distance Zones are important because, in most cases, the closer the viewer is to an object the more visual contrast or detail seen. The Distance Zones are:

1. Foreground-Middleground - from 0 to 5 miles
2. Background - from 5 to 15 miles
3. Seldom seen - beyond 15 miles or closer but hidden

The area of the proposed action lies in the Foreground Distance Zone with a few isolated, seldom seen pockets.

These three factors are then put into the matrix in chart 1 to this appendix to determine the VRM classes. The three factors for the area of the proposed action and the VRM classes are shown on VRM Classes Determination Map, Map 1 to this appendix. Definitions of the VRM classes for the area are as follows:

Class II. Changes in any of the basic elements (form, line, color or texture) caused by a management activity should not be evident in the characteristic landscape.

Class III. Changes in the basic elements, (form, line, color, texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing character.

Chart 1, Determining Visual Resource Management Class

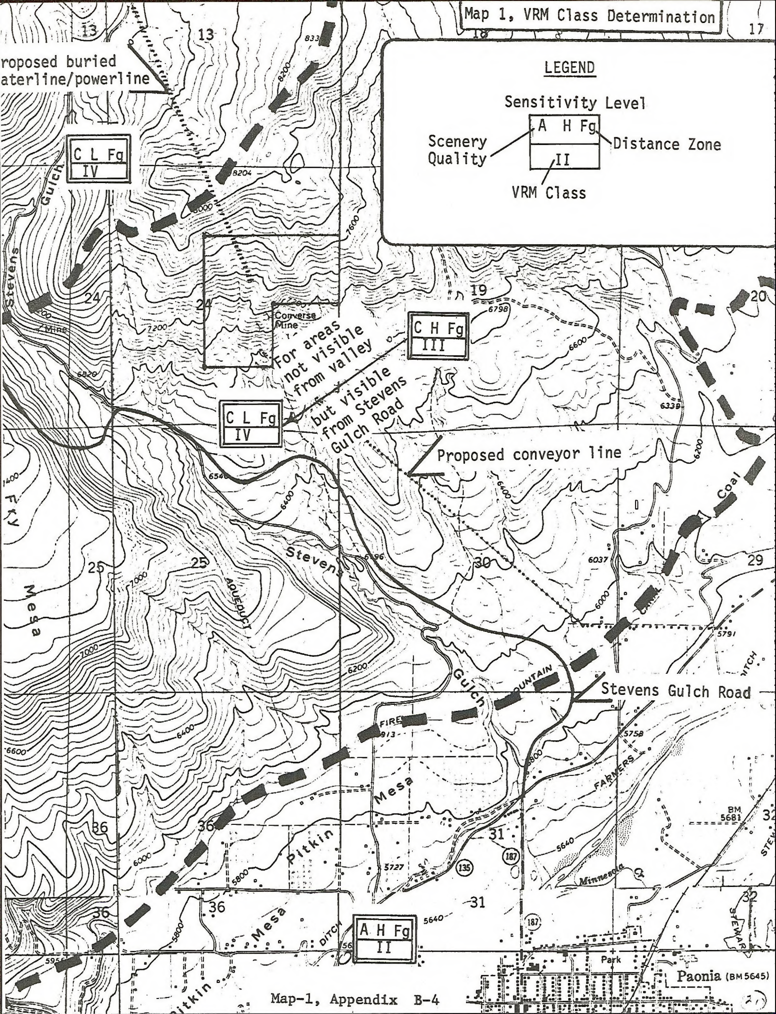
		2/ VISUAL SENSITIVITY LEVEL						
		HIGH			MEDIUM			LOW
SPECIAL AREAS		I	I	I	I	I	I	I
1/ SCENERY CLASS	A	II	II	II	II	II	II	II
	B	II	III	IV	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
		FG	BG	SS	FG	BG	SS	SS
		3/ VISUAL ZONES						

1/ SCENERY QUALITY INVENTORY — A, B, C

2/ VISUAL SENSITIVITY LEVEL — High, Medium, Low

3/ VISUAL ZONES —
FG - Foreground-Middleground
BG - Background
SS - Seldom Seen

NOTE: Class I applies only to classified special areas, e.g., Wilderness, Primitive, Natural Areas, etc. This quality standard is established through legislation or policy.



Map-1, Appendix B-4

Class IV. Changes may subordinate the original composition and character but must reflect what could be a natural occurrence within the characteristic landscape.

Except for a small portion of the conveyor line lying in the VRM Class II area all the proposed action lies in VRM Class III and IV areas.

Determination of Visual Impact

Whether or not a proposed action would create a visual impact is determined through the use of a contrast rating. A contrast rating works like this:

The visual contrast created by a management activity can be measured by determining the contrast caused by that activity in each of the basic elements. The ease of detecting contrast in the basic elements varies on a scale from 4 (form) to 1 (texture). By assigning numbers that indicate degree of contrast, 3 for strong, 2 for moderate, and 1 for weak, we can then set up a direct multiplier for an indication of the strength of the contrast.

Elements		Degree of Contrast	
Form	- 4	Strong	- 3
Lines	- 3	Moderate	- 2
Color	- 2	Weak	- 1
Texture	- 1	None	- 0

The ease of detection for each element is multiplied by the degree of contrast and the results are added to get a total score.

Example:

Elements			Contrast			
Form	- 4	x	Weak	- 1	=	4
Line	- 3	x	Strong	- 3	=	9
Color	- 2	x	Moderate	- 2	=	4
Texture	- 1	x	None	- 0	=	0
				TOTAL		17

A total score for each feature of 1-10 indicates the contrast can be seen, but does not attract attention. 11-20 attracts attention, the contrast begins to dominate the characteristic landscape. 21-30 demands attention, will not be overlooked. The contrast rating is applied to each of the types of features in the landscape separately. That is, a contrast rating is developed for and proposed change in land surface, for the vegetation, and for the structures. In long term projects, a short term and long term evaluation should be done. Short term is usually considered to be about five years, which long term is from five years to the life of the project.

Example:

	Element	Contrast	Score
Land Surface Features	Form - 4	None - 0	0
	Line - 3	None - 0	0
	Color - 2	Moderate - 2	4
	Texture - 1	Moderate - 2	2
		TOTAL	6
Vegetation Features	Form - 4	Strong - 3	12
	Line - 3	Strong - 3	9
	Color - 2	Moderate - 2	4
	Texture - 1	Moderate - 2	2
		TOTAL	27
Structures Features	Form - 4	Moderate - 2	8
	Line - 3	Weak - 1	3
	Color - 2	Weak - 1	2
	Texture - 1	Moderate - 2	2
		TOTAL	15

Another way to look at the definitions of the VRM classes is to see what the contrast rating limits are for each class. The following contrast rating limits have been developed to meet the definitions of the classes:

VRM CLASS	PER ELEMENT	PER FEATURE SHORT TERM/LONG TERM
II	2	13/10
III	2	20/16
IV	-	24/20

To simplify the use of contrast ratings in the text of this report and to gain a better perspective of the magnitudes of a contrast rating relative to a VRM class the following labels are used:

For any one VRM class if contrast is:

1. At or below the limit per element and per feature, visual impact is insignificant;
2. Above the limit for one element but at or below per feature, visual impact is moderate;
3. Below the limit per element but per feature, and over the long term, is within the short term limit, visual impact is moderate;
4. Above the limit for two or more elements but at or below per feature, visual impact is severe;

5. Below the limit per element but per feature is above this short term limit, visual impact is <u>severe</u>;
6. Above the limit for one element and above the limit per feature, visual impact is severe.

On the following pages are the Contrast Rating forms used to determine visual impacts. There are two forms for each proposed activity; they represent the two points of view described in the text, the view from the valley and the view from Stevens Gulch Road. Each form also rates contrast for the activity <u>as proposed</u> and <u>as mitigated</u>.

<u>Mitigation of Visual Impact</u>

Mitigation of visual impact requires design measures that reduce those numerical contrast ratings that exceed the limits for the VRM class. Contrast rating scores show exactly what aspect(s) of visual impact producing proposed actions is (are) creating problems and need redesigning. Redesign measures may focus on all four elements in all three features or just one element in one feature.

CONTRAST RATING Orchard Valley Mine (existing)

Element			Existing Design as seen from Stevens Gulch Road Degree of Contrast	Existing Design as seen from the valley Degree of Contrast
Surface Modification	Form	4 x	3 = 12	22 = 8
	Line	3 x	3 = 9	1 = 3
	Color	2 x	2 = 4	2 = 4
	Texture	1 x	2 = 2	1 = 1
		Total	27	16
Vegetation Modification	Form	4 x	3 = 12	3 = 12
	Line	3 x	3 = 9	3 = 9
	Color	2 x	3 = 6	3 = 6
	Texture	1 x	3 = 3	3 = 3
		Total	30	30
Addition of Structures	Form	4 x	2 = 8	2 = 8
	Line	3 x	2 = 6	1 = 3
	Color	2 x	1 = 2	1 = 2
	Texture	1 x	1 = 1	0 = 0
		Total	17	13

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16 as seen from the valley
IV	-	24 / 20 as seen from Stevens Gulch Road

			Facility		Point of View	
		CONTRAST RATING	Conveyor line		Valley	

Feature	Element		Proposed design: Degree of Contrast Short Term	Proposed design: Degree of Contrast Long Term	With mitigation measure: Degree of Contrast Short Term	With mitigation measure: Degree of Contrast Long Term
Surface Modification	Form	4 x	0 = 0	0 = 0	0 = 0	0 = 0
	Line	3 x	0 = 0	0 = 0	0 = 0	0 = 0
	Color	2 x	0 = 0	0 = 0	0 = 0	0 = 0
	Texture	1 x	0 = 0	0 = 0	0 = 0	0 = 0
		Total	0	0	0	0
Vegetation Modification	Form	4 x	1 = 4	1 = 4	1 = 4	1 = 4
	Line	3 x	1 = 3	1 = 3	1 = 3	1 = 3
	Color	2 x	1 = 2	1 = 2	1 = 2	1 = 2
	Texture	1 x	1 = 1	1 = 1	1 = 1	1 = 1
		Total	10	10	10	10
Addition of Structures	Form	4 x	2 = 8	2 = 8	1(2) = 4(8)	1(2) = 4(8)
	Line	3 x	2 = 6	2 = 6	1(2) = 3(6)	1(2) = 3(6)
For portions elevated and in sparse vegetation	Color	2 x	*2(3) = 4(6)	*2(3) = 4(6)	1(2) = 2(4)	1(2) = 2(4)
	Texture	1 x	1 = 1	1 = 1	1 = 1	1 = 1
*(brightly reflected light)		Total	* 19(21)	* 19(21)	** 10(19)	** 10(19)

**(Highlighting of elevated portions by morning light and blanket of snow.)

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature: Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

			Facility	Point of View
		CONTRAST RATING	Conveyor line	Stevens Gulch Road

Feature	Element		Proposed design: Degree of Contrast Short Term	/ Long Term	With mitigation measure: Degree of Contrast Short Term	/ Long Term
Surface Modification	Form	4 x	2 = 8	/ 0 = 0	2 = 8	/ 0 = 0
	Line	3 x	2 = 6	/ 0 = 0	2 = 6	/ 0 = 0
	Color	2 x	1 = 2	/ 0 = 0	1 = 2	/ 0 = 0
*Temporary stock-piling of excavated material during tunneling.	Texture	1 x	0 = 0	/ 0 = 0	0 = 0	/ 0 = 0
		Total	*16	/ 0	*16	/ 0
Vegetation Modification	Form	4 x	1 = 4	/ 1 = 4	1 = 4	/ 1 = 4
	Line	3 x	1 = 3	/ 1 = 3	1 = 3	/ 1 = 3
	Color	2 x	1 = 2	/ 1 = 2	1 = 2	/ 1 = 2
	Texture	1 x	1 = 1	/ 1 = 1	1 = 1	/ 1 = 1
		Total	10	/ 10	10	/ 10
Addition of Structures	Form	4 x	1 = 4	/ 1 = 4	1 = 4	/ 1 = 4
	Line	3 x	2 = 6	/ 2 = 6	1 = 3	/ 1 = 3
	Color	2 x	2(3) = 4(6)	/ 2(3) = 4(6)	1 = 2	/ 1 = 2
	Texture	1 x	2 = 2	/ 2 = 2	1 = 1	/ 1 = 1
For portions elevated and in sparse vegetation. *(brightly reflected light)		Total	*16(18)	/ *16(18)	10	/ 10

Numerical Contrast Rating Limits		Total contrast rating for any one feature
VRM Class	per element	Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

	Facility	Point of View
CONTRAST RATING	Conveyor line road	Valley

Feature	Element		Proposed design: Degree of Contrast, Short Term	Proposed design: Degree of Contrast, Long Term	With mitigation measure: Degree of Contrast, Short Term	With mitigation measure: Degree of Contrast, Long Term
Surface Modification	Form	4 x	2 = 8	2 = 8	=	=
	Line	3 x	2 = 6	2 = 6	=	=
	Color	2 x	1 = 2	1 = 2	=	=
	Texture	1 x	1 = 1	1 = 1	=	=
	Total		17	17		
Vegetation Modification	Form	4 x	2/3 = 8/12	2/3 = 8/12	0-1 = 0-4	0-1 = 0-4
	Line	3 x	2/3 = 6/9	2/3 = 6/9	0-1(2) = 0-3(6)	0-1(2) = 0-3(6)
	Color	2 x	2/3 = 4/6	2/3 = 4/6	0-1(2) = 0-2(4)	0-1(2) = 0-2(4)
Gentle grade below tunnel as seen from Pan. Am properties/steep grades.	Texture	1 x	2/3 = 2/3	2/3 = 2/3	0-1 = 0-1	0-1 = 0-1
*(Snow on the ground)	Total		20/30	20/30	0-10*(15)	0-10*(15)
Addition of Structures	Form	4 x	2 = 8	1 = 4	2 = 8	0-1 = 0-4
	Line	3 x	1 = 3	1 = 3	1 = 3	0-1 = 0-3
*Vehicles & dust from construction.	Color	2 x	2 = 4	1-2 = 2-4	2 = 4	0-1 = 0-2
**daily patrol	Texture	1 x	2 = 2	1 = 1	1 = 1	0-1 = 0-1
	Total		*17	**10-12	*16	**0-10

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

			Facility	Point of View
		CONTRAST RATING	Conveyor line road	Stevens Gulch Road

Feature	Element		Proposed design — Degree of Contrast Short Term	/ Long Term	With mitigation measure — Degree of Contrast Short Term	/ Long Term
Surface Modification (Steep grades are mostly hidden)	Form	4 x	2 = 8	/ 2 = 8	1 = 4	/ 1 = 4
	Line	3 x	2 = 6	/ 2 = 6	1 = 3	/ 1 = 3
	Color	2 x	1 = 2	/ 1 = 2	1 = 2	/ 1 = 2
	Texture	1 x	1 = 1	/ 1 = 1	1 = 1	/ 1 = 1
		Total	17	/ 17	10	/ 10
Vegetation Modification	Form	4 x	2 = 8	/ 2 = 8	1 = 4	/ 1 = 4
	Line	3 x	2 = 6	/ 2 = 6	1 = 3	/ 1 = 3
	Color	2 x	2 = 4	/ 2 = 4	2 = 4	/ 2 = 4
	Texture	1 x	2 = 2	/ 2 = 2	1 = 1	/ 1 = 1
		Total	20	/ 20	12	/ 12
Addition of Structures Vehicles and dust from construction	Form	4 x	2 = 8	/ 1 = 4	2 = 8	/ 1 = 4
	Line	3 x	1 = 3	/ 1 = 3	1 = 3	/ 1 = 3
	Color	2 x	2 = 4	/ 1-2 = 2-4	2 = 4	/ 1-2 = 2-4
	Texture	1 x	2 = 2	/ 1 = 1	2 = 2	/ 1 = 1
		Total	17	/ 10-12	17	/ 10-12

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

	Facility	Point of View
CONTRAST RATING	Buried waterline	Valley

Feature	Element		Proposed design: Degree of Contrast Short Term	=		/ Long Term	=		With mitigation measure: Degree of Contrast Short Term	=		/ Long Term	=	
Surface Modification	Form	4 x	0	=	0	/ 0	=	0	0	=	0	/ 0	=	0
	Line	3 x	0	=	0	/ 0	=	0	0	=	0	/ 0	=	0
	Color	2 x	0	=	0	/ 0	=	0	0	=	0	/ 0	=	0
	Texture	1 x	0	=	0	/ 0	=	0	0	=	0	/ 0	=	0
	Total				0	/		0			0	/		0
Vegetation Modification	Form	4 x	3	=	12	/2(3)	=	8(12)	0	=	0	/ 0	=	0
	Line	3 x	2(3)	=	6(9)	/1(2)	=	3(6)	0	=	0	/ 0	=	0
	Color	2 x	2(3)	=	4(6)	/1(3)	=	2(6)	0	=	0	/ 0	=	0
*(Snow on ground)	Texture	1 x	1	=	1	/ 1	=	1	0	=	0	/ 0	=	0
	Total				23*(28)	/		14*(25)			0	/		0
Addition of Structures	Form	4 x	2	=	8	/ 0	=	0	0-1	=	4	/ 0	=	0
	Line	3 x	1	=	3	/ 0	=	0	0-1	=	3	/ 0	=	0
dust from construction	Color	2 x	2	=	4	/ 0	=	0	0-1	=	2	/ 0	=	0
	Texture	1 x	1	=	1	/ 0	=	0	0-1	=	1	/ 0	=	0
	Total				16	/ 0					0-10	/		0

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

	Facility	Point of View
CONTRAST RATING	Buried waterline	Stevens Gulch Rd.

Feature	Element		Proposed design: Degree of Contrast Short Term	Proposed design: Long Term	With mitigation measure: Degree of Contrast Short Term	With mitigation measure: Long Term
Surface Modification	Form	4 x	1 = 4	0 = 0	0 = 0	0 = 0
	Line	3 x	1 = 3	0 = 0	0 = 0	0 = 0
	Color	2 x	1 = 2	0 = 0	0 = 0	0 = 0
	Texture	1 x	1 = 1	0 = 0	0 = 0	0 = 0
		Total	10	0	0	0
Vegetation Modification	Form	4 x	3 = 12	2(3) = 8(12)	1(2) = 4(8)	0(1) = 0(4)
	Line	3 x	3 = 9	2 = 6	1(2) = 3(6)	0(1) = 0(3)
	Color	2 x	2(3) = 4(6)	1(3) = 2(6)	1(2) = 2(4)	0(2) = 0(4)
*(Snow on ground)	Texture	1 x	2 = 2	1 = 1	1(2) = 1(2)	0(1) = 0(1)
		Total	27*(29)	17*(25)	10*(20)	0*(12)
Addition of Structures	Form	4 x	2 = 8	0 = 0	2 = 8	0 = 0
	Line	3 x	1 = 3	0 = 0	1 = 3	0 = 0
	Color	2 x	2 = 4	0 = 0	2 = 4	0 = 0
Vehicles and dust from construction	Texture	1 x	2 = 2	0 = 0	2 = 2	0 = 0
		Total	17	0	17	0

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

			Facility	Point of View
		CONTRAST RATING	Diversion channel	Valley

			Proposed design		With mitigation measure	
			Degree of Contrast		Degree of Contrast	
Feature	Element		Short Term	Long Term	Short Term	Long Term
Surface Modification Relative to natural rock outcrops	Form	4 x	0 = 0	0 = 0	0 = 0	0 = 0
	Line	3 x	0 = 0	0 = 0	0 = 0	0 = 0
	Color	2 x	0-1 = 0-2	0-1 = 0-2	0-1 = 0-2	0-1 = 0-2
	Texture	1 x	0 = 0	0 = 0	0 = 0	0 = 0
		Total	0-2	0-2	0-2	0-2
Vegetation Modification Relative to natural rock outcrops	Form	4 x	1-2 = 4-8	1-2 = 4-8	1-2 = 4-8	1-2 = 4-8
	Line	3 x	1 = 3	1 = 3	1 = 3	1 = 3
	Color	2 x	1 = 2	1 = 2	1 = 2	1 = 2
	Texture	1 x	1 = 1	1 = 1	1 = 1	1 = 1
		Total	10-14	10-14	10-14	10-14
Addition of Structures Dust from construction	Form	4 x	2 = 8	0 = 0	2 = 8	0 = 0
	Line	3 x	1 = 3	0 = 0	1 = 3	0 = 0
	Color	2 x	2 = 4	0 = 0	2 = 4	0 = 0
	Texture	1 x	1 = 1	0 = 0	1 = 1	0 = 0
		Total	16	0	16	0

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

			Facility	Point of View
		CONTRAST RATING	Diversion channel	Stevens Gulch Road

Feature	Element		Proposed design: Degree of Contrast Short Term	/ Long Term	With mitigation measure: Degree of Contrast Short Term	/ Long Term
Surface Modification Relative to natural rock outcrops	Form	4 x	1 = 4	/ 1 = 4	1 = 4	/ 1 = 4
	Line	3 x	1 = 3	/ 1 = 3	1 = 3	/ 1 = 3
	Color	2 x	1-2 = 2-4	/ 1-2 = 2-4	1-2 = 2-4	/ 1-2 = 2-4
	Texture	1 x	1-2 = 1-2	/ 1-2 = 1-2	1-2 = 1-2	/ 1-2 = 1-2
		Total	10-13	/ 10-13	10-13	/ 10-13
Vegetation Modification Relative to natural rock outcrops	Form	4 x	3 = 12	/ 2 = 8	1 = 4	/ 1 = 4
	Line	3 x	2 = 6	/ 2 = 6	1 = 3	/ 1 = 3
	Color	2 x	3 = 6	/ 2 = 4	1 = 2	/ 1 = 2
	Texture	1 x	3 = 3	/ 2 = 2	1 = 1	/ 1 = 1
		Total	27	/ 20	10	/ 10
Addition of Structures Vehicles and dust from construction	Form	4 x	2 = 8	/ 0 = 0	2 = 8	/ 0 = 0
	Line	3 x	1 = 3	/ 0 = 0	1 = 3	/ 0 = 0
	Color	2 x	2 = 4	/ 0 = 0	2 = 4	/ 0 = 0
	Texture	1 x	2 = 2	/ 0 = 0	2 = 2	/ 0 = 0
		Total	17	/ 0	17	/ 0

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

			Facility	Point of View
		CONTRAST RATING	Refuse Disposal Site	Valley

Feature	Element		Proposed design: Degree of Contrast *Short Term / Long Term	With mitigation measure: Degree of Contrast Short Term / Long Term
	Form	4 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
Surface Modification	Line	3 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
	Color	2 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
Relative to mine	Texture	1 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
		Total	0 / 0	___ / ___
	Form	4 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
Vegetation Modification	Line	3 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
	Color	2 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
Relative to mine	Texture	1 x	0 = 0 / 0 = 0	___ = ___ / ___ = ___
		Total	0 / 0	___ / ___
	Form	4 x	2 = 8 / 0 = 0	___ = ___ / ___ = ___
Addition of Structures	Line	3 x	1 = 3 / 0 = 0	___ = ___ / ___ = ___
Dust from construction	Color	2 x	2 = 4 / 0 = 0	___ = ___ / ___ = ___
	Texture	1 x	1 = 1 / 0 = 0	___ = ___ / ___ = ___
		Total	16 / 0	___ / ___

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

*Short term = use of site
Long term = completion of revegetation of site

			Facility	Point of View
		CONTRAST RATING	Refuse Disposal Site	Stevens Gulch Road

Feature	Element		* Proposed design Degree of Contrast Short Term	Long Term	With mitigation measure Degree of Contrast Short Term	Long Term
	Form	4 x	0 = 0	0 = 0	___ = ___	___ = ___
Surface Modification	Line	3 x	0 = 0	0 = 0	___ = ___	___ = ___
	Color	2 x	0 = 0	0 = 0	___ = ___	___ = ___
Relative to mine	Texture	1 x	0 = 0	0 = 0	___ = ___	___ = ___
		Total	0	0	___	___
	Form	4 x	0 = 0	0 = 0	___ = ___	___ = ___
Vegetation Modification	Line	3 x	0 = 0	0 = 0	___ = ___	___ = ___
	Color	2 x	0 = 0	0 = 0	___ = ___	___ = ___
Relative to mine	Texture	1 x	0 = 0	0 = 0	___ = ___	___ = ___
		Total	0	0	___	___
	Form	4 x	2 = 8	0 = 0	___ = ___	___ = ___
Addition of Structures	Line	3 x	1 = 3	0 = 0	___ = ___	___ = ___
Vehicles and dust from	Color	2 x	2 = 4	0 = 0	___ = ___	___ = ___
construction	Texture	1 x	2 = 2	0 = 0	___ = ___	___ = ___
		Total	17	0	___	___

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

*Short term = use of site
Long term = completion of revegetation of site

CONTRAST RATING

Facility: Sediment Retention Dams

Point of View: Stevens Gulch Road

Feature	Element		Proposed design: Degree of Contrast, Short Term	/ Long Term	With mitigation measure: Degree of Contrast, Short Term	/ Long Term
Surface Modification	Form	4 x	2/1 = 8/4	2/1 = 8/4	2/1 = 8/4	2/1 = 8/4
	Line	3 x	2/1 = 6/3	2/1 = 6/3	2/1 = 6/3	2/1 = 6/3
	Color	2 x	1 = 2	1 = 2	1 = 2	1 = 2
Earthen/Metal	Texture	1 x	1 = 1	1 = 1	1 = 1	1 = 1
	Total		17/10	17/10	17/10	17/10
Vegetation Modification	Form	4 x	2/1 = 8/4	2/1 = 8/4	2/1 = 8/4	2/1 = 8/4
	Line	3 x	2/1 = 6/3	2/1 = 6/3	2/1 = 6/3	1/1 = 3/3
	Color	2 x	2 = 4	2 = 4	2 = 4	2/1 = 4/2
Earthen/Metal	Texture	1 x	3/2 = 3/2	3/2 = 3/2	3/2 = 3/2	2/1 = 2/1
	Total		21/13	21/13	21/13	17/10
Addition of Structures	Form	4 x	2 = 8	2 = 8	2 = 8	2 = 8
	Line	3 x	2 = 6	2 = 6	2 = 6	2 = 6
Metal	Color	2 x	3 = 6	3 = 6	1 = 2	1 = 2
	Texture	1 x	2 = 2	2 = 2	2 = 2	2 = 2
	Total		22	22	18	18

Numerical Contrast Rating Limits

VRM Class	per element	Total contrast rating for any one feature Short Term / Long Term
II	2	13 / 10
III	2	20 / 16
IV	-	24 / 20

APPENDIX C

WATER RESOURCES

SITE-SPECIFIC HYDROLOGY: HYDROLOGIC MODELS

One basic problem in an investigation such as this is to determine the hydrologic regimes of watersheds for which there are little or no hydro-meteorological data. Several techniques can be used to estimate water balances of ungaged basins. Two broad categories include:

1. Regional analyses of gaged streams and extrapolation of these results to ungaged basins
2. Hydrologic simulation modeling

The regional approach is useful for evaluating large-scale runoff patterns on a seasonal or annual basis. However, regional approaches generally are not formulated in terms of the particular features of the hydrologic systems they represent but are a methodology for analyzing the <u>response</u> of these systems without due consideration for important causative factors. Thus, the regional approach, which most often employs various statistical and empirical procedures, may produce inconclusive and sometimes conflicting results when used to evaluate hydrologic responses on a short-term basis.

Mathematical modeling, or the objective analysis of the information-feedback characteristics of meteorologic and hydrologic systems, should provide more convincing criteria by which to estimate system hydrology, since system structure, delay, and amplification are taken into consideration. The modeling approach involves six basic steps:

1. Construction of a dynamic mathematical model in which important interactions between system components are defined
2. Programming and execution of the model over a period of time on a digital computer
3. Comparison of model results against all pertinent available data (The regional approach can be effectively used for model validation.)
4. Revision (tuning) of the model until it is acceptable as a representation of the actual system
5. Alteration of certain model components in order to represent changes in the real system
6. Repeat of step 3 to verify the "tuning" and/or model alteration

The foregoing process is often called "simulation." Because the model represents the real dynamic system, changes in system behavior can be traced directly to their causes. At each step in the above sequence, the prior steps often need to be revised. The whole procedure is not unlike the development of an aircraft or automobile, where repeated design changes and testing ultimately result in an operational prototype.

No model is "perfect"; not now, or ever, will there be "complete" information about any natural system. Moreover, there are no principles to guide the selection of model content. Failure to include the important system variables in a model can destroy its validity as an operational tool. Accordingly, models should be constructed, used, and interpreted by specialists who are familiar with the natural systems and understand dynamic system analysis.

Simplicity is a primary consideration in modeling and is generally achieved if the objectives of a model are precisely known. An effective model will not be overly complicated, will not have sophisticated data requirements, and can be communicated easily to the practicing professional. By the same token, an effective model cannot be expected to solve problems of minute detail.

Perhaps the most important factor in model design and use is the proper selection of the range over which the model is valid. Again, suitable boundaries or limits for the model are related to concise objectives. If a model is applied in situations outside the range of conditions for which it was designed, then the results are often misleading.

Model application of particular interest in this investigation is the prediction of the impact produced by a change imposed on the system and the approximate extent of that impact. In order to rely on the model, one must be satisfied that it is an acceptable representation of the real system and that model behavior corresponds to that of the real system. While several so-called "objective" tests have been developed for model validation, no completely objective test exists, since all depend eventually on some underlying subjective premise (Forrester 1969). It should be borne in mind that the danger in any quantitative model-validation procedure is that it takes on an "aura of authenticity" which may lead the inexperienced modeler to forget the underlying subjective assumptions. Although some investigators may challenge the idea that at some point "objective" model validation procedures rest on a subjective foundation, primary confidence must depend on: (1) acceptability or plausibility of the model in describing natural processes and (2) the reasonable assumption that "if all the necessary components are adequately described and properly interrelated, the model system cannot do other than behave as it should" (Forrester 1969). Because much of the content of complex natural system models is derived from nonquantitative sources, the defense of such models ultimately must rest in careful subjective evaluation of their performance by experienced professionals who are familiar with these systems.

In practice, the utility of a mathematical model lies in its ability to precisely represent overall behavior of natural systems, and their response to changes in one or more system components. Accordingly, small changes in system response, not otherwise detectable through statistical and regional analyses, can often be detected by careful simulation modeling.

Jones and Leaf (1975) have reviewed several models developed for engineering hydrology. They vary widely in terms of complexity and scope, depending on application. All are based on a practical engineering approach which achieves a balance among (1) theory, (2) available data, and (3) operational objectives and constraints. The successful application of each model depends to some extent on empirical derivations of several parameters and relationships, some of which are unique to the geographic areas for which they were originally derived. Accordingly, adaptation of the models to other areas, in most cases, requires development of similar empirical relationships which reflect new conditions.

It is emphasized that a model should be well documented and applied to watersheds of the same character for which it was developed. One such model, the "Subalpine Water Balance Model," was chosen to simulate watersheds in the North Fork, since it was developed and calibrated for the high-elevation subalpine zone of the central and southern Rocky Mountains. This dynamic hydrologic model was developed by the U.S. Forest Service and is specifically designed to simulate the hydrologic impacts of watershed management (Leaf and Brink 1973b). It simulates on a daily basis (1) winter snow accumulation, (2) the energy balance, (3) snowpack condition, (4) evapotranspiration, (5) snowmelt, and (6) resultant water yield on all combinations of aspect, slope, elevation, and forest cover composition and density. The model determines the form of precipitation (rain or snow), the melting process, and snowpack condition in terms of energy levels and free water requirements.

The energy balance is indexed by shortwave and longwave radiation which is computed from base-station temperature measurements. Where forest cover is present, shortwave radiation reaching the snowpack surface is estimated by means of a transmissivity coefficient which varies as the species and density of the forest cover change.

The snowpack is assumed to behave as a dynamic heat reservoir; thus, all elements in the snowmelt portion of the model, including amount and type of precipitation, are expressed in units of heat. Temperatures within the snowpack are computed using unsteady heat-flow theory. The pack will yield melt water only when it has been primed (temperature = $0^{o}C$, and its free-water-holding capacity is satisfied).
Evapotranspiration is computed by a modified version of the Hamon equation (Hamon 1961), which is adjusted in proportion to the radiation actually received each day. The adjusted evapotranspiration is then redefined according to its source, which can include (1) evaporation from snow intercepted by the forest canopy, (2) evaporation from the snowpack surface, and (3) evapotranspiration during the growing season.

If the source is evapotranspiration, further adjustments are made for (1) available soil water in open or forested areas by a method similar to that proposed by Denmead and Shaw (1962) and (2) the reflectivity of open or forested areas. Evaporation can take place from either the snowpack surface or from snow beneath the trees and from tree canopies, depending on the presence or absence of forest cover.

Input to the watershed system is derived from snowmelt and rainfall. Once evapotranspiration requirements have been satisfied, subsequent input is used to replenish any soil-water deficit. The residual input becomes water available for stream flow (generated runoff).

Westmoreland's mining operations will produce environmental impacts on at lease three drainage basins shown in map C-1. These include (1) the North Fork of the Gunnison River, (2) Stevens Gulch, and (3) Westmoreland Canyon (Orchard Valley Mine). Simulation analyses were made on each watershed.

1. North Fork

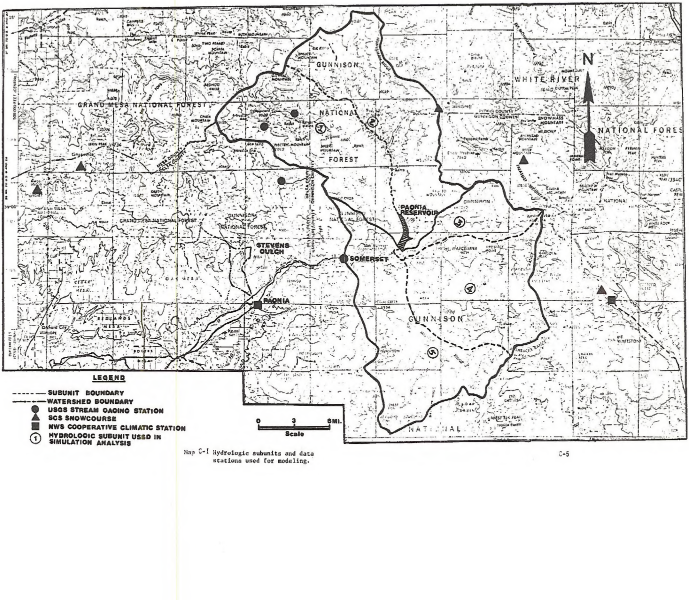
The North Fork watershed was divided into ten hydrologic subunits that vary according to slope, elevation, aspect, and forest cover (table C-1). The water balance was simulated on each subunit; area-weighted responses were computed and summed to obtain the overall response for the entire basin. Both time and spatial variations were taken into account.

Daily temperature extremes in each of the subunits were estimated by extrapolating published temperatures at Crested Butte, a cooperative station operated by the National Weather Service. Because reliable long-term radiation data were not available in the Paonia area, shortwave radiation input to the model was generated from potential solar beam radiation at 40^{o} N. latitude and adjusted for the slope/aspect characteristics of each subunit. These values were further adjusted by empirically derived thermal factors to obtain an index of incident shortwave radiation each day. Peak snowpack accumulation on the North Fork was estimated from snow-course data collected by the U.S. Department of Agriculture, Soil Conservation Service.

Ten water years (1950-59) were simulated on the North Fork. The water balance computed for six-day intervals during the average year is shown in table II-6 in chapter II. An evaluation of the credibility of the simulated responses was made by comparing the simulation analysis with the results of the regional analysis. These comparisons are shown in figure II-5, which compares annual simulated versus observed water yields from the North Fork for 1950-59. Until more surface water and climatological data become available, we must tentatively conclude that the model adequately simulates the flow regime of the North Fork.

2. Stevens Gulch

The drainage on Stevens Gulch above the Orchard Valley Mine was resolved into four hydrologic subunits. Stevens Gulch is a subalpine environment with the primary tree species being quaking aspen, whereas Westmoreland Canyon is an oakbrush-grass, pinyon-juniper type. Geographic characteristics are summarized in table C-2. The same base station data (Crested Butte temperature and precipitation) were used in a simulation analysis with appropriate corrections made for elevation and watershed characteristics.



Map C-I Hydrologic subunits and data stations used for modeling.

Table C-1

Geographic Characteristics

North Fork Gunnison River Near Somerset

Subunit No.	Area (mi.^{2})	Slope (%)	Aspect	Mean Elev. (ft.)	Total Area (%)	Eff. Forest Cov. Den. C_D(%)	Trans.[1] Coeff. (%)
1	118.94	30	NE	8,000			
G1F-76	71.36				13.9	30	35
G1Ø-76	47.58				9.3	0	100
2	125.04	20	SW	8,200			
G2F-160	87.53				17.1	30	35
G2Ø-160	37.51				7.3	0	100
3	37.09	30	SW	8,400			
G3F-160	29.67				5.8	30	35
G3Ø-160	7.42				1.4	0	100
4	110.96	30	N	9,000			
G4F-9	83.22				16.2	55	25
G4Ø-9	27.74				5.4	0	100
5	120.82	30	NNE	9,000			
G5F-9	96.66				18.8	55	25
G5Ø-9	24.16				4.7	0	100
TOTAL	512.85						

[1]/Percent of incident shortwave radiation that reaches the forest floor.

Table C-2

Geographic Characteristics

Stevens Gulch

Subunit No.	Area (mi.^{2})	Total Area (%)	Slope (%)	Aspect	Mean Elev. (ft.)	Eff. Forest Cov. Den. C_D(%)	Trans.[1] Coeff. (%)	
1	0.35		30	SE	7,500			
S1F-WTE	0.35	9.94				35	35	Foliated
						20	50	Not Foliated
2	1.23		25	SE	8,200			
S2F-WTE	0.98	27.84				35	35	Foliated
						20	50	Not Foliated
S2Ø-WTE	0.25	7.08				0	100	
3	1.04		25	SW	8,200			
S3F-WTW	0.83	23.58				35	35	Foliated
						20	50	Not Foliated
S3Ø-WTW	0.21	5.97				0	100	
4	0.90		25	SW	7,800			
S4F-WTW	0.90	25.57				35	35	Foliated
						20	50	Not Foliated
TOTAL	3.52							

[1]/Percent of incident shortwave radiation that reaches the forest floor.

Only during periods of snowmelt and after thunderstorms is surface runoff generated from the Stevens Gulch watershed. The simulated water balance for this drainage is a "potential balance," that is, it represents an estimate of the amount of runoff available to surface or subsurface flow without consideration for the disposition of that flow. Geomorphic factors in this low-to-intermediate elevation zone have produced watersheds which apparently are not tight. In other words, some amount of water generated from this zone may be lost to adjacent watersheds and to deep seepage in the steeply dipping sedimentary formations. That which is left results as intermittent surface flow and subsurface runoff which percolates through alluvial surface aquifers. It is this latter component that may be the water source for the Orchard Valley Mine. Accurate quantification of this component through additional detailed hydro-geologic studies has been done on Stevens Gulch by Wright Water Engineers, Inc. Their well completion report is included in this appendix.

Table II-7 (chapter II) is the simulated average water balance. A conservative estimate of generated runoff (including surface runoff, ground water flow, and deep seepage losses) appears to be at least 2.5 inches in the average year. During dry years, water yields are perhaps 0.5 inch; in high years, they may be 5 to 7 inches. Of the 2.48-inch average annual yield, perhaps 0.5 inch results as near-surface runoff during April and May. The remaining two inches is generated as ground water and deep seepage flow.

3. Westmoreland Canyon - Natural Conditions

The hydrology of Westmoreland Canyon is complex in that streamflow is ephemeral and is derived from both stormflow and snowmelt. The geographic characteristics of this watershed as they relate to flood potential have already been discussed in this report. Those characteristics that are pertinent to the water balance under natural conditions are summarized in table C-3.

Table C-3
Geographic Characteristics
Westmoreland Canyon (Undisturbed)

Subunit no.	Area (Acres)	Slope (%)	Aspect	Mean elev. (ft.)	Total area (%)	Effective forest cov. den. C_D(%)	Transmissivity Coef. 1/ (%)
W1F-0	209	30	S	7,400	100	35	35 Foliated
						20	50 Not Foliated

1/ Percent of incident shortwave radiation that reaches the forest floor.

Under undisturbed conditions, water yields were low, averaging only 0.7 inch due mainly to excess water produced during two wet years. These data suggest that under natural conditions, little or no surface runoff is generated from the basin other than from short duration thunderstorms.

The native plant species and associations have a significant effect on runoff processes, slope stability, and surface erosion. Destruction of this vegetation through mining activities and associated modifications of the land surface itself, can thus have a significant impact on local hydrology. The impact of removing approximately 50 percent of the vegetation from Westmoreland Canyon has increased the runoff potential of this watershed. Disturbance has increased water yields from a baseline of less than one inch to perhaps three inches. It is estimated that minimum yields now will average two inches or less and maximum yields will exceed six inches. Whereas a negligible near-surface runoff component existed on the watershed prior to disturbance, it now will account for perhaps 13 percent (0.4 inch) of the annual yield. The remaining 2.8 inches is generated as subsurface flow and deep seepage.

Table C-4

Summary of STORET Water Quality Data from the North Fork below Hotchkiss, 1971-76

Parameter	Range	Mean	Sample Size	Values >0
Temp (F)	32-68	50	28	
Turbidity (Hach, FTU)	3-420	57	24	
Conductivity (25°C)	200-1343	926	28	
Total hardness (CaCo3) mg/l	118-590	396	22	
Ca (CaCo3) mg/l	78-505	218	22	
D.O. mg/l	8.7-13.8	10.4	15	
BOD (5-day)	0.9-5.5	1.9	20	
COD mg/l	30	-	1	
PH	7.7-9.0	8.3	22	
Ammonia-N mg/l	0-0.60	0.13	24	19
NO2 -N mg/l	0-0.112	0.015	24	16
NO3 -N mg/l	0-1.8	0.91	25	
*Total-PO4 mg/l	0-0.30	0.18	13	
*Total-Phos mg/l	0-0.28	0.09	11	9
Cyanide mg/l	0-0	0	19	
mg- tot. mg/l	14-69	40	20	
Na- tot. mg/l	10-124	68	23	

* Nonoverlapping dates
1971-73
1973-76

Table C-4 (continued)

Parameter	Range	Mean	Sample Size	Values >0
Chloride (mg/l)	3-20	12	23	
SO4 (mg/l)	80-480	303	21	
Fl (mg/l)	0.10-0.90	0.44	21	
As ug/l	0-0	0	19	
B ug/l	0-190	83	22	17
Cd (tot.) ug/l	0-0	0	19	
Cr ug/l	0-0	0	18	
Cu ug/l	0-100	5	19	1
Fe ug/l	0-3000	385	20	
Pb ug/l	0-18	2	18	2
Mn ug/l	0-200	21	19	5
Mo ug/l	0-10	1	12	2
Ag ug/l	0-0	0	6	
Zn ug/l	0-80	6	19	2
Se ug/l	0-10	2	20	11
Hg (ug/l)	0-5.0	1.0	6	2
Alpha pc/l	1-87 (8-24 error)	20	18	
Beta pc/l	8-20 (9-12 error)	14	9	
Total Coliform (100 ml)	2-22000	1300	27	

Figure C-1. Colorado Department of Health sampling sites along the North Fork of the Gunnison River.

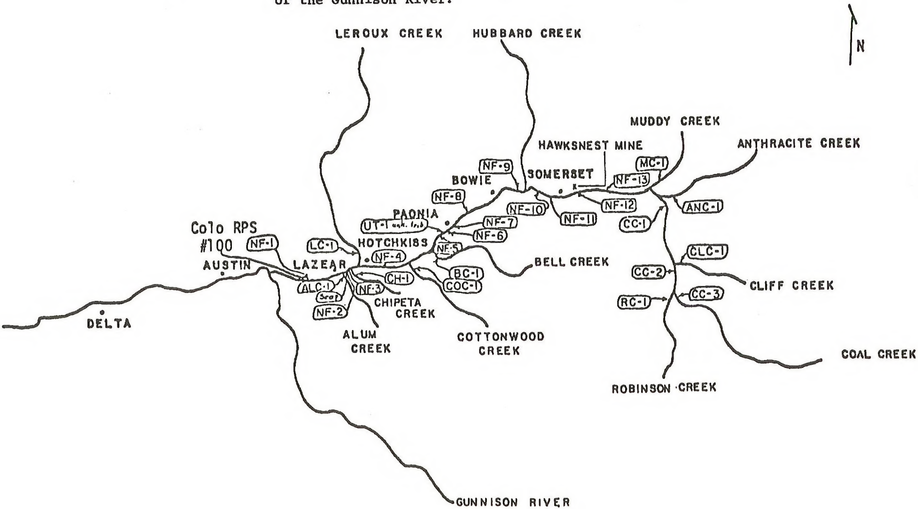


Table C-5. Summary of data from the Colorado Department of Health for the North Fork of the Gunnison River, 1975.

Station Designation	NF-5	UT-1	NF-6	NF-7			
Description	N. Fk. 3 mi. East of Paonia	Unknown Trib. above NF-5	Irrig. return at NF-5	N. Fork above Paonia WWTP			
Sample Number	648	649	650	638	647	664	702
Date	12/6/75	12/6/75	12/6/75	12/2/75	12/6/75	12/9/75	12/17/75
Temperature ^{o}C	34	5		36	32		0
Dissolved Oxygen mg/l	10.8	7.5		11.2	10.7		11.5
pH	7.9	7.9	7.9	8.2	7.9		8.2
Total Alkalinity mg/l HCO_3	136	304	372	152	120		132
Phenolphthalien Alkalinity mg/l CO_3	0	0	12	0	0		0
NO_3 as N mg/l				0			
NO_2 as N mg/l				0			
NH_3 as N mg/l				0			
Orthophosphate as P mg/l		0		0			
Total Hardness as $CaCO_3$ mg/l	188	690	1540	148	168		172
Calcium Hardness as $CaCO_3$ mg/l	120	520	1120	96	102		124
Magnesium as Mg mg/l							12
Turbidity FTU	4.0	2.1	5.1	5.0	4.2		14
Conductivity umhos	418	1058	2337	298	320		290
Suspended Solids mg/l	13	0	12	14	0		
Total Dissolved Solids mg/l	260	850		180	210		
Chlorides as Cl^- mg/l	14	22	36	16	14		14
Sulfates as SO_4 mg/l							
Fecal Coliform col/100ml							
Cadmium Cd mg/l						0	
Copper Cu mg/l						0	
Iron Fe mg/l						200	
Manganese Mn mg/l						0	
Zinc Z mg/l						0	

Table C-5. cont.

Station Designation	NF-10			NF-11	NF-12		NF-13
Description	N. Fork 3 Miles East of Bowie			N. Fk. at Diver.. West of Somerset	N. Fork at Bear Mine		N. Fork at Hawks Nest Mine
Sample Number	614	639	665	706	710	615	712
Date	9/27/75	12/2/75	12/9/75	12/17/75	12/19/75	9/27/75	12/19/75
Temperature ^{o} C	13	0.5		0	2	16	1
Dissolved Oxygen mg/l	9.0	11.8		11.6	12.2	9,0	12.2
pH	8.4	8.2		8.2	7.8	8.5	8.0
Total Alkalinity mg/l HCO_3	104	88		92		104	
Phenolphthalien Alkalinity mg/l CO_3		0		0		16	
NO_3 as N mg/l		0					
NO_2 as N mg/l		0					
NH_3 as N mg/l		0					
Orthophosphate as P mg/l		0		0			
Total Hardness as $CaCO_3$ mg/l	100	80		84	72	92	64
Calcium Hardness as $CaCO_3$ mg/l	80	60		64	52	72	40
Magnesium as Mg mg/l				4.9			6
Turbidity FTU	9.2	4.8		4.6	4	8.5	4.8
Conductivity umhos	158	181		170	175	163	170
Suspended Solids mg/l	12	12			34	15	24
Total Dissolved Solids mg/l	141	100			110	138	97
Chlorides as Cl^- mg/l	6	18		14	11	10	4
Sulfates as SO_4 mg/l	7			8.4	0	6	21
Fecal Coliform col/100ml				12			
Cadmium Cd mg/l			0				0
Copper Cu mg/l			0				0
Iron Fe mg/l			200				100
Manganese Mn mg/l			0				0
Zinc Z mg/l			50				0

Table C-6 Summary of Bimonthly Water Quality Data from the Study Area (North Fork) 1976-77

Parameter		Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
NO_3 (mg/1)	T	0.05	0.05	0.05	0.05	Oct. 26
	T	<0.1	<0.1	<0.1	<0.1	Dec. 8
	T	<0.1	-	-	<0.1	Mar. 7
	D	<0.1	-	-	<0.1	Mar. 7
		<0.1	-	-	-	Apr. 12
		0.15	-	-	-	May 10
PO_4 (mg/1)	D	<0.02	0.04	<0.02	<.02	Oct. 26
	D	0.02	0.02	0.02	.02	Dec. 8
		0.05	-	-	0.07	Mar. 7
		0.25	-	-	-	Apr. 12
		0.20	-	-	-	May 10
		2.6	-	-	2.1	June 2
Chloride (mg/1)	D	-	-	<1	-	Oct. 24
	D	6	6	8	7	Dec. 8
		2	-	-	10	Mar. 7
		12	-	-	-	Apr. 12
		-	-	-	9	May 10
		-			9	June
Hg (µg/1)	T	<.1	-	-	<.1	Oct. 24
		.1	.1	.1	.1	Dec. 8
		<.1	-	-	-	May 10
Zn (µg/1)	T	8	-	-	6	Oct. 24
		2	5	2	2	Dec. 8
		-	-	-	160	Mar. 7
		60	-	-	-	Apr. 12
		30	-	-	-	May 10
		10	-	-	10	June
Pb (µg/1)	T	20	-	-	20	Oct. 24
		20	20	20	10	Dec. 8
		-	-	-	400	Mar. 7
		20	-	-	-	Apr. 12
		20	-	-	-	May 10
		10	-	-	10	June

T- total
D- dissolved

Table C-6 (cont.)
(North Fork) 1976-77

Parameter	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
	Stations				
As T (µg/l)	-	-	-	<10	Mar.7
	-			<10	Apr.12
	-	-	-	10	June
Mb T (µg/l)	-	-	-	<40	Mar.7
	-			<10	Apr.12
	-	-	-	10	June
B T (µg/l)	-	-	-	200	Mar.7
	-			10	Apr.12
	-	-	-	10	June
Na D (mg/l)	-	-	-	25	Mar.7
Li T (µg/l)	-	-	-	<10	Mar. 7
	-			10	Apr.12
	-	-	-	10	June
V T (µg/l)	-	-	-	2	Mar. 7
	-			<2	Apr.12
	-	-	-	<2	June
Phenols T (µg/l)	-	-	-	<1	Mar. 7
	2	-	-	<1	Apr. 12
	18			15	June 2
HCO_3 D (mg/l)	122	-	-	137	Mar. 7
Ni (µg/l)	<5			<5	Mar. 7
	<5			<5	June
Ma	-	-	-	13	June

Table C-6 (cont.)
(North Fork) 1976-77

Parameter	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
	Stations				
Se ($\mu g/l$)	<5			<5	Oct.24
	<5	<5	<5	<5	Dec. 8
T	-	-	-	<5	Mar.7
	<5	-	-	-	May 10
Cu ($\mu g/l$)	<5	-	-	<5	Oct.24
	<5	<5	<5	<5	Dec. 8
T	-	-	-	<5	Mar. 7
	<5	-	-	-	May 10
Fe ($\mu g/l$)	220	130	150	150	Oct. 24
	130	180	130	340	Dec. 8
T	840	-	-	8100	Mar. 7
	9400	-	-	-	Apr. 12
	280	-	-	-	May 10
	400			220	June
Mn (3) ($\mu g/l$) T	20	20	20	30	Dec. 8
	20	-	-	-	Apr. 12
	30	-	-	-	May 10
Ba T (mg/l)	<0.5	-	-	<0.5	Mar.7
	<0.5	-	-	-	Apr.12
	1.0	-	-	-	May 10
	<0.5			<0.5	June 2
Al ($\mu g/l$) T	-	-	-	30	Mar.7
Cr T ($\mu g/l$)	<5	-	-	-	May 10
SO^4 (1) (mg/l)	27	22	26	28	Oct.24
	18	18	19	21	Dec.
	-	-	-	23	Mar.7
	-	-	-	13	June 2

Table C-6 (cont.)
(North Fork) 1976-77

Parameter (date)		Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)
BOD (2) (mg/l)(3)	Oct.26	1.4	1.2	2.5	2.1
	Dec.	1.8	1.5	1.0	1.1
	Mar. 7	2.0	-	-	<1
	June 2	1.5	-	-	<1
Oil & Grease (2) (mg/l)	Oct.26	1.	2.	<1	2
	Dec.	5	1	<1	<1
	Mar. 7	2	-	1	3
TDS (1) (mg/l) (3)	Oct. 24	146	161	183	207
	Dec.	145	140	161	191
	Mar. 7	56	-	-	75

Table C-6 Summary of Bimonthly Water Quality Data from the Study Area (cont.) (North Fork) 1976-77

Parameter		NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
NO_3 (mg/l)	T	0.05	0.05	0.05	0.05	Oct. 26
	T	<0.1	<0.1	<0.1	<0.1	Dec. 8
	T	<0.1	-	-	<0.1	Mar. 7
	D	<0.1	-	-	<0.1	Mar. 7
		<0.1	-	-	-	Apr. 12
		0.15	-	-	-	May 10
PO_4 (mg/l)	D	<0.02	0.04	<0.02	<.02	Oct. 26
	D	0.02	0.02	0.02	.02	Dec. 8
		0.05	-	-	0.07	Mar. 7
		0.25	-	-	-	Apr. 12
		0.20	-	-	-	May 10
		2.6	-	-	2.1	June 2
Chloride (mg/l)	D	-	-	<1	-	Oct. 24
	D	6	6	8	7	Dec. 8
		2	-	-	10	Mar. 7
		12	-	-	-	Apr. 12
		-	-	-	9	May 10
		-			9	June
Hg (µg/l)	T	<.1	-	-	<.1	Oct. 24
		.1	.1	.1	.1	Dec. 8
		<.1	-	-	-	May 10
Zn (µg/l)	T	8	-	-	6	Oct. 24
		2	5	2	2	Dec. 8
		-	-	-	160	Mar. 7
		60	-	-	-	Apr. 12
		30	-	-	-	May 10
		10	-	-	10	June
Pb (µg/l)		20	-	-	20	Oct. 24
		20	20	20	10	Dec. 8
	T	-	-	-	400	Mar. 7
		20	-	-	-	Apr. 12
		20	-	-	-	May 10
		10	-	-	10	June

T- total
D- dissolved

Table C-6 (cont.)
(North Fork) 1976-77

	Stations				
Parameter	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
As T (μg/l)	- - -	- -	- -	<10 <10 10	Mar.7 Apr.12 June
Mb T (μg/l)	- - -	- -	- -	<40 <10 10	Mar.7 Apr.12 June
B T (μg/l)	- - -	- -	- -	200 10 10	Mar.7 Apr.12 June
Na D (mg/l)	-	-	-	25	Mar.7
Li T (μg/l)	- - -	- -	- -	<10 10 10	Mar. 7 Apr.12 June
V T (μg/l)	- - -	- -	- -	2 <2 <2	Mar. 7 Apr.12 June
Phenols T (μg/l)	- 2 18	- -	- -	<1 <1 15	Mar. 7 Apr. 12 June 2
HCO_3 D (mg/l)	122	-	-	137	Mar. 7
Ni (μg/l)	<5 <5			<5 <5	Mar. 7 June
Ma	-	-	-	13	June

Table C-6 (cont.)
(North Fork) 1976-77

Parameter	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Date
	Stations				
Se ($\mu g/l$) T	<5			<5	Oct.24
	<5	<5	<5	<5	Dec. 8
	-	-	-	<5	Mar.7
	<5	-	-	-	May 10
Cu ($\mu g/l$) T	<5	-	-	<5	Oct.24
	<5	<5	<5	<5	Dec. 8
	-	-	-	<5	Mar. 7
	<5	-	-	-	May 10
Fe ($\mu g/l$) T	220	130	150	150	Oct. 24
	130	180	130	340	Dec. 8
	840	-	-	8100	Mar. 7
	9400	-	-	-	Apr. 12
	280	-	-	-	May 10
	400			220	June
Mn (3) ($\mu g/l$) T	20	20	20	30	Dec. 8
	20	-	-	-	Apr. 12
	30	-	-	-	May 10
Ba T (mg/l)	<0.5	-	-	<0.5	Mar.7
	<0.5	-	-	-	Apr. 12
	1.0	-	-	-	May 10
	<0.5			<0.5	June 2
Al ($\mu g/l$) T	-	-	-	30	Mar.7
Cr T ($\mu g/l$)	<5	-	-	-	May 10
SO^4 (1) (mg/l)	27	22	26	28	Oct.24
	18	18	19	21	Dec.
	-	-	-	23	Mar.7
	-	-	-	13	June 2

Table C-6 (cont.)
(North Fork) 1976-77

Parameter (date)		Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)
BOD (2) (mg/l)(3)	Oct.26	1.4	1.2	2.5	2.1
	Dec.	1.8	1.5	1.0	1.1
	Mar. 7	2.0	-	-	<1
	June 2	1.5	-	-	<1
Oil & Grease(2) (mg/l)	Oct.26	1.	2.	<1	2
	Dec.	5	1	<1	<1
	Mar. 7	2	-	1	3
TDS (1) (mg/l) (3)	Oct. 24	146	161	183	207
	Dec.	145	140	161	191
	Mar. 7	56	-	-	75

Table C-7

Summary of Bimonthly Water Quality Data From the Study Area
(Stevens Gulch Creek) 1976-77

Parameter (Date)	Stations SG-4(a)	4(b)	4(c)	4(d)	4(e)	4(f)	SG-1(a)
BOD (T) Mar. 7				-	-	2.4	-
(mg/l) Apr. 12				1.2	1.4	1.9	-
May 10				-	-	-	5.5
Oil & Grease (T) Mar. 7				-	-	1	3
(mg/l) Apr. 12				2	1	2	-
May 10				-	-	-	13
TDS (T) Mar. 7				-	-	415	566
(mg/l) Apr. 12				334	350	341	-
May 10				-	-	-	238
SO^4 (D) Mar. 7				-	-	32	60
(mg/l) Apr. 12				29	28	48	-
May 10				-	-	-	66
NO^3 (D) Mar. 7				-	-	0.1	0.1
(mg/l) Apr. 12				< 0.1	<0.1	< 0.1	-
May 10				-	-	-	< 0.1
PO^4 (D) Mar. 7				-	-	0.02	.02
(mg/l) Apr. 12				<0.02	0.06	0.02	-
May 10				-	-	-	0.25
Chloride (D) Mar. 7				-	-	-	-
(mg/l) Apr. 12				7	6	9	-
May 10				-	-	-	12
Hg (T) Mar. 7				-	-	-	-
(ug/l) Apr. 12				<.1	<.1	<.1	<.1
May 10				-	-	-	-

(cont.)

T - Total
D - Dissolved

Table C-7

(Stevens Gulch Creek) 1976-77

Parameter (Date)		SG-4(a)	4(b)	4(c)	4(d)	4(e)	4(f)	SG-1(a)
Zn (T)	Mar. 7				-	-	-	-
(ug/l)	Apr. 12				<2	< 2	2	10
	May 10				-	-	-	60
Pb (T)	Mar. 7				-	-	-	-
(ug/l)	Apr. 12				30	30	30	30
	May 10				-	-	-	20
Se (T)	Mar. 7				-	-	-	-
(ug/l)	Apr. 12				<5	<5	<5	<5
Cu (T)	Mar. 7				-	-	-	-
(ug/l)	Apr. 12				5	5	5	5
Fe (T)	Mar. 7				-	-	170	170
(ug/l)	Apr. 12				1400	620	220	-
	May 10				-	-	-	9400
Mn (T)	Mar. 7				-	-	-	-
(mg/l)	Apr. 12				720	430	280	-
	May 10				-	-	-	20
Ba (T)	Apr. 12				-	-	-	< 500

T - Total
D - Dissolved

Table C-8 Summary of Temperature (°C) Measures in the Study Area - 1976-77

Date	North Fork Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
Oct. 24	2.7	2.6	2.5	2.5			
Dec. 3	0.1	0.6	0.0	0.0	7.3	2.0	0.3
(1976) 9	0.2	1.2	-	-	-	-	-
16	0.1	0.9	0.5	0.1	-	-	-
23	0.9	0.0	0.0	0.9	4.0	3.9	2.9
30	*	0.2	0.5	0.2	0.0	3.0	*
Jan. 6	*	0.9	0.0	1.0	*	3.8	*
(1977) 13	*	0.5	0.2	0.0	*	4.1	1.4
20	*	0.9	0.0	0.2	*	6.3	2.8
27	*	0.1	0.0	0.0	0.0	4.7	2.8
Feb. 3	*	1.5	2.2	3.2	1.0	+	2.1
17	*	2.0	4.5	5.0	+	+	+
28	0.0	3.0	3.0	3.5	+	+	+
Mar. 3	2.0	2.0	2.0	3.0	+	+	+
9	3.0	4.0	5.0	5.0	+	+	+
17	2.1	2.0	2.4	3.5	+	+	+
23	8.8	8.8	0.5	0.5	+	+	+
31	4.0	4.9	5.0	5.8	+	+	+
Apr. 6	14.0	14.7	14.0	14.5	+	+	+
13	11.9	12.1	12.5	12.0	+	+	+
20	11.0	11.0	11.0	11.0	+	+	+
28	9.0	9.3	9.5	9.9	+	+	+
May 5	13.9	13.8	13.9	14.0	+	+	+
11	10.0	9.3	9.5	10.0	10.5	18,	11.
18	12.0	12.5	15.0	15.5	+	+	+
25	12.5	13.0	11.5	11.0	+	+	+
***June 1	13.0	12.0	9.8	9.5	10.1	13.1	13.5
June 8	13.8	13.5	13.2	12.9	14.8	14.8	15.2
(1977) 17	9.8	8.8	10.0	10.0	+	+	+
22	14.5	11.0	10.8	10.0	+	+	+
29	17.25	13.0	14.3	14.0	+	+	+

* water frozen over
+ no water remaining
***Temp.for SG4(f) taken 6/2 not 6/1

Table C-8 Summary of Temperature (°C) Measures in the Study Area - 1976-77

Date	North Fork Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
Oct. 24	2.7	2.6	2.5	2.5			
Dec. 3 (1976)	0.1	0.6	0.0	0.0	7.3	2.0	0.3
9	0.2	1.2	-	-	-	-	-
16	0.1	0.9	0.5	0.1	-	-	-
23	0.9	0.0	0.0	0.9	4.0	3.9	2.9
30	*	0.2	0.5	0.2	0.0	3.0	*
Jan. 6 (1977)	*	0.9	0.0	1.0	*	3.8	*
13	*	0.5	0.2	0.0	*	4.1	1.4
20	*	0.9	0.0	0.2	*	6.3	2.8
27	*	0.1	0.0	0.0	0.0	4.7	2.8
Feb. 3	*	1.5	2.2	3.2	1.0	+	2.1
17	*	2.0	4.5	5.0	+	+	+
28	0.0	3.0	3.0	3.5	+	+	+
Mar. 3	2.0	2.0	2.0	3.0	+	+	+
9	3.0	4.0	5.0	5.0	+	+	+
17	2.1	2.0	2.4	3.5	+	+	+
23	8.8	8.8	0.5	0.5	+	+	+
31	4.0	4.9	5.0	5.8	+	+	+
Apr. 6	14.0	14.7	14.0	14.5	+	+	+
13	11.9	12.1	12.5	12.0	+	+	+
20	11.0	11.0	11.0	11.0	+	+	+
28	9.0	9.3	9.5	9.9	+	+	+
May 5	13.9	13.8	13.9	14.0	+	+	+
11	10.0	9.3	9.5	10.0	10.5	18,	11.
18	12.0	12.5	15.0	15.5	+	+	+
25	12.5	13.0	11.5	11.0	+	+	+
***June 1	13.0	12.0	9.8	9.5	10.1	13.1	13.5
June 8 (1977)	13.8	13.5	13.2	12.9	14.8	14.8	15.2
17	9.8	8.8	10.0	10.0	+	+	+
22	14.5	11.0	10.8	10.0	+	+	+
29	17.25	13.0	14.3	14.0	+	+	+

* water frozen over

\+ no water remaining

***Temp.for SG4(f) taken 6/2 not 6/1

Table C-8 Summary of Temperature (^{o}C) Measures in the Study Area - 1976-77

Date	North Fork Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
Oct. 24	2.7	2.6	2.5	2.5			
Dec. 3 (1976)	0.1	0.6	0.0	0.0	7.3	2.0	0.3
9	0.2	1.2	-	-	-	-	-
16	0.1	0.9	0.5	0.1	-	-	-
23	0.9	0.0	0.0	0.9	4.0	3.9	2.9
30	*	0.2	0.5	0.2	0.0	3.0	*
Jan. 6 (1977)	*	0.9	0.0	1.0	*	3.8	*
13	*	0.5	0.2	0.0	*	4.1	1.4
20	*	0.9	0.0	0.2	*	6.3	2.8
27	*	0.1	0.0	0.0	0.0	4.7	2.8
Feb. 3	*	1.5	2.2	3.2	1.0	+	2.1
17	*	2.0	4.5	5.0	+	+	+
28	0.0	3.0	3.0	3.5	+	+	+
Mar. 3	2.0	2.0	2.0	3.0	+	+	+
9	3.0	4.0	5.0	5.0	+	+	+
17	2.1	2.0	2.4	3.5	+	+	+
23	8.8	8.8	0.5	0.5	+	+	+
31	4.0	4.9	5.0	5.8	+	+	+
Apr. 6	14.0	14.7	14.0	14.5	+	+	+
13	11.9	12.1	12.5	12.0	+	+	+
20	11.0	11.0	11.0	11.0	+	+	+
28	9.0	9.3	9.5	9.9	+	+	+
May 5	13.9	13.8	13.9	14.0	+	+	+
11	10.0	9.3	9.5	10.0	10.5	18.	11.
18	12.0	12.5	15.0	15.5	+	+	+
25	12.5	13.0	11.5	11.0	+	+	+
***June 1	13.0	12.0	9.8	9.5	10.1	13.1	13.5
June 8 (1977)	13.8	13.5	13.2	12.9	14.8	14.8	15.2
17	9.8	8.8	10.0	10.0	+	+	+
22	14.5	11.0	10.8	10.0	+	+	+
29	17.25	13.0	14.3	14.0	+	+	+

* water frozen over

\+ no water remaining

***Temp.for SG4(f) taken 6/2 not 6/1

Table C-9
Summary of pH Readings
in the Study Area
1976- 77

	North Fork Stations				Stevens Gulch Stations		
Date	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	SG-4(d)	(e)	(f)
Oct. 26 (1976)	6.6	7.4	8.1	8.1			
Dec. 8	7.5	7.8	7.8	7.8			
Mar. 3 (1977)	7.6	7.5	7.7	7.6			
14	-	7.8	7.8	7.8			
Apr. 6	7.7	7.7	7.8	7.7			
13	7.9	7.9	7.9	7.9			
20	8.2	8.0	8.1	8.0			
28	***	***	***	***			
May 5	7.8	7.5	7.7	7.8			
11	7.2	7.25	7.2	7.2	7.3	7.1	7.25
18	7.7	7.7	8.0	7.9	-	-	-
25	7.6	7.7	7.75	7.8	+	+	+
June 1	7.3	7.6	7.2	7.1	7.2	7.5	7.3
June 8	7.9	7.7	7.5	7.1	7.3	7.1	7.3
17	7.65	7.5	7.35	7.3	+	+	+
22	8.0	7.9	7.7	7.7	+	+	+
29	7.8	7.5	7.7	7.7	+	+	+

\+ no water remaining
\- no sample taken
***meter out of order
SG4(f) sample taken 6/2 not 6/1

Table C-9
Summary of pH Readings
in the Study Area
1976- 77

	North Fork Stations				Stevens Gulch Stations		
Date	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	SG-4(d)	(e)	(f)
Oct. 26 (1976)	6.6	7.4	8.1	8.1			
Dec. 8	7.5	7.8	7.8	7.8			
Mar. 3 (1977)	7.6	7.5	7.7	7.6			
14	-	7.8	7.8	7.8			
Apr. 6	7.7	7.7	7.8	7.7			
13	7.9	7.9	7.9	7.9			
20	8.2	8.0	8.1	8.0			
28	***	***	***	***			
May 5	7.8	7.5	7.7	7.8			
11	7.2	7.25	7.2	7.2	7.3	7.1	7.25
18	7.7	7.7	8.0	7.9	-	-	-
25	7.6	7.7	7.75	7.8	+	+	+
June 1	7.3	7.6	7.2	7.1	7.2	7.5	7.3
June 8	7.9	7.7	7.5	7.1	7.3	7.1	7.3
17	7.65	7.5	7.35	7.3	+	+	+
22	8.0	7.9	7.7	7.7	+	+	+
29	7.8	7.5	7.7	7.7	+	+	+

\+ no water remaining
\- no sample taken
***meter out of order
SG4(f) sample taken 6/2 not 6/1

Table C-10 Summary of D.O. Measures in the Study Area 1976-77

Date	NF-1(a)	North Fork Stations NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
Dec. 3 (1976)	11.8	12.2	11.1	10.8	2.2	8.8	6.9
9	11.7	11.0	-	-	-	-	-
16	12.5	11.9	11.6	11.7	-	-	-
23	11.9	11.7	11.8	11.3	4.0	3.9	2.9
30	*	10.6	11.6	12.3	11.3	5.0	*
Jan. 6 (1977)	*	12.1	11.6	11.4	*	4.8	*
13	*	11.5	12.0	12.1	*	3.8	8.9
20	*	11.7	11.8	11.5	*	7.2	9.0
27	*	11.6	11.5	11.5	*	5.3	10.8
Feb. 3	*	12.2	11.5	10.8	11.3	+	10.7
17	*	11.6	10.3	10.6	+	+	+
28	10.7	10.9	10.4	10.3	+	+	+
Mar. 3	10.8	10.6	10.4	10.7	+	+	+
9	10.5	11.0	9.7	9.9	+	+	+
17	11.1	10.7	11.1	10.7	+	+	+
24	10.0	10.2	11.4	11.3	+	+	+
31	10.8	10.3	10.2	10.6	+	+	+
Apr. 6	9.1	9.0	9.0	9.1	+	+	+
13	8.9	9.1	9.3	9.4	+	+	+
20	9.7	9.5	9.4	9.2	+	+	+
28	9.8	9.9	9.8	9.8	+	+	+
May 5	8.8	8.5	8.5	8.4	+	+	+
11	9.4	9.6	9.5	9.0	8.1	7.9	8.0
18	+	+	+	+	+	+	+
25	9.25	9.0	9.3	9.6	+	+	+
***June 1	8.55	8.8	8.6	8.45	7.6	+	7.8

* water frozen over
\+ no water remaining
\- no sample taken
***SG4 d &f -sample taken 6/2 not 6/1

Table C-10 Summary of D.O.

Measures in the Study Area

1977

Date	North Fork Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
(1977)							
June 8	9.0	8.4	8.7	7.8	7.0	7.1	7.1
17	10.4	9.8	8.2	8.0	+	+	+
22	9.7	10.6	10.0	9.6	+	+	+
29	9.7	9.8	8.6	8.7	+	+	+

* water frozen over
\+ no water remaining
\- no sample taken

Table C-11 Summary of Conductivity Measures in the Study Area 1976-77

Date		North Fork Stations			Steven Gulch Stations		
	NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	SG-4(d)	(e)	(f)
Dec. 3	258	275	280	296	563	548	544
(1976) 9	210	234	-	-	-	-	-
16	221	239	240	243	-	-	-
23	245	282	308	301	480	516	498
30	*	292	287	282	277	539	*
Jan. 6	718	284	650	*	*	1734	*
(1977) 13	1077	346	463	*	*	546	376
20	*	421	244	219	*	537	385
27	*	256	258	272	428	1057	922
Feb. 3	*	294	293	286	270	+	261
17	*	**	**	**	+	+	+
28	**	**	**	**	+	+	+
Mar. 3	**	**	**	**	+	+	+
9	**	**	**	**	+	+	+
17	199	230	215	202	+	+	+
23	206	215	235	232	+	+	+
31	194	213	227	237	+	+	+
Apr. 6	207	230	237	227	+	+	+
13	147	-	161	168	+	+	+
20	168	247	199	210	+	+	+
28	145	167	174	178	+	+	+
May 5	136	207	173	180	+	+	+
11	105	123	338	123	117	690	133
18	156	170	182	271	+	+	+
25	170	347	213	218	+	+	+
*** June 1	103	116	134	132	122	132	167

1 µhmos corrected to 25°C
* water frozen over
\+ no water remaining
** conductivity meter sent for factory check
\- no sample taken
***SG4(f)taken 6/2 not 6/1

Table C-11 Summary of Conductivity Measures in the Study Area 1977

Date	North Fork Stations NF-1(a)	NF-2(a)	NF-3(a)	NF-4(a)	Stevens Gulch Stations SG-4(d)	(e)	(f)
(1977) June 8	102	110	112	111	182	581	304
17	435	552	810	540	+	+	+
22	300	359	420	446	+	+	+
29	678	401	980	930	+	+	+

1 µmhos corrected to 25°C
* water frozen over
\+ no water remaining
** conductivity meter sent for factory check
\- no sample taken

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WRIGHT WATER ENGINEERS, INC.
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(303) 458-6201

KENNETH R. WRIGHT
WILLIAM L. LORAH
RUSSELL E. DARR
DR. F. ROBERT McGREGOR

July 18, 1977
Glenwood Springs

Mr. S.O. Ogden
Colorado Westmoreland, Inc.
P. O. Box E
Paonia, Colorado 81428

Re: Orchard Valley Mine
Water Resources/Water Rights

Dear Mr. Ogden:

This letter is an engineering overview of the water resources and water rights situation for Westmoreland's Orchard Valley Mine, near Paonia, Colorado. The detailed legal aspects are being summarized by Ted Worcester of Dawson, Nagel, Sherman and Howard.

Water Requirements

Westmoreland has estimated that their ultimate water requirements for the operation of the Orchard Valley Mine will be 40,000 gallons per day (gpd). This amount covers the needs for mining operations (mining equipment, belt feeders, train loading facilities, etc.) and domestic uses (office and shop builings, change house, etc.).

The ultimate 40,000 gpd water requirements equates to an average constant flow of 28 gpm (.062 cfs) or an annual usage of 45 acre feet. In the North Fork Valley, this amount of water typically would support 10 acres with a full irrigation water supply.

For water rights purposes, it has been assumed that all of the water diverted by Westmoreland is consumptively used. That is, none of the 40,000 gallons diverted daily will be available for reuse by downstream users. The effluent from the waste water treatment plant that serves the domestic needs of the Orchard Valley Mine will be used to irrigate green areas below the mine.

Physical Water Supply

Westmoreland needs a reliable water supply 365 days a year. Wright Water Engineers has determined that there are three practical water sources that could be developed for the Orchard Valley Mine. The most reliable water supply, from the physical point of view, would be the North Fork Gunnison River and its alluvium. This source would be extremely expensive to develop because of the cost of pumping the water to the mine site, approximately 1500 feet above the river bed.

Water from the Terror Creek drainage could be economically developed and delivered to the Orchard Valley Mine. This source would probably originate from wells in the West Fork of Terror Creek alluvium in section 36, T 12 S, R 92 W. The main drawback in developing this source would be the acquisition of adequate water rights. It is our opinion that Westmoreland would have to acquire senior water rights on the Terror Creek drainage, and probably storage rights in the Bruce Park Reservoir.

The third water supply, the one now being used, is the ground water in Stephens Gulch. Even though Stephens Gulch has surface flow for only a few weeks of the year, Wright Water Engineers believes that there is adequate ground water to supply most, if not all, of the 40,000 gallons per day required for the Orchard Valley Mine operations.

Wright Water Engineers has developed a well field in about 100 feet of Stephens Gulch alluvium in section 13, T 13 S, R 92 W. This well field is being closely monitored to determine its long term yield.

Water Rights

In addition to coal properties Westmoreland has acquired many agricultural lands and their appurtenant water rights. Westmoreland intends to continue using these agricultural water rights to irrigate their orchard properties. Westmoreland is developing a separate set of water rights for their mining operations. In addition to the physical water supply for the mining operations, Westmoreland must obtain the "legal" right to divert and use the water. Westmoreland's use of the water must not injure any vested water right.

Westmoreland has applied to the Division 4 Water Court for 1976 rights to divert water from North Fork Gunnison River, Stephens Gulch, and Terror Creek (water right cases W-2998, W-2999 and W-3000). These rights are junior to all other previously established water rights. In our opinion, these rights would be allowed to divert water only during the winter months when there has historically been no "call" on the North Fork. These junior rights do not supply a reliable water right for Westmoreland's needs.

Currently, the backbone of Westmoreland's industrial water supply for the Orchard Valley Mine is their 25% interest in the Lost Lake Slough (East Beckwith No. 1 Reservoir) located about 48 miles upstream from Paonia on a tributary to Anthracite Creek. Westmoreland's 25% interest yields more than 100 acre feet of storage water each year.

The Lost Lake water is exchanged to the Stephens Gulch wells via an Augmentation Plan (W-3106) that has been temporarily approved by the State Engineer's Office and is now before the water court. The augmentation plan allows releases to be made out of the Lost Lake Slough to compensate for any injury to vested water rights that might occur because of the pumping of the Stephens Gulch wells.-

It has been assumed that water pumped from the Stephens Gulch wells would have been tributary of the North Fork Gunnison River. In general, any injury caused by the Stephens Gulch wells would be to water rights on the North Fork. This injury is mitigated by releases from the Lost Lake Slough. The State Engineer's Office will charge a "transportation loss" for the water transported in the stream from the Reservoir to the Paonia area.

Orchard Valley Mine's ultimate annual water use is estimated to be 45 acre feet. The 100 acre feet plus of the Lost Lake Slough water is more than adequate to cover the stream depletions caused by Westmoreland's industrial use.

To date, Westmoreland has developed a producing well field in Stephens Gulch that may be able to supply the Orchard Valley Mine's ultimate water requirements. It is Wright Water Engineers' opinion that if, for some reason, the Stephens Gulch wells do not produce the ultimate water needed, an alternate or supplimental supply can be developed from Terror Creek or the North Fork. It is our opinion that Westmoreland's interest in the Lost Lake Slough can be used to augment the mine's diversions from Stephens Gulch and the North Fork in a way that will not injure any vested water rights in the North Fork basin.

If you have any questions please do not hesitate to contact us.

Very truly yours,

WRIGHT WATER ENGINEERS, INC.

By William L. Lorah
William L. Lorah

WLL:gh
761-71

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STEAMBOAT VILLAGE, COLORADO 80499
SANTO DOMINGO OFFICE
WRIGHT-MENA WATER ENGINEERS
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KENNETH R WRIGHT
WILLIAM L LORAH
RUSSELL E DARR
F ROBERT McGREGOR
RALPH L TOREN
ROBERT D TAFELSKI

June 14, 1977
Glenwood Springs
Tel: 945-7755

Mr. Charles Leaf
4412 E Mulberry - 133
Fort Collins, Colorado 80521

Re: Westmoreland

Dear Chuck:

At your request we are sending you a copy of our May 4, 1977 report entitled "Groundwater Investigation of Stevens Gulch for Colorado Westmoreland, Inc." We are currently working with Westmoreland to monitor their well. To date it has pumped over 600,000 gallons.

As to the water requirements I suggest that you use the data in the augmentation plan that was filed with the water court. The State Engineer's office has given temporary approval to implement that plan.

I also suggest that you coordinate your contacts with the State Engineer's office with Ted Worcester.

Very truly yours,

WRIGHT WATER ENGINEERS, INC.

By William L. Lorah
William L. Lorah

WLL:gh
761-71

cc: S. O. Ogden w/o enclosures
Ted Worcester w/o enclosures

GROUND WATER INVESTIGATION OF STEVENS GULCH FOR COLORADO WESTMORELAND, INC.

INTRODUCTION

During the period of March 14, 1977, to April 24, 1977, a ground water investigation was conducted in Stevens Gulch to determine the ground water potential as a water supply for the Converse coal mine. Four test and observation holes were drilled in SW¼, NW¼, Section 13, T13S, R92W, 6th P.M. During drilling of these holes, geologic samples were taken and analyzed at selected intervals and noticeable formation changes. Also during drilling of the holes, pumping and bail tests were conducted to determine quantity and quality.

SITE SELECTION

A surface geologic reconnaissance was conducted. The Stevens Gulch site was selected because of proximity to the mine site and the potential water-bearing alluvium.

TEST HOLE DRILLING

Collins Drilling Company, Inc., of Carbondale, Colorado, was contracted to do the test drilling. They set up their cable tool equipment at the Stevens Gulch site on March 17-19, 1977, and started drilling Test Hole SG-A. See figures 1, 2, and 3 for location and distance relationships of test holes. A 6-5/8" casing, with the bottom 20 feet torch slotted, was driven into the hole as drilling progressed. At selected intervals bailing tests and pumping tests were conducted to determine the aquifer characteristics and water quality. (See table 2 for summary.) Geologic samples were collected at 5-foot intervals or at significant changes in formation. (See figure 4 for geologic cross sections.)

At a depth of 95 feet bedrock was encountered. The bedrock is a member of the Mesa Verde sandstone. Drilling was then undertaken on Test Hole SG-1, which is located at a distance of 50 feet from SG-A. As the hole was drilled, 8-5/8" casing was driven into the hole.

The 8-5/8-inch casing was not slotted to facilitate conversion to production well. Samples were taken at 5 feet intervals for comparison to test hole SG-A. The samples indicated similar geologic material. From information gathered, it was decided to install a well screen in Test Hole SG-1. While waiting for delivery of the screen, Test Hole SG-B was drilled. A 6-5/8-inch steel casing with the bottom 15 feet torch slotted was driven as drilling progressed. See figure 5 for as-built and figure 4 for geologic log.

At this time, 18 feet of 8-inch telescope stainless steel, 80 slot, well screen was installed in Test Hole SG-1. The casing was pulled back to expose the screen to the aquifer. Development with a surge block was undertaken to cause stresses on the aquifer. Surging was conducted for two days with approximately one cubic yard of sand being removed from the well. This type of development is generally used to improve well yield and make for a more efficient well. High pressure jetting was then undertaken to attempt well improvement. After four hours of jetting, no improvement was noted.

BAIL AND PUMPING TEST

Several bail and pumping tests were conducted during the drilling of the test holes in Stevens Gulch. These tests were conducted to determine water yielding potential of the alluvium at selected depths. Figure 3 illustrates the drawdown and recovery curves at these selected depths in Test Hole SG-A. As can be noted, the zone of highest yield potential is from 70 to 90 feet.

After the well screen was installed in SG-1 and development was completed, a short pumping test was run. The well was pumped at a rate of 7 gpm. In response to this pumping, it immediately drew down to 65 feet.

Due to the low yield at Well SG-1, a 24-hour constant rate pumping test was run on Test Hole SG-A. During this pumping test, water levels were monitored in all four of the observation holes. Figures 6 and 7 are time drawdowns of all wells combined. At the end of the 24-hour pumping test, recovery readings were taken and are plotted on figure 8. These readings are used to determine physical characteristics of the aquifer.

HYDROLOGIC ANALYSIS

Time-drawdown data from the pumping test of Well SG-A were analyzed using a Theis nonequilibrium method of analysis. The Theis equation describes the reduction in pressure head expected in an artesian aquifer in response to pumping stress imposed on the aquifer. The producing sands appear to be under artesian conditions because the water level rises above the top of the aquifer in wells.

With these limitations in mind, a best fit procedure was used to identify aquifer parameters (i.e., transmissivity and storage coefficient) that allow accurate prediction of drawdowns during the pumping test in each of the holes. The recovery portion of the test was also used to develop aquifer characteristics. Table 1 lists the optimum parameters.

TABLE NO. 1

Well	T transmissivity GPD/ft from drawdown	T transmissivity GPD/ft from recovery	S Storage coefficient (unitless)
SG-A (pumping well)	1660 (early fit) 1413 (late fit)	1650	.0009 .004
SG-1 (50' from pumping well)	1057	1100	.002
SG-B (116.5' from pumping well)	1441	1750	.0003

An additional check on the validity of the parameter estimates involved calculation of aquifer parameters from the distance drawdown relationship at the end of the pumping test. This analysis showed an average T of 1,720 gpd/ft and S of 0.0002. The general configuration of the time-drawdown curves suggests that no hydrologic boundaries were intersected by the rapidly expanding cone of influence.

Prediction of future pumping effects for extended periods of time were completed for various pumping rates and are shown on figure 10. An average T of 1,400 gpd/ft and an S of 0.002 were used. An important point to note is that when the aquifer water level is drawn down to the top of the aquifer, physical dewatering of the aquifer begins and yields are much lower. Once the potentiometric head is dropped to this level, a well production of 5 to 10 gpm is the maximum that can be expected. The data from the 24-hour test suggests that a pumping rate of about 40,000 gpd can be sustained for at least ten years. With expected recharge, this rate may be sustained for an indefinite period.

The transmissivity (T) and storage coefficient (S) allow the drawdown to be predicted for an aquifer that fits the assumptions inherent in the Theis equation. The most important of these assumed conditions are (1) the aquifer is infinite in size and (2) aquifer parameters are the same everywhere in the aquifer. The small mountain basin under study does not strictly meet either of these conditions so the predictions based on this method are only estimates. During the 24-hour aquifer test, the conditions were satisfied for (1) above because the radius influenced by the test did not reach any boundaries.

It should be noted that the aquifer life of ten years has been determined from characteristics derived from the 24-hour pumping test. This test did not indicate the presence of boundaries. However, longer periods of pumping may indicate a boundary condition.

WATER QUALITY

During drilling and during the pumping test water samples were taken and field analyzed. Samples taken just after the beginning of the 24-hour test and just prior to shutting off the pump were sent to Industrial Laboratories of Denver. Complete chemical analyses were performed by standard wet chemical methods plus a spectrographic analysis. See tables 3 and 4 for the results of these analyses.

As can be noted by the tables, the analyses indicate good quality water. Iron and manganese were reported above U.S. Public Health Service standards in the sample taken just after pumping began. However, the sample taken just prior to the end of the test indicates the iron and manganese concentrations were well within acceptable limits. This indicates that the cone of depression had spread sufficiently to encounter good quality water. The last sample indicates that no constituent analyzed exceeded the recommended standards of the U.S. Public Health Service. The only treatment necessary is chlorination as required by the Colorado Department of Health for public drinking water supplies.

CONCLUSIONS AND RECOMMENDATIONS

The results of the test drilling program indicate that the alluvial material investigated in Stevens Gulch is capable of producing the desired 40,000 gallons per day. This projection is based upon data from the 24-hour pumping test. Prolonged pumping could give results which could have additional bearing upon this pumping rate.

The present situation of Colorado Westmoreland is that of immediate need for about 16,000 gpd of water and a future need of 40,000 gpd. Therefore, the following program is recommended to supply the present demands while collecting additional information.

1. A pump capable of producing 40 gpm from a depth of about 60 feet below ground surface should be installed in Test Hole SG-A. Pumping from the hole would be on a noncontinuous basis, as needed to fill the tank trucks. A totalizing flow meter should be attached to the discharge pipe.

2. During the first month of pumping, all holes should be monitored. Continuous water level recorders should be installed on well Nos. SG-B and SG-C. Together with these devices, water levels and total gallonage pumped should be recorded daily. This should be realized each morning before pumping begins.

3. After one month of gathering this data, an evaluation should be made regarding long-term reliability.

4. If deemed a reliable supply, plans should be made to pull the screen from Test Hole No. SG-1. At a distance of about ten feet from Test Hole SG-A, a production well should be drilled and the screen set at the proper intervals. Additionally, a backup well should be drilled a short distance from the production well. This well would be equipped with a pump and would be for backup purposes only. At no time should the production well and the backup well be pumped simultaneously.

5. Upon completion of these wells, data should be recorded on a weekly basis.

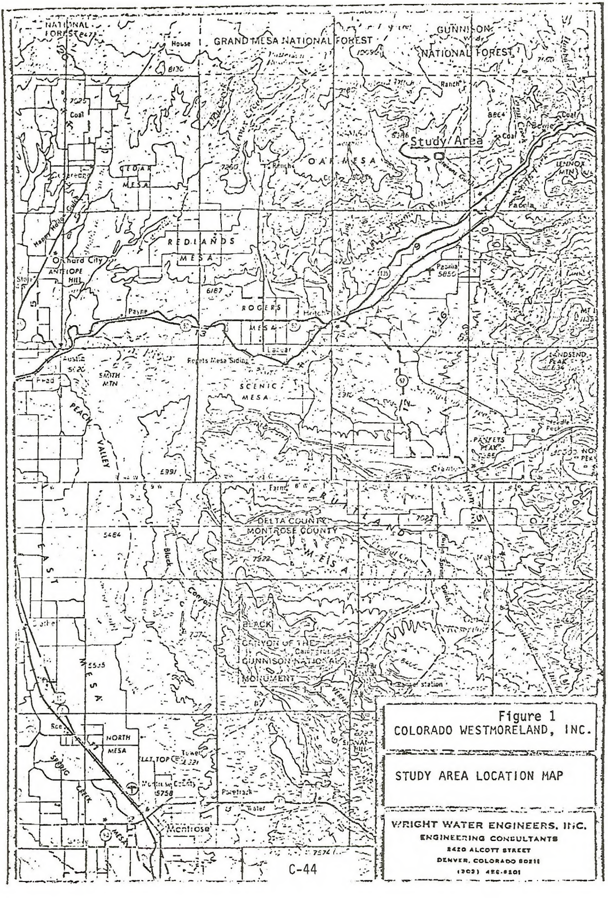

Figure 1
COLORADO WESTMORELAND, INC.

STUDY AREA LOCATION MAP

WRIGHT WATER ENGINEERS, INC.
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(303) 480-1700

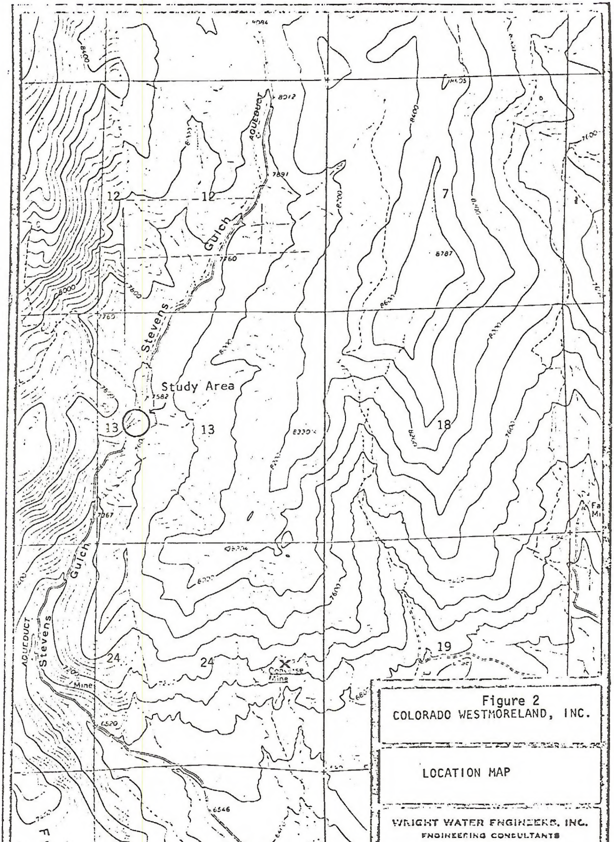

Figure 2
COLORADO WESTMORELAND, INC.

LOCATION MAP

WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
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DENVER, COLORADO 80211
(303) 482-6201

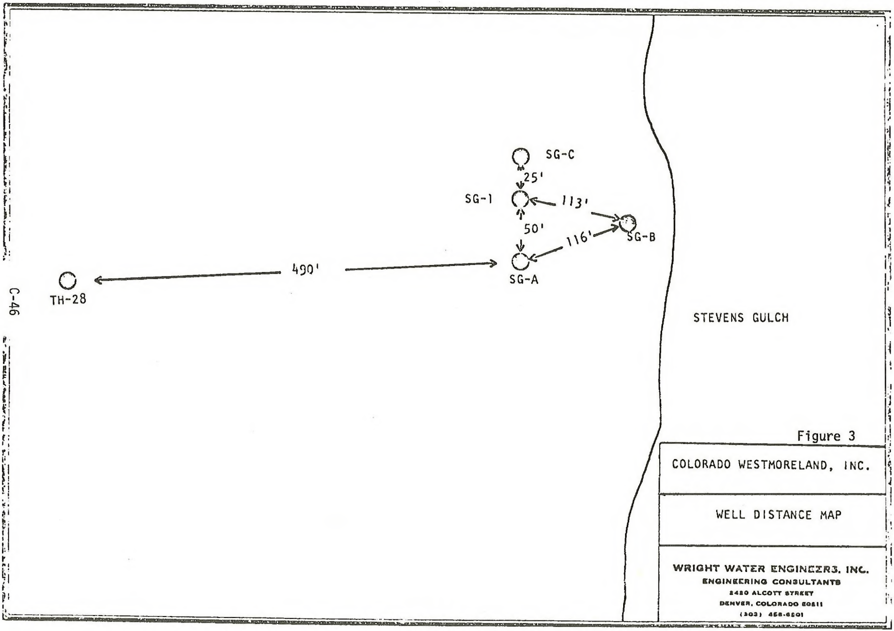
SG-C
25'
SG-1
113'
50'
116'
SG-B
490'
SG-A
TH-28
STEVENS GULCH
COLORADO WESTMORELAND, INC.
WELL DISTANCE MAP
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201

Figure 3

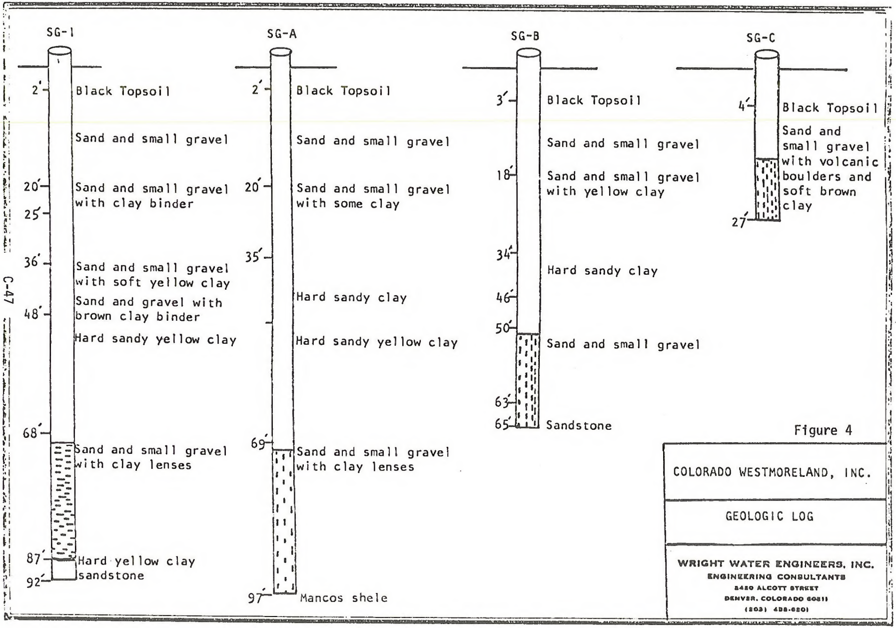
SG-1
2'
Black Topsoil
Sand and small gravel
20'
Sand and small gravel with clay binder
25'
36'
Sand and small gravel with soft yellow clay
Sand and gravel with brown clay binder
48'
Hard sandy yellow clay
68'
Sand and small gravel with clay lenses
87'
Hard yellow clay
sandstone
92'
SG-A
2'
Black Topsoil
Sand and small gravel
20'
Sand and small gravel with some clay
35'
Hard sandy clay
Hard sandy yellow clay
69'
Sand and small gravel with clay lenses
97'
Mancos shele
SG-B
3'
Black Topsoil
Sand and small gravel
18'
Sand and small gravel with yellow clay
34'
Hard sandy clay
46'
50'
Sand and small gravel
63'
65'
Sandstone
SG-C
4'
Black Topsoil
Sand and small gravel with volcanic boulders and soft brown clay
27'
COLORADO WESTMORELAND, INC.
GEOLOGIC LOG
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS

Figure 4

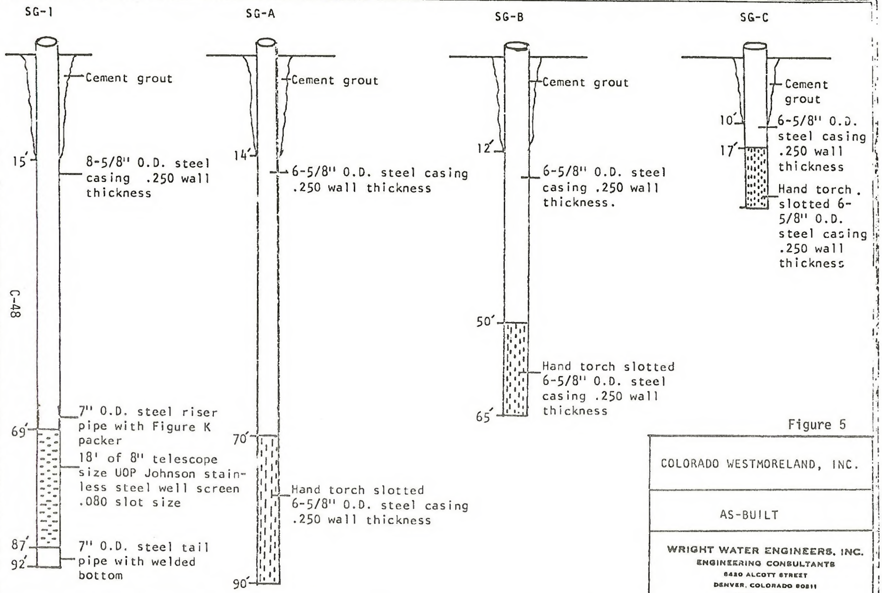

Figure 5

COLORADO WESTMORELAND, INC.

AS-BUILT

WRIGHT WATER ENGINEERS, INC.
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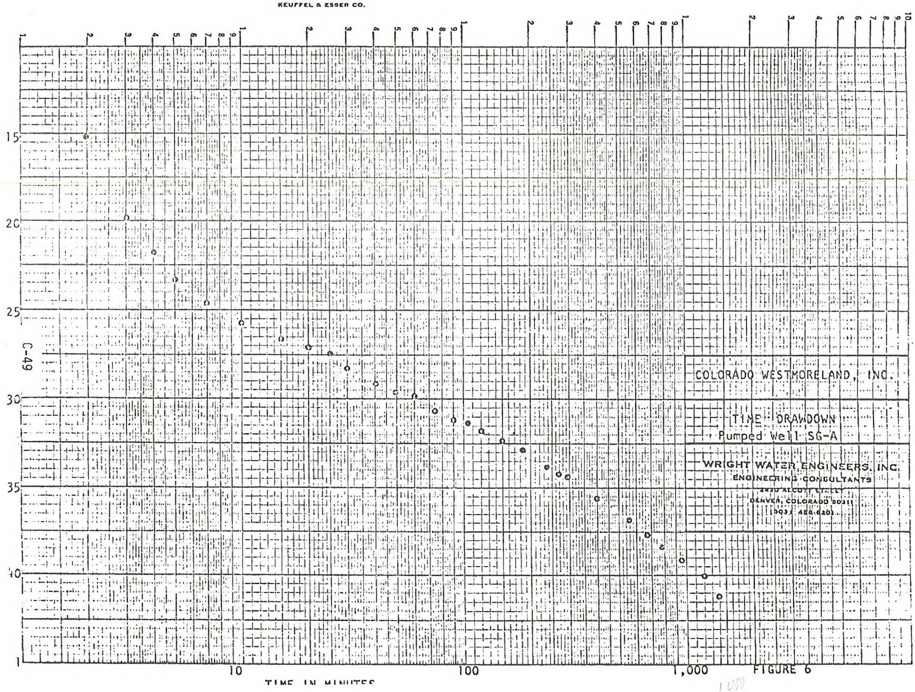
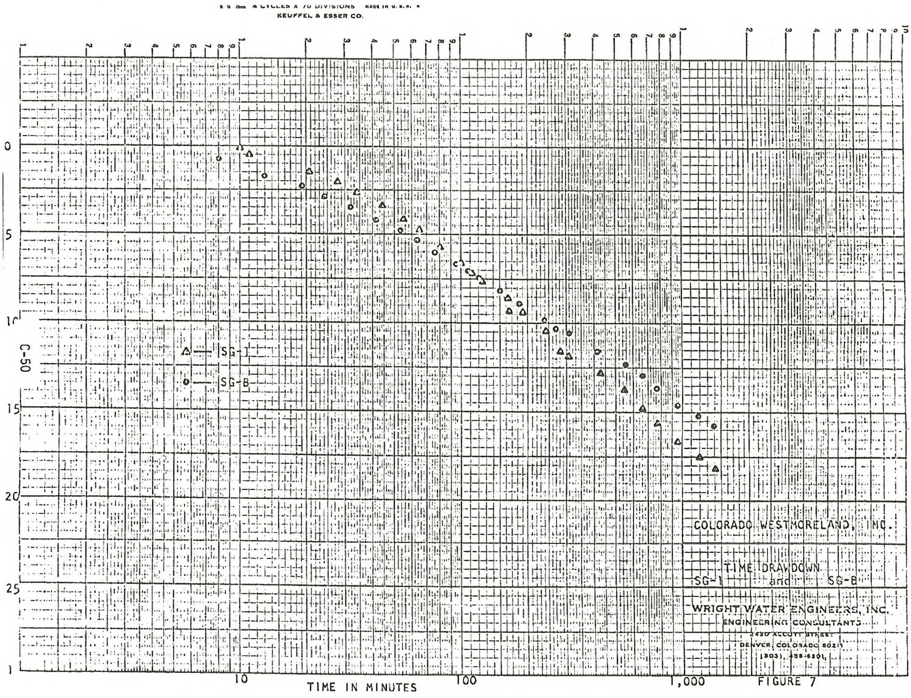


FIGURE 6

1400

C-50



KEUFFEL & ESSER CO.
0
5
10
15
20
25
SG-1
SG-B
10
100
1,000
TIME IN MINUTES
COLORADO WESTMORELAND, INC.
TIME DRAWDOWN
SG-1 and SG-B
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
DENVER, COLORADO

FIGURE 7

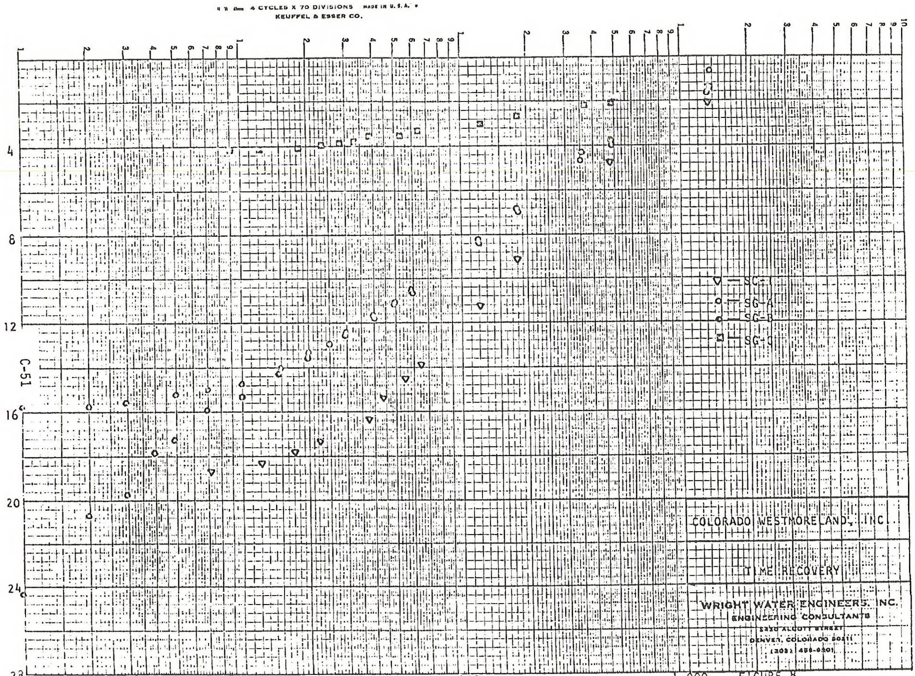
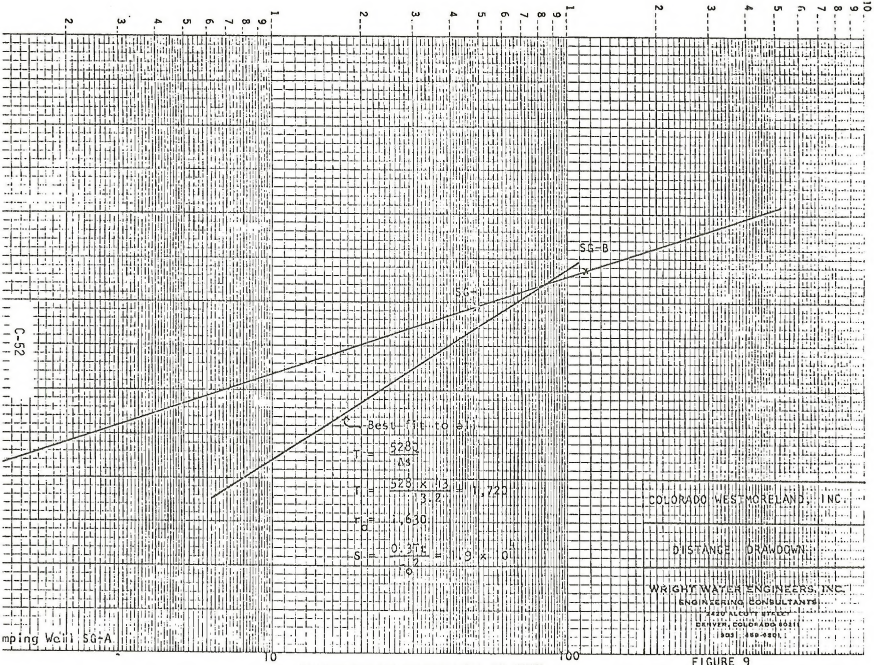
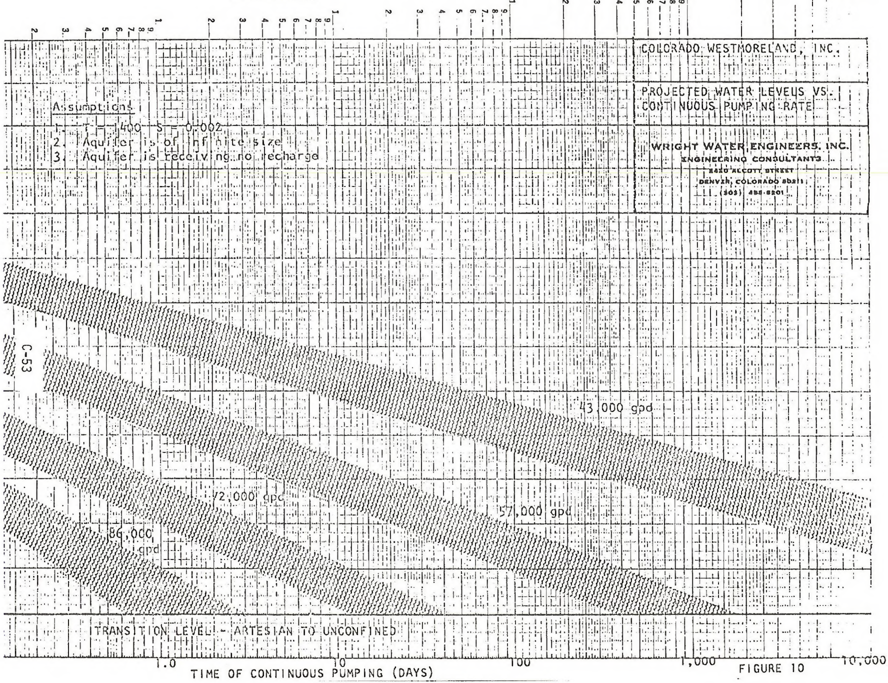

4 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
4
8
12
16
20
24
28
1
10
100
1,000
TIME SINCE PUMPING STOPPED IN MINUTES
SG-1
SG-A
SG-B
SG-C
COLORADO WESTMORELAND, INC.
TIME RECOVERY
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
DENVER, COLORADO

FIGURE 8



DISTANCE FROM PUMPED WELL IN FEET

FIGURE 9



COLORADO WESTMORELAND, INC.
PROJECTED WATER LEVELS VS. CONTINUOUS PUMPING RATE
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
Assumptions
1. T = 1400 S = 0.002
2. Aquifer is of infinite size
3. Aquifer is receiving no recharge
C-53
43,000 gpd
57,000 gpd
72,000 gpd
86,000 gpd
TRANSITION LEVEL - ARTESIAN TO UNCONFINED
1.0
10
100
1,000
10,000
TIME OF CONTINUOUS PUMPING (DAYS)

FIGURE 10

PUMPING AND BAIL TEST SUMMARY

Test Hole	Type of Test	Interval Tested	Pumping rate (gpm)	Specific Capacity (gpm/ft DD)	Length of Test (minutes)	pH (unitless)	Temp °C	Hardness (grains/gal.)	Conductivity (µmhos/cm)
SG-A	P	2'-20'	7	0.7	30	6.9	10	12	--
SG-A	B	20'-30'	--	No Production	--	--	--	--	--
SG-A	P	30'-40'	5	0.1	45	6.9	10	12	--
SG-A	B	40'-60'	--	No Production	--	--	--	--	--
SG-A	P	60'-80'	12.5	0.98	90	6.9	9	13	611
SG-A	P	70'-90'	16	1.7	120	6.9	9	13	600
SG-1	B	30'-35'	5	0.5	25	--	10.5	12	--
SG-1	B	70'-90'	14	0.8	20	--	--	--	--
SG-C	P	0'-25'	2	0.2	30	--	--	--	--

Notes:

Type of Test B = Bail, P = Pumping

Water quality tests were conducted with field test kits.

All pumping and bail tests were conducted for less than 2 hours.

TABLE 2

Table 3
DRINKING WATER QUALITY STANDARDS
(Standard Wet Chemical Analysis)

CHEMICAL Constituent	SG-A 3-24-77	SG-A 4-21-77	LIMITS (mg/1) or (ppm) Recommended'	Maximum'	Unestablished'	Comment
Alkalinity	300.	310				Generally not harmful
Alkyl Benzene Sulfonate (ABS)[5]			0.5			Taste, Frothing
Arsenic[5]			0.01	0.05		Poisoning
Barium[5]				1.0		Poisoning
Bicarbonate	370	380			700	Taste
Cadmium[5]				0.01		Poisoning
Calcium	79	44			200	Hardness
Carbon Chloroform[5] Extract (CCE			0.2			Indicator of Potentially Toxic Material
Carbonate	<0.0	<0.1			20	Taste
Chloride	4.0	5.4	250.0			Taste & Laxative Prop.
Chromium[5]				0.05		Poisoning
Copper[5]			1.0			Taste
Cyanide[5]			0.01	0.2		Poisoning
Fluoride	0.2	0.3	0.8-1.7	1.4-2.4		Mottling of Teeth
Hardness	280	230			500	Economics, Health
Iron	0.06	<0.05	0.3			Staining, Taste
Lead[5]				0.05		Poisoning
Magnesium	20	29			125	Laxative
Manganese	0.4	<0.05	0.05			Staining, Taste
Nitrate	0.5	0.4	45.0			Methemoglobinemia in infants (Blue babies)
Phosphate	<0.1	<0.1				
Phenol[5]			0.001			Taste
Selenium[5]				0.01		Poisoning
Silicon dioxide	39	36				Generally not harmful
Silver[5]				0.05		Poisoning-- Discoloration of Membranes
Sodium	55	80	10.0[3]		115	Heart Conditions
Sulfate	26	25	250.0			Laxative & Taste Prop.
Total Dissolved Solids (TDS)	405	405	500.0			Laxative, Taste
Zinc[5]			5.0			Taste
Radium -226[5]				3.0 pc/l		Poisoning
Strontium - 90[5]				10.0 pc/l		Poisoning
Mercury						

Table 4
DRINKING WATER QUALITY STANDARDS
(Qualitative Spectrographic Analysis)

CHEMICAL Constituent	SG-A 3-24-77	LIMITS (mg/1) or (ppm) Recommended'	Maximum'	Unestablished'	Comment
Aluminum	.5				Generally not harmful
Antimony				Unknown	Poisoning
Arsenic[4]		0.01	0.05		Poisoning
Barium	.001		1.0		Poisoning
Beryllium					Generally not harmful
Bismuth					
Boron	.05			30	Food preservative
Cadmium[4]			0.01		Poisoning
Calcium	Major			200	Hardness
Cerium				Unknown	Radioactive
Cesium				Unknown	Radioactive
Chromium(+6)			0.05		Poisoning
Cobalt				Unknown	Radioactive
Columbium					
Copper	.001	1.0			Taste, staining
Dysprosium					
Erbium					
Europium					
Gadolinium					
Gallium					
Germanium				<100	Poisoning
Gold					Usually not present
Hafnium					
Holmium					
Indium					
Iridium					
Iron	.1	.3			Staining, taste
Lanthanum					Generally not harmful
Lead			0.05		Poisoning
Lithium	.001			5.0	Not given
Lutetium					
Magnesium	Major	125[2]			Taste, hardness
Manganese	.5	0.05			Staining, taste
Mercury[4]				0.005	Poisoning
Molybdenum					Usually not present
Neodymium					
Nickel	.001			1.0	Unknown
Osmium					
Palladium					Unknown
Platinum					
Potassium	.01			2000	Laxative
Praseodymium					
Radium(226)[4]			3pc/1		Poisoning
Rhenium					
Rhodium					
Rubidium					Generally not harmful

Table 4

DRINKING WATER QUALITY STANDARDS (Continued)

(Qualitative Spectrographic Analysis)

CHEMICAL Constituent	SG-A 3-24-77	LIMITS (mg/1) or (ppm) Recommended[1]	Maximum[1]	Unestablished[1]	Comment
Samarium					
Scandium					
Selenium[5]			0.01		Poisoning
Silicon	5.				Generally not harmful
Silver	.001		0.05		Skin pigmentation
Sodium	5.	10^3		115	Heart conditions
Strontium	.1		10 pc/1		Poisoning
Tantalum					
Terbium					
Thallium				0002	Poisoning
Thorium				Unknown	Radioactive
Thulium					
Tin					Generally not harmful
Titanium	.001				Generally not harmful
Tungsten					Usually not present
Uranium[4]				.001	Poisoning
Vanadium					Has beneficial effects
Ytterbium					
Yttrium				Unknown	Radioactive
Zink		5.0			Taste, poisoning
Zirconium					Generally not harmful

1. Established by U.S. Public Health Service and adopted by Colorado Department of Health.
2. Established by Colorado Department of Health
3. Reported in California State Water Resources Control Board "Water Quality Criterid" 1963.
4. Minimum detectable amount may not be low enough to detect recommended, maximum or unestablished limit.
5. Not Analyzed.

Recommended limits should not be exceeded whenever more suitable water supplies are available at reasonable cost. Units expressed in milligrams per liter (mg/1)
Note: 1.0 mg/1 = 1.0 parts per million (ppm)

Maximum limits, if exceeded, are grounds for rejection of the water supply.
Units expressed in mg/1 and pico-Curies per liter (pc/1).

Unestablished limits are recommended by some members of the scientific community but not adopted by the controlling governmental agencies.

TABLE 4 Continu

THE INDUSTRIAL LABORATORIES COMPANY

Analytical and Consulting Chemists

2600 WEST 29TH AVENUE
DENVER, COLORADO 80211
ANALYSIS REPORT

TELEPHONE 455-3241

WRIGHT WATER ENGINEERS
2420 Alcott Street
Denver, Colorado 80211

Attn: Ray Newmeyer

DATE RECEIVED: 4/25/77
DATE REPORTED: 5/3/77

LAB. NUMBER: 8034

SAMPLES ARE DISCARDED IN 15 DAYS FROM DATE OF REPORT UNLESS WE ARE REQUESTED, IN WRITING, TO RETAIN THEM FOR A LONGER PERIOD. PERISHABLE SAMPLES ARE USUALLY DISCARDED IMMEDIATELY UNLESS CLIENT HAS REQUESTED SPECIAL HANDLING (FREEZING, ETC.) IN ADVANCE.

SAMPLE MARKED: #761-71.2 SA-A3 Stevens Gulch Well #A
4/21 11:45 AM

ANALYSIS: WATER, MINERAL ANALYSIS

FORMULA AND NAME	Milligrams per liter
Ca, Calcium	44
Mg, Magnesium	29
Na, Sodium (by ~~XXXXXXXXXX~~ flame)	80
CO_3, Carbonate	Less than 0.1
HCO_3, Bicarbonate	380
SO_4, Sulfate	25
Cl, Chloride	5.4
NO_3, Nitrate	0.4
PO_4, Phosphate	Less than 0.1
SiO_2, Silicon dioxide	36
Fe, Iron	Less than 0.05
F, Fluoride	0.3
P Alkalinity (in terms of calcium carbonate)	Less than 0.1
MO Alkalinity (in terms of calcium carbonate)	310
Hardness (in terms of calcium carbonate)	230

FORMULA AND NAME	Milligrams per liter
pH	7.3
Evaporated Solids	405
Mn, Manganese	Less than 0.05

HYPOTHETICAL COMBINATIONS

FORMULA AND NAME	Milligrams per liter
KCl, Potassium chloride	
NaCl, Sodium chloride	
Na_2SO_4, Sodium sulfate	
Na_2CO_3, Sodium carbonate	
$NaHCO_3$, Sodium bicarbonate	
$MgSO_4$, Magnesium sulfate	
$Mg(HCO_3)_2$, Magnesium bicarbonate	
$CaSO_4$, Calcium sulfate	
$CaCO_3$, Calcium carbonate	
$Ca(HCO_3)_2$, Calcium bicarbonate	
$CaSiO_3$, Calcium silicon dioxide	

MEMBERS OF:
AMERICAN ASS'N OF CEREAL CHEMISTS
AMERICAN CHEMICAL SOCIETY

THE INDUSTRIAL LABORATORIES COMPANY
H. Paul Vcks

THE INDUSTRIAL LABORATORIES COMPANY

Analytical and Consulting Chemists

2600 WEST 29TH AVENUE
DENVER, COLORADO 80211
ANALYSIS REPORT

TELEPHONE 455-3641

DATE RECEIVED: 3/25/77
DATE REPORTED: 3/30/77

WRIGHT-MCLAUGHLIN ENGINEERS
2420 Alcott Street
Denver, Colorado 80211

LAB. NUMBER: 7285

SAMPLES ARE DISCARDED IN 15 DAYS FROM DATE REPORT UNLESS WE ARE REQUESTED, IN WRITI TO RETAIN THEM FOR A LONGER PERIOD. PERI ABLE SAMPLES ARE USUALLY DISCARDED IMM IATELY UNLESS CLIENT HAS REQUESTED SPECI HANDLING (FREEZING, ETC.) IN ADVANCE.

SAMPLE MARKED: Water #71 Job #761-71.2 TH-1 Stevens Gulch Westmorland

ANALYSIS: WATER, MINERAL ANALYSIS

FORMULA AND NAME	Milligrams per liter	FORMULA AND NAME	Milligrams per liter
Ca, Calcium.	79	— pH.	7.3
Mg, Magnesium.	20	— Evaporated Solids	405
Na, Sodium (by Flame)	55	Mn, Manganese	0.4
CO_3, Carbonate . . . . .Less	than 0.1	. . . .	
HCO_3, Bicarbonate.	370	. . . .	
SO_4, Sulfate	26	HYPOTHETICAL COMBINATIONS	
Cl, Chloride	4.0	KCl, Potassium chloride	
NO_3, Nitrate	0.5	NaCl, Sodium chloride	
PO_4, Phosphate . . . . .Less	than 0.1	Na_2SO_4, Sodium sulfate.	
SiO_2, Silicon dioxide.	39	Na_2CO_3, Sodium carbonate. . . .	
Fe, Iron	0.06	$NaHCO_3$, Sodium bicarbonate. . .	
F, Fluoride.	0.2	$MgSO_4$, Magnesium sulfate. . . .	
P Alkalinity . . . . .Less (in terms of calcium carbonate)	than 0.1	$Mg(HCO_3)_2$, Magnesium bicarbonate	
MO Alkalinity. . . . . (in terms of calcium carbonate)	300	$CaSO_4$, Calcium sulfate.	
Hardness . . . . (in terms of calcium carbonate)	280	$CaCO_3$, Calcium carbonate. . . .	
		$Ca(HCO_3)_2$, Calcium bicarbonate.	
		$CaSiO_3$, Calcium silicon dioxide	

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C-59

THE INDUSTRIAL LABORATORIES COMPANY

THE INDUSTRIAL LABORATORIES COMPANY

Analytical and Consulting Chemists

2600 WEST 29TH AVENUE
DENVER, COLORADO 80211
ANALYSIS REPORT

TELEPHONE 455-3641

WRIGHT WATER ENGINEERS

DATE RECEIVED:
DATE REPORTED: 4/29/77

LAB. NUMBER: 7285

SAMPLES ARE DISCARDED IN 15 DAYS FROM DATE REPORT UNLESS WE ARE REQUESTED, IN WRITING TO RETAIN THEM FOR A LONGER PERIOD. PERISHABLE SAMPLES ARE USUALLY DISCARDED IMMEDIATELY UNLESS CLIENT HAS REQUESTED SPECIAL HANDLING (FREEZING, ETC.) IN ADVANCE.

SAMPLE MARKED: Water #71 Job #761-71.2 TH-1
Stevens Gulch Westmorland

ANALYSIS: Qualitative Spectrographic Analysis - BY COLLABORATIVE LABORATORY

Figures are milligrams per liter ~~Estimates~~ Approximations

Antimony		Molybdenum	
Arsenic		Neodymium	
Aluminum	.5	Nickel	.001
Boron	.05	Osmium	
Barium	.001	Palladium	
Beryllium		Potassium	.01
Bismuth		Praseodymium	
Calcium	Major	Platinum	
Columbium		Radium	
Cadmium		Rubidium	
Cerium		Rhenium	
Cobalt		Rhodium	
Chromium		Ruthenium	
Caesium		Scandium	
Copper	.001	Silicon	5.
Dysprosium		Samarium	
Erbium		Strontium	.1
Europium		Silver	.001
Gallium		Sodium	5.
Gadolinium		Tantalum	
Germanium		Terbium	
Gold		Thallium	
Hafnium		Thulium	
Holmium		Thorium	
Indium		Tin	
Iron	.1	Titanium	.001
Iridium		Tungsten	
Lanthanum		Uranium	
Lead		Vanadium	
Lithium	.001	Yttrium	
Lutecium		Ytterbium	
Magnesium	Major	Zinc	
Manganese	.5	Zirconium	
Mercury			

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[illegible] OF AMERICA
INSTITUTE OF FOOD TECHNOLOGY
SIGMA XI

THE INDUSTRIAL LABORATORIES COMPANY
H. Paul Ocks
CHEMIST

ASPEN, COLORADO 81611

GLENWOOD SPRINGS OFFICE
P. O. BOX 1208
GLENWOOD SPRINGS, COLORADO 81601

STEAMBOAT OFFICE
P. O. BOX 5220
STEAMBOAT VILLAGE, COLORADO 80499

ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-5201

DR. F. ROBERT McGREGOR

January 11, 1977
Glenwood Springs
TEL: 945-7755

Since the January 11, 1977, report was completed, Westmoreland has acquired a 25% interest in the Lost Lake Slough and has established their ultimate water requirements at 40,000 gallons per day.

William L. Lorah
William L. Lorah
July 11, 1977

Mr. S. O. Ogden
Colorado Westmoreland, Inc.
Suite 307
4465 Northpark Drive
Colorado Springs, Colorado 80933

Re: Orchard Valley Mine
Water Resources Strategy

Dear Mr. Ogden,

The main purpose of this letter report is to present preliminary recommendations to develop a water resource strategy for Westmoreland's Orchard Valley Mine near Paonia, Colorado. We have reviewed water requirements for the mine, studied the physical availability of water, analyzed the water rights situation and have reached several conclusions relating to a physical and "legal" water supply to meet Westmoreland's needs.

Colorado Westmoreland retained Wright Water Engineers on November 16, 1976, to review existing water studies completed for Westmoreland. We were also instructed to work with the law firm of Dawson, Nagel, Sherman and Howard to develop a viable "legal" water supply for Westmoreland's needs. Since that time we have reviewed the Harrison Western Corporation's report entitled "Water Requirements Study and Construction Cost Estimate for Converse D Mine Project," dated September 10, 1976. We have reviewed the "Engineering Report on Water Rights Owned by Colorado Westmoreland, Inc. near Paonia, Colorado" by the Ute Engineering and Surveying Company, dated November, 1976, - hereinafter referred to as the "Ute Report". In addition to reviewing decrees and water diversion records, we have interviewed local water users and state water officials regarding water use and water rights in this area. We have made two field inspections of the area, paying particular attention to geology and stream flow characteristics.

Following are estimated water requirements for the mine, information on the hydrology and water rights in the area, additional possible sources of water, and our conclusions and recommendations.

WATER SUPPLY REQUIREMENTS

The Harrison Western Corporation has estimated the ultimate water supply requirements for the Orchard Valley Mine facilities in a report entitled "Water Requirements Study and Construction Cost Estimate for Converse D Mine" dated September 10, 1976. Water needs for fire fighting, dust control on roads, and green belt irrigation have not been included in their estimates. The following table and qualifying paragraph are taken from the Harrison Western Report.

Total Estimated Daily Water Requirements

UP-DATED 40,000 gpd

A.	Supply and Shop Building		6,810 gal.
B.	Office Building		3,600 gal.
C.	Change House		21,600 gal.
D.	Fire Water - Surface, Storage Only		0 gal.
E.	Fire Water - Mine, Storage Only		0 gal.
F.	Service Water		
	Belt Feeders	16,800 gal.	
	Drill	1,280 gal.	
	Cutting Machine	8,400 gal.	
	Transfer Paints	1,300 gal.	
	Tipple	700 gal.	
	Continuous Miner (Possible)	8,820 gal.	
	Train-Loading Facilities	700 gal.	38,000
	Total Estimated Daily Demand		70,010

"On a 24-hour basis this will require a water source of approximately 50 gpm minimum. This minimum gallons-per minute requirement makes no allowance for such contingencies as expansion, different equipment, mine transmission line leakage, well pump repairs, fire, etc. However, a 5 or 6 day work week and a 7-day well production coupled with adequate storage would provide some reserve for contingencies."

It is our understanding that maximum mining operations would occur in 3 shifts and employ a total work force of 250. Excluding service water requirements, the Harrison Western report estimated that 32,010 gpd is needed for sanitary purposes, or about 128 gallons per person per day assuming a 250 man work force. Our past experience has been that a miner will use about 50 gallons per shift or 12,500 gallons for a 250 man shift-day. For this report we have used Harrison Western's very conservative estimates as an ultimate sanitary water supply requirement as we have limited knowledge of the proposed operation at this mine.

We have also used the Harrison Western estimated requirement for service water of 38,000 gpd. Excluding water for fire fighting, estimated daily service and work force requirements for the mine total 70,010 gallons, or a continuous flow of about 50 gpm. Assuming that the 150,000 gallons of water stored for fire fighting would be replaceable in one day, an additional flow of about 100 gpm is needed. Therefore a conservative estimate of the maximum daily requirement would be 220,000 gallons or an average daily rate of 150 gpm. Based on the above estimates, we believe it would be prudent to develop a water supply system with the capacity to deliver 75 gpm on a continuous basis and 150 gpm on an emergency basis.

Consumptive Use

Consumptive use is defined as the amount of water that a particular use evapotranspires to the atmosphere. It is the difference between the amount of water diverted from a stream system and the amount returned to the stream system - i.e. the depletion. Determination of consumptive use is important in analysis of water rights and plans for augmentation of water supply systems.

For this report we have assumed that the service water is 100% consumptively used, and that of the water supplied to the work force (that which will be collected and treated by a waste water treatment facility) 25% will be consumptively used. Therefore of the ~~70,000~~ gallons to be used each day ~~46,000~~ gallons will be consumptively used and ~~24,000~~ will be returned to the stream system. This ~~46,000~~ gallons represents one of the basic elements a "legal" water supply must provide. The ~~46,000~~ gallons per day represents 0.14 acre feet per day or a total consumptive use of ~~51.5~~ acre feet of water per year.

Westmoreland's Agriculture Water Requirements

Westmoreland has acquired several properties in the Paonia area that have historically been irrigated. It is our understanding that Westmoreland intends to maintain most, if not all, of this land as irrigated acreage. Even though the main focus of this report is water for industrial use, we have made a cursory evaluation of the agricultural water rights to determine the adequacy (or hopefully, the excess) of irrigation water rights for Westmoreland's irrigation needs.

According to the Ute Report, "approximately 166 acres of irrigated orchards and fields were purchased by Colorado Westmoreland. Ute Engineering further states that about 26 acres of irrigated land have been taken out of production, but these will be replaced with more irrigated land elsewhere, resulting in a future total of 176 acres to be irrigated by Westmoreland. A memo to Westmoreland (11/29/76) from Wesley Wade, Orchard Manager, states that 246 acres of land are to be irrigated. For this report we will use Mr. Wade's figure for irrigated acreage in estimating irrigation water supply requirements.

Irrigation water requirements depend upon local climatic conditions (temperature, precipitation, etc.), soil characteristics, topography, type of irrigation practice (e.g. sprinklers, contour ditch, sub-irrigation, flooding, etc.) and many other factors. The normal growing season in this area extends from late April or early May through late October, or for about 180 days.

The Jensen-Haise Method of calculating irrigation water requirements has been used for this report. This method takes most of the above factors into account, and uses solar radiation as one of the main parameters.

Table I presents the consumptive use and irrigation water requirements for irrigated cropland in the Paonia area. The calculations are for a full water supply for a hay crop. Water requirements for deciduous orchards are slightly less, alfalfa requirements are higher. We have assumed an irrigation efficiency of 40%, i.e. 40% of the irrigation water that is applied is evapotranspired and 60% is returned to the stream system through seepage and direct runoff. Table I presents our estimate of the amount of water a prudent rancher would use assuming the water was physically available.

Assuming Westmoreland will irrigate 246 acres of land, they will need water rights that will produce 1132 acre feet of water during the proper times in an average year and 1419 acre feet of water in a dry year. Very careful management and efficient irrigation practice could reduce these "requirements".

Mr. Wade has indicated that he believes that Westmoreland has sufficient water rights (see Table 3) to meet the company's present irrigation needs. He does not know if there is an excess since he has not had even one year to manage Westmoreland's orchards.

Our preliminary analysis of Westmoreland's water rights indicate that the current water rights may not be sufficient to yield a full supply to the 246 acres, especially in a dry year - see section on water rights later in this report.

TABLE 1

WATER REQUIREMENTS FOR

IRRIGATED CROPLAND In The PAONIA AREA

(All Values in Acre Feet Per Acre)

	CONSUMPTIVE USE		WATER REQUIREMENTS (assuming 40% efficiency)	
	Average Year	Dry Year	Average Year	Dry Year
May	.27	.29	.67	.72
Jun	.44	.48	1.10	1.20
Jul	.50	.60	1.25	1.50
Aug	.42	.48	1.05	1.20
Sep	.21	.34	.52	.85
Oct	.04	.12	.01	.30
Total	1.88	2.31	4.60	5.77

HYDROLOGY

The purpose of this section is to define the physical water supply alternatives that may be available to meet Westmoreland's water requirements.

Annual precipitation at Paonia is about 16 inches. At the mine portal it is probably a few inches more. North and east of the mine, at elevations above 10,000 feet the annual precipitation may be as much as 40 inches - most of which is in the form of snow.

The North Fork Gunnison River is the most reliable surface water source in the Paonia area. The North Fork Gunnison River at Somerset (elevation 6,000 feet) has a tributary area of about 521 square miles. At this point the river has an average annual flow of 438 cfs (317,100 acre feet per year) of which over 75% occurs during the spring snowmelt runoff in April, May and June. Only about 6% of the total annual flow occurs during the winter month of December through March. The total run-off in a dry year is about one-third the amount in an average year.

Several "north side" tributaries to the North Fork might provide an intermittent water supply to Westmoreland. They are, from west to east:

STREAM	TRIBUTARY AREA IN SQUARE MILES
Roatcap Creek	16
Stevens Gulch	
to 7,000'	2.9
Total basin	5.3
Coal Gulch	
@Fire Mountain Canal	2.0
Terror Creek	25
Hubbard Creek	67

All of these streams occasionally dry up due to (a) lack of natural flow and (b) diversions by irrigation ditches. This winter the stream flows are unusually low due to lack of precipitation and unusual freezing conditions. Normally the snow cover insulates the land so that the ground is not frozen.

Each of these creeks is over-appropriated - i.e., there is not enough natural flow to satisfy the needs of all the water rights decrees.

It has been suggested that Coal Gulch (the Beezley Ditch) be used as as physical supply for Westmoreland. We believe this is a physically unreliable source. The flow is reported to be partly irrigation return flow from Garvin Mesa. If Garvin Mesa becomes mainly residential in the future the historic return flow will no longer exist. It is also our opinion that the water commissioner records of the amount of flow in the Beezley Ditch show more flow than actually existed, especially in the winter.

There are no stream gages on any of the stream listed above. Their flows can be estimated by ditch diversion records, field observations and correlation with other gaged streams in the area. Table 2 presents a summary of the data from stream gaging stations in the area.

GROUNDWATER HYDROLOGY

The area near Paonia and north of the North Fork Gunnison River is underlain by Cretaceous Age Mesa Verde Group formations, which are underlain by the Mancos Shale. The base of the Mesa Verde Group is called the Rollins Sandstone Member, 50-150 feet thick and existing at the mine level at an elevation of approximately 7,000 feet. The coal beds which are mined exist in the shales within 200 feet above the Rollins Sandstone, which is underlain by several thousand feet of Mancos Shale. The dip of these formations is north-northeast at approximately 5 percent or 3-4 degrees. The high areas of the mountain above elevations of approximately 7,500 feet are covered with 10-150 feet of colluvium, a boulder, sand and clay material consisting primarily of intermixed volcanic boulders and clays of the Mesa Verde Group that have been eroded from the Grand Mesa area to the north as far as 10 miles away. This colluvial cover is very regular in thickness and in composition.

TABLE 2

DATA FROM

STREAM GAGING STATIONS

in the PAONIA AREA

GAGE	TRIBUTARY AREA (Sq.Mi.)	YEARS	No. of YEARS	AVERAGE ANNUAL RUNOFF	AVERAGE ANNUAL UNIT RUNOFF (AF/sq.mi.)	MINIMUM STREAM FLOW
Cow Creek (near Bowie)	9.7	1939-40	2	10.1 cfs 7300 AF	755	0 cfs
Cow Creek (near Paonia)	12.0	1968-74	6	8.22 cfs 5940 AF	210	0.2 cfs 145 AF/yr
North Fork Gunnison River (near Somerset)	531	1933-76	41	435 cfs 314,374 AF	592	17 cfs 12,286 AF/yr
North Fork Gunnison River (near Paonia)	702	1921-30	9	572 cfs 413,384 AF	590	2 cfs 1445 AF/yr
West Muddy Creek (near Ragged Mt.)	6.9	1955-60	5	4.69 cfs 3400 AF	494	0 cfs 1870 AF/yr
East Muddy Creek (near Bardine)	136	1934-50	16	89.7 cfs 64,826 AF	477	8.4 cfs 35,400 Af/yr

Deep Groundwater Potential

Considerable work has been conducted by Westmoreland to investigate potential deep groundwater sources. They have concluded that no saturated sandstones exist below the site which would yield water for the mine. It is our opinion that the Dakota Sandstone and the Entrada Formation are not likely to be totally dry; however, there is no evidence from the drilling or from other wells in the area to indicate that either possibility is correct. We do not propose, at this time, that another deep test hole be drilled in these formations. Some additional tests on the existing holes might have provided further information concerning the Dakota, Entrada and basement hydrology. These would have included:

(1) electric logging
(2) conducting drill stem tests
(3) setting some casing down to the Dakota so that water losses would not occur during the drilling process

These items would have been relatively inexpensive in view of the $125,000 + cost of that test hole. However, the hole has been plugged and cemented and is now unavailable for any further testing.

The only other potential deep groundwater source is the Rollins Sandstone Member of the Mesa Verde Formation. Several test holes have penetrated a portion of the Rollins Sandstone to the north of the mine in the Stever Gulch area; however, none of the wells have penetrated the full thickness of this sandstone. Mr. Bill Russell of E. H. Ehmling Co., reports that a flow of a few gallons per minute is occasionally encountered during drilling in the colluvial deposits above the bedrock shales. Below a depth of 200 feet, however, no increase in water production has been encountered, even when the Rollins Sandstone has been penetrated. It is our opinion that an increase in water flow may have been encountered from time to time in the Rollins, but was lost during the drilling process in the colluvial zone at the top of the well, which remained uncased. Electric logs have been run in these holes in a portion of the Rollins Sandstone and do not indicate that the Sandstone is saturated. Neutron logs would have helped define the water content in the sandstone. The Rollins appears to be porous and fractured in some areas even though it is a dirty beach sand deposit.

All but two proposed core holes have been completed to date; however, the two which remain to be drilled (as of December 20th) are in the best possible locations to test the Rollins Sandstone. These are the furthest north and the furthest away from the outcrop, where the sandstone would be at the greatest depth. One of the core holes could easily be enlarged to a greater diameter and drilled entirely through the Rollins Sandstone. This would enable a casing to be set to the top of the Rollins Sandstone and pumping tests conducted to accurately determine its water bearing characteristics.

These are the only potential deep groundwater sources that we have observed to date. Other potential water sources in the area appear to be either directly or indirectly tributary to the North Fork Gunnison River.

Shallow Groundwater Potential

Shallow groundwater exists in two primary areas of consideration: (1) in the extensive alluvial sand and gravel deposits along the North Fork Gunnison River, (2) in the alluvial sand and gravel deposits along Stevens Gulch, West Fork Terror Creek, and Roatcap Creek. The North Fork Gunnison River near the Town of Paonia appears to be promising as a source of groundwater. The potential is good and could be easily developed with a series of wells. Supplying this water to the mine site itself, however, will require, in addition to normal production heads, over 3 miles of pipeline and an additional 1,600 + feet of pumping head. Although water requirements at the mine itself will be about 50 gpm continuously, the standby capacity for fire will need to be larger. This alternative would be expensive because of high initial cost, pumping heads and operation of an intermediate pumping station between the wellfield and the mine site.

Stevens Gulch has potential as a shallow groundwater source. The gradient of Stevens Gulch makes an abrupt change approximately at the center of Section 13 where a 25 + foot thick sandstone outcrops at approximately the 7,600 foot elevation contour. Downstream, or south of this outcrop, the gradient of Stevens Gulch is much steeper than to the north, i.e., south of the outcrop Stevens Gulch is eroding down into the Mesa Verde Group very rapidly and north of the outcrop some deposition occurs. This sandstone has created an apparent topographic restriction to the erosion of Stevens Gulch and immediately north of the restriction, near the center of Section 13, Stevens Gulch opens up into a broad meadow where a considerable thickness of alluvial sands has been deposited by the intermittent flow of Stevens Gulch. Stevens Gulch is probably dry in most places much of the year. However, a pond that exists just west of the Stevens Gulch road is reportedly full all year round, i.e., it intercepts enough subsurface flow and spring flow to remain full of water throughout even dry summer months.

The alluvium along Stevens Gulch has been drilled and tested on a limited basis. The area which appears to be the most promising for alluvial groundwater development along Stevens Gulch is in the northwest quarter of Section 13 near the corral and the large pond. Test Holes 1, 6 and 7 were drilled with an air rotary rig in this area. These test holes were drilled to depths of approximately 40-60 feet, but not to bedrock shale because of extreme caving problems. During drilling in the deeper portion of the holes, large volumes of very fine sand were pumped out of the hole in addition to 30 gpm (visual estimate) of water. In addition to these holes, Test Hole 28, located on the hillside east of the road, was cased with 5½ inch casing and 40 feet of torch slot perforations in the bottom.

This test hole was drilled and completed to approximately 160 feet. Water production was reportedly from the boulder-gravel colluvium located above the shale bedrock. Static water level in this hole is about the same elevation as the bottom of Stevens Gulch just west of the test hole. It was verbally reported that the well was pumped at 7 gpm with no drawdown for a period of time. The water production was then increased to 20-30 gpm and drawdown was experienced. However, this data is not available for interpretation at the present time. It is our opinion that this well was constructed inefficiently and thus is not an accurate test of the alluvial potential in this area.

Numerous springs exist in the area and are being developed by the Morrell family for stock watering. Most of these springs exist as soil seeps overlying impervious, localized clay zones in the colluvium. There are many springs in the area, most of which produce very little water, generally less than 2 gpm, although they may flow more during the spring runoff. It is estimated that approximately 110 acre feet per year of water could be recharged to the Stevens Gulch alluvium.

The West Fork Terror Creek, north of Stevens Gulch, in the area near the Morrell Cow Camp in Section 1, could also be tested and evaluated for alluvial groundwater potential. This alluvium would be recharged primarily from the drainage basin of the West Fork Terror Creek. We feel this area would be feasible for testing and evaluation because of its accessibility, size of drainage basin and relatively easy pipeline right-of-way to the mine.

The Roatcap Creek drainage basin, over the divide to the west of Stevens Gulch, has been briefly inspected in the field and appears to be an additional potential source area for water supply. This basin has a larger drainage area and more reliable flow than Stevens Gulch, and should be evaluated for potential water supply from springs or alluvial wells. Drawbacks to this area are difficulties in well and pipeline construction and accessibility due to rugged terrain and availability of right-of-way.

WATER RIGHTS

This report will not review or discuss the general aspects of Colorado water laws or water administration except as they may relate to specific water rights discussed below. We believe that Westmoreland is well advised of the legal aspects by their special water counsel.

The North Fork Gunnison River and its tributaries make up Water District 40 in Water Division 4. It is our opinion (which has been confirmed by Ralph Kelling, Division 4 Engineer) that the North Fork Gunnison River has historically been a "free river" during the non- irrigation season, e.g. a 1976 water right could divert water and would not be called out by any senior rights down stream. This condition will probably exist in the future until several conditional reservoir rights are perfected. It is our opinion that Westmoreland's 1976 North Fork right will still be able to divert even if several reservoirs are constructed as they would probably be located upstream from Paonia.

During the irrigation season District 40 often has a "theoretical" call from the Redlands Ditch which diverts from the Gunnison River. However, the Redlands Ditch call has often been administered as a "futile call," i.e., no ditch in District 40 would be shut down to satisfy the Redlands call.

Table 3 presents a list of water rights that Colorado Westmoreland is reported to own. The first column comes from the Ute Engineering report, the second comes from an inter-office memo dated Nov. 29, 1976 from Wesley Wade, Orchard Manager, to Bill Connelly.

It is our understanding that Colorado Westmoreland intends to maintain about 246 acres of irrigated land in the Paonia area. We have assumed that Westmoreland will attempt to provide a full irrigation supply to these lands with the water rights it now holds. If the present water rights portfolio produces more than enough water to meet these demands then a portion can be transferred and changed to meet Westmoreland's industrial and mining needs.

Table 4 presents our estimates of the yields of Westmoreland's current irrigation water rights.

TABLE 3

WATER RIGHTS OWNED

by WESTMORELAND

NAME OF DITCH OR COMPANY	NUMBER of SHARES or CFS (Ute Report)	NUMBER of SHARES or CFS (Reported by Wesley Wade)
Fire Mountain Canal and Reservoir Company	3364 shares	3578 shares
North Fork Farmer's Ditch Association	10.25 shares	10 shares
Tenor Ditch and Reservoir Company	7 shares	7 shares
Pitkin Mesa Domestic Pipeline Water Company	1 tap	
Tropic Ditch Company	11.4 shares	11.4 shares
John Beezley Ditch -domestic	1.0 cfs 0.1 cfs	1.1 cfs
Heddles and Hofer Waste Ditch	0.26 cfs	0.31cfs
George W. Small Pipeline	0.0083 cfs	1/6 interest Stock 1/4 interest Domesti
Deer Trail Ditch		600 shares

TABLE 4

ESTIMATED YIELDS OF WATER RIGHTS

CURRENTLY OWNED BY COLORADO WESTMORELAND

(Values in Acre Feet)

DITCH	NO. OF SHARES	AVERAGE YEAR YIELD PER SHARE	AVERAGE YEAR TOTAL	DRY YEAR YIELD PER SHARE	DRY YEAR TOTAL
Fire Mountain Canal	3578	.2	715	.15	537
Farmers Ditch	10	40	400	35	350
Terror Creek	7	10	70	8	42
Deer Trail Ditch	600	.15	90	.10	60
Tropic Ditch	11.4		60		50
John Beezley Ditch	1.1 cfs		200?		100?
Heddles & Hofer Ditch	.31 cfs		150?		90?
Total			1685		1229

Deer Trail Ditch

This report delves deeper into this ditch's decree than the other decrees since the ditch is decreed for "mining" purposes. The Deer Trail Ditch diverts out of the right bank of Hubbard Creek about 3000 feet upstream from the North Fork confluence. It has the following priorities:

Priority	Approp.	Adj.	Amt.	Use
25	11-01-90	4-12-01	1.25	Irr.
28	6-01-93	4-12-01	.50	Irr.
26	7-01-93	6-23-14	1.80	Irr.
	11-05-90	8-16-36	1.25	Dom. & Stock
	2-15-07	8-16-36	.50	Power & Mining

The first decrees for 1.25 and .5 cfs are typical irrigation rights. These two decrees state that a total of 68 acres are irrigated by the 1.75 cfs. The third decree which is an enlargement of the ditch, states that the carrying capacity of the ditch is 5 cfs. The enlargement is for 1.8 cfs and the third decree mentions 78 acres of land. This 78 acres may be interpreted as meaning that the entire acreage served by the Deer Trail Ditch is 78 acres.

It appears that in 1936 the ditch company wanted the first 3 ditch rights, which were decreed for irrigation use only, to be changed to include the uses of water for domestic, stock, power and mining purposes. The petition was denied; however, new junior rights were decreed for the new uses. A portion of the 1936 decree is attached as an Appendix.

The ditch has historically diverted about 1000 acre feet each year for the irrigation of about 70 acres in recent years. For purposes of the report we have assumed each share of stock will produce 0.15 acre feet per year.

Adolph Coors Co. owns a portion of the Deer Trail Ditch Company and may be interested in developing new uses for their share of the ditch's waters.

Westmoreland has purchased 600 shares of stock (assumed to be 1st class) from Barnes. We believe that 300 additional shares have been retained by Barnes.

Fire Mountain Canal

Of all the ditch stock and water rights Westmoreland currently owns, the Fire Mountain Canal water is the most reliable and produces the greatest number of acre feet. The decrees and organization of the Company are complex. Much of the Paonia Reservoir water can be taken and used by the Fire Mountain Canal Company.

It is our opinion that each share of Class 2 stock (the class Westmoreland apparently owns) will yield in the future about 0.20 acre feet per share per year in an average year and .15 acre feet in a dry year. Westmoreland's 3578 shares would yield enough water to serve about 150 acres of irrigated land in a normal year.

The most important aspect of the Company for Westmoreland is that shares can be bought and sold and transferred from one headgate to another (price per share was reported to be about $10 a few years ago). Therefore if Westmoreland needs additional irrigation water it would be relatively easy to purchase shares (if they were for sale) and transfer them to the appropriate land (if it were irrigated under the ditch). We do not recommend trying to convert any of this water to industrial use.

John Beezley Ditch

It has been suggested that the John Beezley Ditch be used as a physical water supply source for Westmoreland's mine water requirements. We do not recommend the Beezley Ditch or Coal Gulch as a physical water supply source because of its questionable reliability as a water source. In addition to having a very small tributary basin area, much of its past flow has come from irrigation return flow which may not exist under future land use conditions.

If Westmoreland is not committed to use the Beezley Ditch for agricultural purposes then its irrigation use could be terminated and the historic consumptive use could be transferred to mining purposes.

RECOMMENDATIONS

The recommendations presented below are not necessarily final. They are intended to provide a basis for determining the best possible water resources/water rights strategy for Westmoreland.

For the purpose of this preliminary report we have separated our recommendations into two general categories. The first category consists of recommendations for securing a physical water supply to meet the mine's water requirements. The second category of recommendations relates to the development of the "legal" water rights. The "legal" strategy should be guided by your counsel.

Physical Water Supply Recommendations

1. A ground water supply should be developed for the mines water needs instead of a surface water source. Reasons include fewer freezing problems in the winter, less treatment is required and reliability of supply.

2. If water well test holes are still being drilled, we would recommend drilling completely through the Rollins Sandstone, and performing tests to determine the groundwater potential from this formation.

3. Perform geophysical tests (seismic and/or resistivity surveys) of the Stevens Gulch alluvium in the northwest part of Section 13. At the present time, we feel that Stevens Gulch might prove to be an adequate source of water.

4. Reconnaisance level geologic evaluation should be undertaken in the West Fork Terror Creek and Roatcap Creek areas. The West Fork drainage basin has a large recharge area which, along with other factors, makes a good potential physical water supply source. These investigations probably should be carried out concurrently with geophysical testing in Stevens Gulch.

5. Drill and evaluate (electric log, etc.) a test hole with a cable tool rig at the most promising location determined by geophysical and field investigation, probably in the northwest part of Section 13 in Stevens Gulch. This test hole should be drilled in such a manner that it could be converted to a production well if flow is sufficient. Two or more observation holes should also be drilled for water level monitoring.

6. If a well in Stevens Gulch produces an adequate water supply, and if the water rights problems can be successfully resolved,

then a second well should be drilled as a backup to the first to ensure a reliable water supply.

7. If Stevens Gulch or the other tributaries fail to produce the necessary water, then geophysical investigation of the alluvial deposits of the North Fork Gunnison River should be carried out, followed by drilling a test well that can be converted to a production well.

Water Rights Recommendations

1. Apply to the Division 4 water court for new 1976 mining water rights out of the North Fork Gunnison River, Stevens Gulch.

2. Reevaluate the water requirements for mining operations, including any uses not previously considered (dust control, etc). Measure the present usage of water at the mine.

3. Evaluate potential of using the 1936 Deer Trail Ditch Mining Decree. This would involve a legal opinion from your water counsel. A joint effort to use this ditch for mining purposes with the Adolph Coors Co. should be considered.

4. Have Wesley Wade use Westmoreland's water rights (Table 3) to their fullest this next year. He should also keep a record of the actual yield from each ditch. The records should be separate from the water commissioner's records. Irrigated acreage and water needs should be documented.

5. If Stevens Gulch is selected for the water supply, develop a water rights strategy that would mitigate any harm to senior vested water rights. The strategy might be:

   A. No harm in winter, therefore do nothing for winter period.

   B. Purchase a portion of Morrell's interest in Stevens Gulch water.

   C. If the Fire Mountain Canal is injured then agree not to divert all of the water Westmoreland is entitled to takes out of the canal.

6. Identify any Westmoreland land and its historic consumptive use that has been dried up by Westmoreland's activities (load out area) or by its predecessors (development on Garvin Mesa).

7. Do not at the present time pursue a "base" water supply from the Pitkin Mesa Pipeline Company or the Terror Creek Ditch Company.

8. Pursue the right to use 25 to 50 acre feet in a storage reservoir for depletion make up purposes. Reservoirs that may be available include:

   A. Overland

   B. Paonia (contract with North Fork Water Users Association)

   C. Develop new storage in existing pond near river

If you have any questions please do not hesitate to contact us.

Very truly yours,

WRIGHT WATER ENGINEERS, INC.

By William L. Lorah
William L. Lorah

WLL:gh
761-71

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Office of Chief Engineer
Denver Federal Center
Denver, Colorado 80225

December 14, 1965

Memorandum

To: Head, Flood Hydrology Section

From: D. W. Davis

Subject: Review of inflow design flood for Fruitgrowers Dam Project, Colorado--Examination of existing structures--Safety of Dams Program

Authority

The Regional Director, Salt Lake City, requested review of the subject report by letter dated November 26, 1965.

Recommendations

It is recommended that the updated inflow design flood be approved. The flood has the following characteristics:

Peak discharge (cfs)	18-hour volume (acre-feet)
12,000	3,440

For routing purposes, it is recommended that the reservoir be assumed full to the top of conservation pool at the beginning of the design flood, as stated in the Region's study.

I concur with the recommendation that no further consideration be given to the possibility of Surface Creek changing course and flowing into Fruitgrowers Reservoir, as stated in Acting Regional Director's letter dated November 30, 1965.

COMMENTS

General

The Region's study utilizes the following specific hydrologic criteria recommended in our letter of October 12, 1965:

1. The design storm rainfall

2. Initial loss of 0.5 inch in first 15-minute period and a retention loss rate of 0.2 inch per hour thereafter

3. A base flow of 200 cfs based on capacity of feeder canals was added to the hydrograph

4. The investigation of possible channel change of Surface Creek during flood periods

5. A drainage area of 12 square miles

6. A 15-minute unit hydrograph

Dimensionless graph

The dimensionless graph was adopted from alternate Spring Creek Damsite design flood study, Paonia Project, August 1949, and considered acceptable for this study. This graph was also used in a previous inflow design flood study for the Fruitgrowers Project dated January 12, 1954.

Lag time

The reservoir is fed by two separate channels having nearly identical drainage basins. An average lag time of 3.35 hours to the head of the reservoir was determined and is acceptable.

Unit hydrograph

A 15-minute unit hydrograph was developed with a peak of 2,689 cfs and a volume of 640 acre-feet and is approved.

Design storm

As furnished by this office:

Minutes	Inches
15	2.9
30	4.5
45	5.5

Retention losses

Initial loss of 0.5 inch in first 15 minutes and retention loss rate of 0.2 inch per hour thereafter.

Design rain hydrograph

The resulting hydrograph developed from 4.9 inches of storm runoff has a peak of 11,807 cfs and a volume of 3,140 acre-feet. I checked the computations and found them accurate.

Inflow design hydrograph

The design rain hydrograph was set over the 200-cfs base flow hydrographs (18-hour volume 300 acre-feet) based on the capacities of Feeder Canals. The Transfer, Alfalfa, and Cedar Mesa Ditches have respective capacities of 100, 50, and 50 cfs. The resulting final inflow design flood hydrograph has a peak of 12,000 cfs and an 18-hour volume of 3,440 acre-feet.

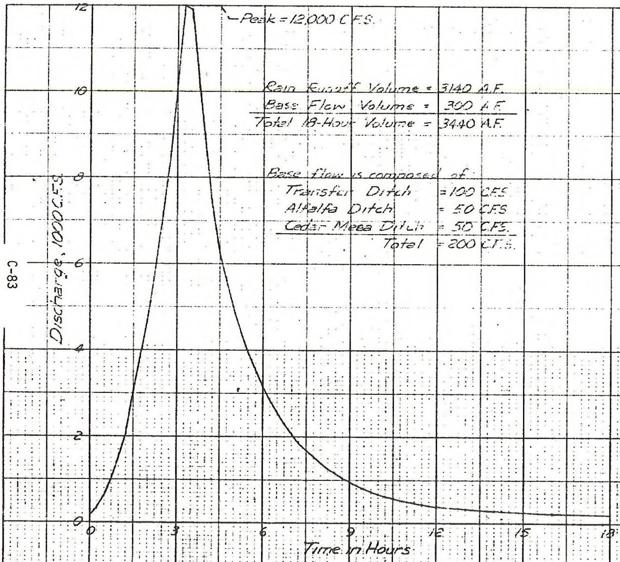
Surface Creek investigation

The report of investigation was compiled by the Grand Junction Project Office and submitted to this office by separate letter by the Acting Regional Director dated November 30, 1965. His letter recommended no further consideration be given, as stated above. I made an analysis of the topography in the upper reaches of the Alfalfa Ditch and concluded the chance that Surface Creek would develop a new channel along the Alfalfa Ditch water course is remote because of the gradient characteristics of the natural channels.

I concur:

Head, Flood Hydrology Section

K•E 12 X 20 TO THE INCH 359-21



Time, Hours	Discharge, C.F.S.
0:00	200
:15	330
:30	650
:45	1040
1:00	1560
:15	2030
:30	3060
:45	3960
2:00	4830
:15	5890
:30	7050
:45	8350
3:00	10,160
:15	12,000
:30	11,900
:45	10,400
4:00	8670
:30	6260
5:00	4930
:30	3920
6:00	3170
:30	2570
7:00	2090
:30	1690
8:00	1390
9:00	950
10:00	680
11:00	500
12:00	390
13:00	320
14:00	280
18:00	200

REVISED

INFLOW DESIGN FLOOD

FRUITGROWERS DAM

FRUITGROWERS PROJECT, COLO.

SAFETY OF DAMS PROGRAM 11-12-65

APPENDIX D

SOILS

APPENDIX D

SOILS--DESCRIPTION OF ENVIRONMENT

1-Cerro stony loam, 10 to 35 percent slopes

This is a deep, well drained soil. It formed in old landslide deposits and glacial outwash on alluvial fans, terraces, and mountain sideslopes. Slopes are 10 to 35 percent.

Typically the surface layer is brown stony loam about 6 inches thick. The subsoil layer is reddish brown clay about 25 inches thick. The underlying material is pink gravelly clay loam that extends to 60 inches or more.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium to rapid, and erosion hazard is slight from wind and high from water.

Included with this soil in mapping are a few small areas of Radersburg, Scholle, Samsil, and Gaynor soils. There may also be some areas of rough broken land. Some areas have clay loam surface textures, and some spots may be very or extremely stony. Stone content usually increases with depth.

2A-Agua Fria stony loam, 3 to 12

This is a deep, well drained soil. It formed in cobbly or stony outwash alluvium from basalt on old terraces, mesas, and fans in the north-central part of the survey area at elevations of 5,800 to 7,000 feet. Slopes are 3 to 12 percent.

Typically the surface layer is brown stony loam about 2 inches thick. The subsoil layer is reddish brown stony clay loam about 22 inches thick. The underlying material is pink cobbly loam at a depth of about 24 inches. Basaltic cobble and stone may range up to 30 percent in the soil profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Saraton, Mesa, Avalon, Cerro, and Delson soils. Some surface layers are stone free. The surface texture in some areas may be stony clay loam.

Small areas may have marl at depths above 40 inches. Some areas have less clay in subsoil. Very stony surface layers are also included.

2B-Agua Fria stony loam, 12 to 25 percent slopes

This is a deep, well drained soil. It formed in cobbly or stony outwash alluvium from basalt on old high terraces, mesas, and fans. Slopes are 12 to 25 percent.

Typically the surface layer is a brown stony loam about 2 inches thick. The subsoil layer is a reddish brown stony clay loam about 22 inches thick. The underlying material is pink cobbly loam at a depth of about 24 inches. Basaltic cobble and stone may range up to 30 percent in the profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is rapid, and erosion hazard is slight from wind and moderate to severe from water.

Included with this soil in mapping are a few small areas of Saraton, Orchard, Avalon, Cerro, and Delson soils. Some surface layers are stone-free. The surface texture in some areas may be stony clay loam. Some areas may have marl at depths above 40 inches. Some areas have less clay in the subsoil.

3-Saraton-Agua Fria complex, 20 to 50 percent slopes

These moderately steep, steep, and very steep soils are on sideslopes of mesas, benches, and terraces. Slopes are 20 to 50 percent.

The Saraton soil makes up about 40 percent of this complex. It occupies upper margins of slopes and steeper areas. The Agua Fria soil makes up about 40 percent of this complex and occupies positions lower on the slope and small valleys.

Included in mapping are a few small areas of Delson, Mesa, Midway, Gaynor, and Torriorthents-Rock outcrop, sandstone, and shale; these areas make up the other 20 percent. Some surface textures are relatively stone-free. Slips or small landslides are common on this mapping unit.

The Saraton soil is a moderately deep, well drained soil over cobbly or stony marl at a depth of 20 to 40 inches. It formed in stony or cobbly outwash alluvium from basalt.

Typically the surface layer is brown gravelly loam about 5 inches thick. The subsurface layer is light brown gravelly loam about 5 inches thick. The underlying material is pinkish white, very gravelly loam and is over marl at a depth of about 30 inches.

The Saraton soil has moderate permeability, and the available water capacity is low. The effective rooting depth is about 28 inches. Surface runoff is rapid, and erosion hazard is slight from wind amd moderate to severe from water.

The Agua Fria soil is a deep, well drained soil. It formed in cobbly or stony outwash alluvium from basalt.

Typically the surface layer is brown stony loam about 2 inches thick. The subsoil is reddish brown stony clay loam about 22 inches thick. The underlying material is pink cobbly loam that extends to 60 inches or more.

The Agua Fria soil has slow permeability, and the available water capacity is high. The effective rooting depth extends to 60 inches or more.

Surface runoff is rapid, and erosion hazard is slight from wind and moderate to high from water.

<u>4-Agua Fria clay loam, 1 to 6 percent slopes</u>

This is a deep, well drained soil. It formed in cobbly or stony outwash alluvium from basalt on high terraces, mesas, and fans. Slopes are 1 to 6 percent.

Typically the surface layer is brown loam about 2 inches thick. The subsoil layer is a reddish brown stony clay loam about 22 inches thick. The underlying material is pink cobbly loam at a depth of about 25 inches. Basaltic cobble and stone may range up to 30 percent in the soil profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Saraton, Mesa, Avalon, Cerro, and Delson soils. Some areas are cobbly or stony. Small areas may have marl at depths above 40 inches. Some areas have less clay in the subsoil.

5-Saraton gravelly loam, 3 to 12 percent slopes

This is a moderately deep, well drained soil over marl at a depth of 20 to 40 inches. It formed in cobbly or stony outwash alluvium on old terraces, mesas, and sideslopes. Slopes are 3 to 12 percent.

Typically the surface layer is brown gravelly loam about 5 inches thick. The subsurface layer is light brown gravelly loam about 5 inches thick. The underlying material is pinkish white very gravelly loam and is over marl at a depth of about 30 inches.

Permeability is moderate, and the available water capacity is low. The effective rooting depth is about 28 inches. Surface runoff is medium, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Agua Fria, Avalon, Radersburg, Delson, and Cerro. In some areas the surface texture may be a sandy loam. Some areas have stony surface layers.

6A-Delson loam, 3 to 12 percent slopes

This is a deep, well drained soil. It formed in stony alluvium on fans and mesas. Slopes are 3 to 12 percent.

Typically the surface layer is dark brown loam about 8 inches thick. The subsoil layer is reddish brown light clay about 34 inches thick. The underlying material is pale brown stony clay loam. The underlying material is pale brown stony clay loam that extends to 60 inches or more. Basaltic cobble and stone is common throughout the profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Agua Fria, Cochetopa, Cerro, and Saraton soils. Some areas have cobble or stony surface textures and may be light clay loam.

6B-Delson stony loam, 3 to 20 percent slopes

This is a deep, well drained soil. It formed in stony alluvium on fans and mesas. Slopes are 3 to 20 percent.

Typically the surface layer is a dark brown stony loam about 8 inches thich. The subsoil layer is reddish brown clay about 34 inches thick.

The underlying material is pale brown stony clay loam that extends to 60 inches or more. Basaltic cobble and stone are in the profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium to rapid, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Cerro, Agua Fria, and Cochetopa soils. Some areas are relatively stone free. Some areas may have clay loam surface textures.

<u>6C-Delson very stony loam, 20 to 60 percent slopes</u>

This is a deep, well drained soil. It formed in stony alluvium and colluvium on mountain slopes. Slopes are 20 to 60 percent.

Typically the surface layer is dark brown very stony loam about 8 inches thick. The subsoil layer is reddish brown stony clay about 34 inches thick. The underlying material is pale brown very stony clay loam. Basaltic cobble and stone are in the profile.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is rapid, and erosion hazard is slight from wind and moderate from water.

Included with this soil in mapping are a few small areas of Cerro, Agua Fria, and Cochetopa. Some areas are relatively stone free. Some areas may have clay loam surface textures. Small slips are common on steeper slopes.

<u>7-Cochetopa stony loam, 10 to 40 percent slopes</u>

This is a deep, well drained soil. It formed in landslide deposits and alluvium on upland slopes, fans, valley and mountain sideslopes. Slopes are 10 to 40 percent.

Typically the surface layer is dark gray stony loam about 18 inches thick. The subsoil layer is yellowish brown stony clay loam about 18 inches thick. The underlying material is light gray stony heavy clay loam that extends to 60 inches or more.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is medium to rapid, and erosion hazard is slight from wind and moderate to high from water.

Included with this soil in mapping are a few small areas of Delson, Fughes, and Curecanti soils. Also included are some steep stony slopes and some Fluvaquents, flooded. Some areas may have stony clay loam surface textures. Some areas are stone free, and minor areas have greater amounts of stone and cobble.

8-Fughes loam, 25 to 65 percent slopes

This is a deep, well drained soil. It formed in old alluvial fan and landslide deposits on alluvial fans , valley sideslopes, and uplands. Slopes are 25 to 65 percent.

Typically the surface layer is very dark grayish brown loam about 5 inches thick. The subsoil layer is dark grayish brown clay loam that grades into reddish brown light clay and is about 39 inches thick. The underlying material is light reddish brown clay loam that extends to 60 inches or more.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is rapid to very rapid, and erosion hazard is slight from wind and high from water.

Included with this soil in mapping are a few small areas of Curecanti, Cochetopa, Bulkley soils, and small areas of well drained alluvial land by drainages. This soil may slip on steeper slopes especially if areas are disturbed. Outcroppings of interbedded sandstone and shale may occur on steeper areas.

9-Colona silty clay loam, 6 to 12 percent slopes

This is a deep, well drained soil. It formed in alluvium on fans, terraces, and swales. Slopes are 6 to 12 percent.

Typically the surface layer is light brownish gray silty clay loam about 3 inches thick. The subsoil layer is grayish brown silty clay about 20 inches thick. The underlying material is light gray silty clay that extends to 60 inches or more.

Permeability is slow, and the available water capacity is high. The effective rooting depth extends to 60 inches or more. Surface runoff is rapid, and erosion hazard is moderate from wind and high from water.

Included with this soil in mapping are a few small areas of Billings, Medway, Razor, Gaynor, and Apishapa soils; also some Fluvaquents, flooded. Surface texture may be silt loam or silty clay. Stones on the surface and in underlying layers are common at the base of mesas. Some areas have darker colored surface layers.

10-Beenom-Absarokee association, 20 to 60 percent slopes

These hilly, steep, and very steep soils are on mountain slopes. Slopes are 20 to 60 percent.

The Beenom soil makes up about 50 percent of this assoication and occupies upper margins of the slopes and ridgetops. The Absarokee soil makes up about 30 percent of this association and occupies positions lower on the slope and bottom of swales.

Included in this association in mapping are a few small areas of Kech, Progresso, and Work soils, and also rock outcrops, very shallow soils, and deep stony soils; together these make up the other 20 percent. There are minor areas of clay loam and sandy loam surface textures.

The Beenom soil is a shallow, well drained soil over bedrock at a depth of 10 to 20 inches. It formed in place from material weathered from sandstone and interbedded shale.

Typically the surface layer is grayish brown loam about 4 inches thick. The subsoil is dark brown clay loam about 85 inches thick. The underlying material is very pale brown channery loam and is over sandstone bedrock at a depth of about 14 inches.

The Beenom soil has moderately slow pèrmeability, and the available water capacity is low. The effective rooting depth is about 14 inches. Surface runoff is rapid, and erosion hazard is slight from wind and high from water.

The Absarokee soil is a well drained soil over bedrock at a depth of 20 to 40 inches. It formed in locally transported sediments derived from sandstone and interbedded shale.

Typically the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is brown clay about 18 inches thick. The underlying material is light brown channery clay loam and is over sandstone bedrock at a depth of about 30 inches.

The Absarokee soil has moderately slow permeability, and the available water capacity is low. The effective rooting depth is about 30 inches. Surface runoff is rapid, and erosion hazard is slight from wind and moderate to high from water.

11-Torriorthents-Rock outcrop, sandstone, complex

This broadly defined unit consists of exposed bedrock, loose stones, and very shallow layers of soil material over bedrock mixed with pockets of deep, weakly to moderately developed soils. Exposed bedrock and stone cover about 30 to 90 percent of the surface area. The most common type of rock is sandstone.

Relief is moderately steep to very steep on slope gradients ranging from 20 to 70 percent. Minor areas are outside the slope limits.

This broadly defined unit occurs somewhat intermittently throughout the survey area and is most common on the steeper sloping terrain. In these locations, soil material may be removed by wind, water, and gravity, exposing barren rock. Rock escarpments frequently occur along the upper margin of the slope. Rocks weathered from the escarpments are carried downslope by gravity and create very stony surface conditions. It is not uncommon for surface stones to be many feet in diameter. The deeper soils are at or near the toe slopes.

This unit has limited capacity to store water for plant growth, and most of the capacity is in the deeper soils. Surface runoff is excessive in most cases.

APPENDIX E

WILDLIFE

APPENDIX--WILDLIFE

Species of Fish from the North Fork of the Gunnison and Stevens Gulch Creek

Species	Location 2/	Source 1/ S.A.	Shock W.L.	Stock	Probable
Cutthroat trout	NF				X
Rainbow trout	NF		X	X	
Brown trout	NF		X		X
Northern pike	NF			X	X
Western white sucker	NFSA SG	X	X		
Flannelmouth sucker	NF		X		
Bluehead sucker	NFSA	X	X		
Colorado mottled sculpin	NFSA	X	X		
Colorado speckled dace	NFSA SG	X			

Table from Thorne Ecological Report

2/ NF-anywhere on North Fork
NFSA -North Fork Study Area
SG-Stevens Gulch Creek

1/ S.A.-determined from field electroshock results, October 1976-in Study Area
Shock- Div. W.L.-from shocking records of the Division of Wildlife
Stock-known from Division of Wildlife stocking records
Probable-species likely to occur based on old records or conversations with professionals in the area.

Table 1

Big Game Utilization of Shrubs*
(Percent of current years growth)

	1977	1976	1975	1974	1973	1972	1971	1970
Sagebrush	24	30	70		0	10	26	20
Bitterbrush	29	40	39		42	--	64	67
Serviceberry	13	12	17		.8	13	23	18
Mountain Mahagony	--	--			22	43	8	--
Gambel Oak	--	--	27		.7	--	--	--
Squawapple	--	--	20		0	--	--	3

Other species utilized but not recorded on transect:

Snowberry
Fendler __________
Juniper
Skunkbush
Morman tea

* From Colorado Division of Wildlife extensive utilization transect located south of Orchard Valley Mine.

Note: Transect was relocated in '76 due to construction of Stevens Gulch Road.

See Map, 6, Chapter II

Table--2

Big Game Use*

	DDA+	EDA+
1977	58	
1976	48	
1975	37	.8
1974	11	4
1973	16	
1972	51	
1971	52	
1970	43	
1969	69	
	43 DDA average	

* From Division of Wildlife transect located approximately 1/2 mile south of the Orchard Valley Mine and east of the Stevens Gulch Road.

\+ Based on pellet group counts

DDA = deer days per acre

EDA = elk days per acre

See Map, 6, Chapter II

APPENDIX F

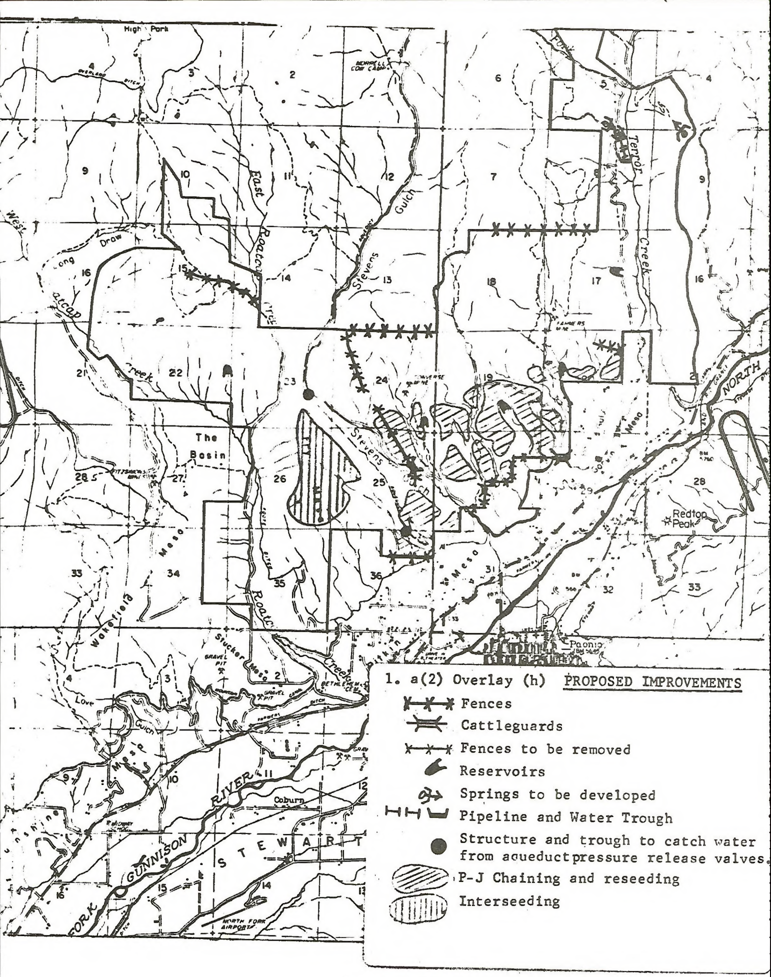
VEGETATION

APPENDIX - VEGETATION

Common Name	Plant Species Composition of the Vegetation Zones (in order of inclusion in the Vegetation portion of existing environment)
Pinyon	Pinyon edulis
Juniper	Juniperus osteosperma
Serviceberry	Amelanchier utahensis
Gambel Oak	Quercus gambelii
Mountain Mahogany	Cercocarpus montanus
Snowberry	Symphoricarpos sp.
Skunkbrush	Rhus trilobata
Squawapple	Peraphyllum ramosissimum
Big Sagebrush	Artemisia tridentata
Bitterbrush	Purshia tridentata
Mormon Tea	Ephedia viridis
Cheatgrass	Bromus tectorum
Western Wheatgrass	Agropyron smithii
Fendler Bluegrass	Poa fendleriana
Lambstongue Groundsel	Senecio integerrimus
Bedstraw	Galium boreale
Squirrel Tail	Sitanion jubatum
Junegrass	Koeleria cristata
Arrowleaf Balsamroot	Balsamorrhiza sagittata

APPENDIX G

PROPOSED IMPROVEMENTS


1. a(2) Overlay (h) PROPOSED IMPROVEMENTS
Fences
Cattleguards
Fences to be removed
Reservoirs
Springs to be developed
Pipeline and Water Trough
Structure and trough to catch water from aqueduct pressure release valves.
P-J Chaining and reseeding
Interseeding
High Park
East
Stevens Gulch
Terror Creek
Long Draw
Creek
The Basin
Stevens
Redtop Peak
Mesa
Wakefield
Stucker Mesa
Paonia
NORTH
Love
Gulch
Coburn
RIVER
GUNNISON
FORK
STEWART
NORTH FORK AIRPORT
BETHLEHEM CEM.
GRAVEL PIT

APPENDIX H

MINIMUM ROAD REQUIREMENTS

Appendix

Minimum Road Requirements

Geometric design - single lane with 10 feet of surface.

Curve - 85 ft. minimum radius

Grades - 8% with 200 ft. lengths of 15% not to exceed one 15% length for every 1,000 feet of road.

Insloped Outsloped - Roads with considerable runoff potential should be insloped sections and areas where erosion is not a prime factor should be constructed to an outsloped section.

Outsloped Roads. Outsloping is sloping the entire width of the road toward the fill bank to divert water from the road surface. In order to gain full benefit of this method of road construction, outsloping should exceed the horizontal gradients of the road up to a maximum of 5 percent. Steeper outsloping may be used if the road is only temporary, and will be put-to-bed after a short period of use.

Insloped Roads. Insloping is sloping the entire width of the road surface toward the cut bank. The degree of sloping should be the same as for outsloped roads. An insloped road necessitates that the installation of waterbar and discharge points should be at points of minimum fill to prevent erosion of fill material.

Waterbars. Waterbars are to be located at points of minimum fills and to following spacing requirements.

Grade	Spacing
0-4%	1,000 ft.
4-8%	500 ft.
8-10%	200 ft.
10-15%	100 ft.

Additional waterbars constructed where necessary to intercept side drainages.

APPENDIX I

SOCIAL AND ECONOMIC

Population and Employment

In chapter II it was shown that the population of Delta County has been growing steadily since 1970 though at a slightly slower rate than for Colorado; however, the change from 1975 to 1976 showed a sharply increased rate. A small percentage of the permanent resident increase can be attributed to Colorado Westmoreland, Inc. (CWI). The following information supplied by the administration of CWI shows a breakdown of the present work force, 107 employees, as to where they were living prior to being employed by CWI.

Colorado Westmoreland, Inc.
Employees (6/16/77)
by Residence

Residence	Number	Percent
Out of State	19	17.8
Colorado, but not Delta County	12	11.2
Delta County	76	71.0
	107	100.0

It is CWI's policy to hire locally and/or from western Colorado whenever possible; therefore, the impact of the project on population growth would be minimal. There would be a small number of service industry workers who would locate in the county not to service incoming workers but to accommodate the needs of mine workers who would be earning higher than average incomes and thus have more disposable income.

The proposed project would ultimately have a permanent work force of 250 people, an increase of 143, or 133 percent, over the present force of 107. The proposal would also require a maximum temporary work force of approximately 98 construction workers. The average per month would be 66 construction workers. Assuming that the 1976 average unemployment rate for Delta County remains stable at 454 unemployed, or 7.1 percent of the labor force, a possible impact of the proposed project, by bringing 143 new jobs into the area, could be to reduce unemployment in Delta County.

The following is a breakdown of new permanent work force as to their projected origin prior to being employed by CWI. These figures are based on CWI's past hiring record.

Employees Project Place of Residence
Prior to Being Employed
by CWI

Residence	Number
Out of State	25
Other Colorado Counties	16
Delta County	102
TOTAL	143

During the first five months CWI will also employ a temporary construction maximum work force of approximately 88 workers. (Table I shows the breakdown by month as when they would be employed.) However, it is anticipated that the present construction force of 490 will be down to 9 when work is initiated on the proposed action. Therefore, impacts of the temporary construction work force should be minimal. Approximately half of the present construction work force does not live within the county.

Table II shows estimated energy-related basic and nonbasic employment for employment in Delta County and the North Fork Valley directly associated with CWI's proposals. The number of employees living in Delta County and the North Fork Valley was determined by using the criteria outlined in the employment, population, and income section from other energy development.

Table III depicts the incremental energy-related population for Delta County and the North Fork Valley resulting from CWI's proposals.

Income

In March 1977 the preliminary estimates of the weekly earnings of bituminous lignite coal miners in the State of Colorado was $316.00 1/. This is the equivalent of $16,640 for surface workers to $17,680 for mine and maintenance workers which means that the proposed project will have a wage scale from 1.3 to 7.6 percent over the current annual average for coal mine workers in the State of Colorado, and somewhat under the highest paid city of Delta workers, plumbers-pipefitters, who earn $17,930 annually (Table II-28, Ch. II), but considerably over the city's clerk salaries which equal $6,240 annually.

The projected annual gross payroll for the proposed project when the work force is at its full strength of 250 people will be $5,002,271. (Table on "Projected Payroll," etc.) The net payroll after deductions for FICA, federal and state taxes, survivor income insurance, long-term disability insurance, and 24-hour accident insurance will be $3,680,451; $1,321,820, or 26.4 percent, below the gross payroll. There will be some additional income in stock dividends for workers who purchase CWI stock under an employee's purchase plan. They can also earn an average of $540 annually per worker, or a total of $135,000 in safety bonuses.

Social Structure

The proposed project will be an additional increment in the shift of the social structure from one based heavily on an agricultural economy to a

1/ Colorado Department of Labor and Employment, Research and Analysis Section, Colorado Manpower Region Vol XIV, No. 3, Denver, March 1977

Table I
Estimated Construction Manpower Requirements

Month No.	Overland Conveyor No. of Men	Waterline No. of Men
1	34	4
2	52	8
3	57	12
4	67	12
5	77	12
6	93	6
7	92	
8	98	
9	79	
10	74	
11	59	
12	51	
13	51	
14	39	
15	15	

Average per month: 66.1 workers

Incremental Energy-Related	Delta County 1977	Delta County 1980	Delta County 1985	North Fork Valley 1977	North Fork Valley 1980	North Fork Valley 1985
Basic	107	350	415	71	264	331
Nonbasic	129	462	569	59	229	292
TOTAL	236	812	974	130	493	623

TABLE II. ESTIMATED TOTAL COAL MINING INCREMENTAL EMPLOYEES (BEYOND 1976 LEVELS) RESIDING IN DELTA COUNTY AND THE NORTH FORK VALLEY

	Increase in:		Increase in:		Increase in:	
	Total Population	No. Children[a]	Total Population	No. Children[a]	Total Population	No. Children[a]
Delta County						
Westmoreland	277	88	610	196	818	262
North Fork Valley						
Westmoreland	153	49	386	124	513	164

[a]Assuming 1.2 children per family.

TABLE III. ESTIMATED INCREMENTAL POPULATION ATTRIBUTED TO ENERGY DEVELOPMENT IN DELTA COUNTY AND THE NORTH FORK VALLEY

PROJECTED PAYROLL FOR ONE YEAR - 1977

Gross Payroll	$5,002,271
Deductions:	
F.I.C.A.	241,320
Federal Income Tax Withheld	825,000
State Income Tax Withheld	200,000
Survivor Income Insurance	21,500
Long-Term Disability Insurance	18,000
24-Hour Accident Insurance	16,000
Total Deduction	1,321,820
NET TAKE HOME	$3,680,451

At January 1, 1977, $ and Manpower at 250 level amortized mixed rural-industrial economy and toward a social system with a higher proportion of employees than previously.

In the immediate past, 33 percent of the local labor force was self-employed (chapter II). In the future it can be expected to approach closer to the national average of 9 percent self-employed.

Culture

Since it has been and remains CWI's policy to hire local job applicants whenever possible, no change in the basic Anglo (88 percent of the population) Spanish-American (11 percent of the population) relationship can be expected.

Attitudes

Since there are prevailing attitudes of individuality, independence, and self-reliance existing in the area and communities, the expected impact of the proposed project will be to alter the individualistic and independence attitudes toward those of cooperation and teamwork in an intradependent organization.

Institutions

Provided that subcultural factors do not interfere, the long-term guaranteed income would perhaps allow a more elaborate lifestyle, including more emphasis on leisure time activities. Guaranteed incomes may tend to stabilize marriage and family relationships.(Footnote 1, Page III-23.)

Life Styles

Because of the isolated geographic location of the proposed project, the style of life in the area will retain much of its American rural village/open country flavor. CWI indicates support for the persistence of the rural life style by declaring one of its ten paid company holidays as "Hunting Day."

Increased incomes among miners' families will permit a more elaborate lifestyle, especially in leisure time activities.

Infrastructure

Political System. The impact of the proposed project upon the political system of the county will be to add an increment in the shift of political power from one dominated by ranchers/farmers to one shared with mine personnel and people from the growing service industries. It is estimated that CWI will make tax payments of approximately $997,470 annually to Delta County. It can be presumed that mine personnel will participate in the political system in order to have a voice as to how it is spent, and also to retard pressures to increase taxes. (Table II-5)

There will be no union representatives from the project becoming involved in the political system if CWI's union-free policy is successful; "At CWI we want our employees to clearly understand that we desire to operate a union-free operation." 1/

However, there has already been one confrontation with United Mine Workers of America (UMWA) which has been unionizing mine workers in the North Fork Valley since 1933.2/ If serious confrontations occur in the future the impact of the project then will be for the political/social systems to become polarized into union vs. nonunion factions.

Entities of Government

Delta County. In terms of tax revenues Delta County will be the principal local government impacted by the proposed project. According to CWI sources Delta County will receive an estimated $997,470 annually in property taxes. The total tax revenue in the County in 1975 was $2,436,305 including municipalities and other political subdivisions. Revenue to the County totalled $453,076.3/ The impact of the proposed project on Delta County's tax revenues will be to increase them by 115 percent.

PROJECTED TAXES PAID
FOR ONE YEAR - 1977

F.I.C.A. 250 x 965.25	241,320
State unemployment 250 x $42	10,500
Federal unemployment 250 x 29.40	7,350
Colorado Coal Tonnage Tax	7,000
Colorado Annual Mine License Tax	50
Colorado Foreign Corporation Annual Report Filing Fee	100
Delta County Property Tax	520,500
Total Taxes (non-income)	$786,620
Income Taxes	592,000
GRAND TOTAL	$1,378,620

At January 1977 Tax Rate

1/ S. O. Ogden, Employee Policy Guide; Colorado Westmoreland, Inc.; Paonia, Colorado, 1977.

2/ UMWA source and United Banks of Colorado, Inc., Delta, Colorado; An Economic Overview-1976, Denver: Economic Development Dept., United Banks of Colorado, Inc., 1976

3/ State of Colorado; 1975, 5th Annual Report of the Department of Local Affairs Division of Property Taxation; Denver, 1976.

There will be indirect benefits to the county too as Orchard Valley Mine employees with guaranteed annual wages upgrade the assessed valuations of their property and augment sales tax revenues to help to meet increasing costs of local government.

The county which has a 1 percent sales tax will benefit also from increased sales tax revenue as CWI workers spend a portion of their estimated $3,680,451 take home pay in the county. The towns of Delta and Hotchkiss which have passed referendums authorizing 1 percent sales taxes will also receive increased revenue from the workers' expenditures.

Ultimately the county will receive a portion of the bonuses, rentals and royalty money paid to the Federal Government and then to the State of Colorado. The Federal Coal Leasing Amendments Act of 1976 dictates that the State will continue to receive 37.5 percent of these revenues for use on schools and roads (limited by State Law to $200,000 per county), and an added 12½% that will be used for (1) planning, (2) construction and maintenance of public facilities, and (3) provision of public services primarily in areas impacted by development of leased minerals. The 12½% would amount to approximately $92,500 annually.

Starting in January 1978, the county and other local governmental entities will receive a portion of the severance tax monies paid to the State of Colorado by the company. Between January 1, 1978, and June 30, 1981, the political subdivisions of Delta County will receive 45% of the severance to be used for planning, construction, and maintenance of facilities and for the provisions of public services. At the proposed production of 1,000,000 tons/year this would amount to $130,680. However, after June 30, 1981, the total gross receipts realized from the severance tax will be credited to the State severance tax fund. The income from investment of this fund will be deposited into the State's general fund.

The Federal Government

The Federal Government will receive royalties of not less than 8% of the price of the estimated 1,000,000 tons of coal that will be mined annually from BLM land. Assuming that the 1977 price per ton continues at $18.50 the Federal Government will receive an estimated $1,480,000 annually in royalties (1,000,000 tons x $18.50 ton - $18,500,000 x .08 = $1,480,000) of which the State of Colorado will receive 50 percent, or $740,000.

The Federal Government will also receive an estimated $825,000 taxes annually deducted from mineworkers' personal income earned on the proposed project. According to CWI sources the Federal Government will also receive an estimated $592,000 in corporate income taxes.

Nongeneral revenue taxes received by the Federal Government will be an estimated $241,320 in F.I.C.A. taxes and $7,350 in federal unemployment taxes. In all the Federal Government will receive an estimated $2,350,000 in general revenue funds ($933,000 royalties + $825,000 personal income taxes + $592,000 corporate income taxes = $2,350,000). The Federal Government will also receive $248,670 in nongeneral revenue funds ($241,320 F.I.C.A. + $7,350 Federal Unemployment = $248,670).

The State of Colorado

The Federal Coal Leasing Amendments Act of 1976 dictates that the State will continue to receive 37½% of these revenues for use on schools and roads, and an added 12½% that will be used for (1) planning, (2) construction and maintenance of public facilities, and (3) provision of public services primarily in areas impacted by development of leased minerals. This will amount to an estimated $740,000 annually in royalties from the Federal Government.

Income tax deductions from the workers' payroll will provide $200,000 annually to the State of Colorado.

House Bill 1076 enacted a severance tax on coal effective January 1, 1978. The rate of tax on the underground mining of coal is thirty cents per ton of coal. No tax shall be imposed on the first 8,000 tons of coal produced in each quarter of the taxable year.

H. B. 1076 provides for the following distribution of the coal severance tax:

For fiscal years ending on or before June 30, 1979, forty percent to the state general fund, fifteen percent to the state severance tax trust fund, and forty-five percent to the local government severance tax fund.

For the fiscal year ending June 30, 1980, thirty percent to the state general fund, twenty-five percent to the state severance tax trust fund, and forty-five percent to the local government severance tax fund.

For fiscal years ending after June 30, 1980, twenty percent to the state general fund, thirty-five percent to the state severance tax trust fund, and forty-five percent to the local government severance tax fund.

The total gross receipts realized from the severance taxes imposed on minerals and mineral fuels after June 30, 1981, shall be credited to the state severance tax trust fund.

The bill also provides for the income from the investment of the severance tax trust fund to be deposited in the State's general fund.

Ultimately, the proposed action will result in a severance tax income to the State of approximately $290,000 (total, annually).

The State will also receive $7,000 in tonnage taxes for its general revenue fund and $10,500 for the state unemployment fund.

Status of Planning and Zoning and the Socio-Economic Impacts of the Proposed Project

The impact of the proposed project on the status of planning and zoning will be mostly to alert local leadership to the strong probability of significant coal development coming, and the need to cope with it by planning. The proposed project in itself has been planned to minimize negative social and economic impacts principally by the CWI policy of hiring and training local people whenever possible. The project's principal impacts will be positive: an annual injection of an estimated $3,680,451 in take-home pay into the local economy, and an estimated $997,470 in property taxes to Delta County which will more than double the county's tax revenue.

A possible negative impact of the project will be on persons on fixed incomes, the aged, retirees, and public assistance families, and/or any category of people whose incomes respond slowly, or not at all, to inflation. As pointed out in Chapter II, it is estimated that 28.5 percent of the population in Delta County is over 60 years of age and 21.4 percent is over 65. The introduction of a new payroll of the size stated above, plus the half-million in property taxes, could add a local increment to the national trend in inflation, but may well be absorbed within the Grand Junction-Delta trade areas without significant impact on retail prices. Housing prices are more susceptible to inflation from continuing population growth.

Another major possibility for a negative social impact may evolve from the company's union-free policy. The United Mine Workers of America (UMWA) has been organizing mine workers in the North Fork Valley for over 40 years, and the probabilities are high that UMWA will continue in its attempt to organize CWI workers, too. If the UMWA organizing activities lead to confrontations the social impact, obviously, will be negative.

Education

The proposed project will probably not have a direct negative effect on the education system due to CWI's policy of hiring from the local labor force; the children of the future workers are already in school, or in the community in preschool age brackets.

There is a possibility that the proposed project may have a positive impact on the educational system in the North Fork Valley which, as noted in Chapter II, has many indices of an inadequate school system. As explained in Chapter III, Delta County federal mineral royalties can be returned to the county of origin, 37½% to be used for schools and roads, and 12½% to be used for planning, construction and maintenance of public facilities and provisions of public services primarily in areas impacted by development of leased minerals. State law requires that no more than 75 percent of the 37½% revenues for one year be spent in either category. However, traditionally Delta County has given no more than 15 percent, the minimum allowed by law, annually to the school system. It is presumed that 75 percent, the maximum allowable in a single year, goes to roads; at this writing the other 10 percent has not been accounted for.

If royalties from the proposed project are allotted to the educational system at higher percentages than in the past, then the impact of the project on educational system in the North Fork Valley would be decidedly positive, especially in view of the fact that most of the royalty money in the past went to Gunnison County, the coal having been dug just across the Delta County line at Somerset. Under existing law, as much as $150,000 annually could be added to the existing education budget which would permit additions to and upgrading of the physical plant, as well as increasing teachers' average salaries from the current $12,054 to a figure closer to the Colorado 1976-77 average of $13,117 or to the Denver average of $16,733 annually.1/ Raising teachers' salaries from royalty money rather than from local tax revenues would be a method for continuously retaining income from the proposed project in the county for a longer time, thus increasing its multiplier value and its positive social and economic impacts. The severance tax benefits, as outlined in Chapter III State of Colorado, should also benefit the educational system.

That portion of the federal royalties and State severance tax which goes into the State's general fund is to be used in areas of impact through grants, etc.

Housing

The number of Westmoreland employees requiring housing should be comparatively small. Local hiring is stressed for both operational and construction workers. However, there may be newcomers moving into the area to fill positions in the local service industries vacated by those residents taking mining jobs. These newcomers would be in need of housing. Within the primary impact area, there are three subdivisions in various stages of development; Willow Heights (Hotchkiss), Pan American

1/ Colorado Department of Education, Salaries and Related Information Certificated Personnel, Fall 1976, Denver, 1976 and Bonine Brothers (Paonia). In addition, preliminary plans have been announced for three more housing projects. Two are near Paonia, Lamborn Hills (18-21 sites) and Fire Mountain Estates (19 sites), and the third near Hotchkiss (Land's End Estates, 50 sites). Since Westmoreland is the first energy company to initiate development plans, many of these sites will still be available.

Westmoreland is already aiding employees in finding homes in the North Fork Valley. The company will purchase a house for an employee and lease it back to the employee for a period of two years. After this time period, the employee is expected to buy the house. This arrangement has been made for five houses.

Transportation

The increased traffic during shift changes (50/shift) will place additional strain on an already over-taxed transportation network. The necessity of commuting to and from work on the existing roads will increase the risk of accidents and place additional strain on those presently using the network.

CWI is planning to temporarily truck coal from the mine site to the loading facility along Highway 133, a distance of approximately two miles. Trucks will be 20-ton bottom dump trucks with approximately 40 truckloads/day in 1977, and 80 to 95 loads/day in 1978. This action will add to the accident risk on Stevens Gulch with shift changes as well as the general public who use this major forest access road.

The increase in population, even though it is relatively small, will contribute to traffic congestion in the small communities as well as the main thoroughfares.

CWI's proposal will also require two additional trains/week, adding to the one train/day already going through Paonia, Hotchkiss and Delta. This will add to the existing problem of school children in Hotchkiss and Paonia crossing the tracks to and from school while the train is going through the community. The additional train traffic will also add to traffic congestion at rail crossings throughout the North Fork Valley.

APPENDIX J

COAL POLL RESULTS

COAL POLL RESULTS *

Here are the results of the poll conducted the past week by a group of citizens concerned about coal production in the North Fork Valley.

1. Do you believe additional coal production will help solve the national energy problem? 283 yes, 8 no.

2. Do you believe that there is a need for coal production in Delta County for residential use? 293 yes, 7 no.

3. Are you aware that new coal production by Colorado Consolidated Coal Co. would add about $7 million to Delta County's tax base? 197 yes, 101 no.

4. Are you aware that 80 percent of CCCC's employment applicants now live in Delta County? 224 yes, 73 no.

5. Do you think Delta County would benefit from a $3 million additional annual payroll? 293 yes, 11 no.

6. Are you aware that supporting activities would benefit existing businesses and services by an amount nearly equal to the CCCC mining payroll of $3 million? 226 yes, 78 no.

7. Do you think Delta County residents should have the main voice in deciding the future of coal production activities in Delta County? 273 yes, 21 no.

8. Have you been contacted for your opinion on Delta County coal production by a representative of FUND? 10 yes, 285 no.

9. Are you aware that Colorado University's Business Research Division has been, for the past year, conducting a socio-economic study of the North Fork area, and that it is scheduled for release in March 1975? 108 yes, 190 no.

10. Do you feel that local, state or federal governmental agencies should be influenced by private firms, such as the FUND report financed by three companies? 30 yes, 258 no.

11. Do you feel that CCCC's development as now publicized would create any serious or adverse environmental problems in Delta County? 39 yes, 257 no.

* Conducted and compiled in February 1975 by Citizens for a Stronger Delta Economy.

Those answering the poll fell in the following categories: 248 property owners, 17 renters, 10 other residents, 5 students, 92 wage-earners, 94 self-employed, 99 retired.

APPENDIX K-1

USGS MEMORANDUM

United States Department of the Interior

GEOLOGICAL SURVEY
Box 25046 Stop 602
Denver Federal Center
Denver, Colorado 80225

Colorado 25079

IN REPLY REFER TO:

RECEIVED
JUN 1'77
B.L.M. Montrose Dist.

May 27, 1977

Memorandum

To: District Manager, Bureau of Land Management
Montrose, Colorado

From: Area Mining Supervisor

Subject: Coal lease application Colorado 25079 of Colorado Westmoreland Coal Company

The following calculations may be useful to you:

Mine Production Rate - 650,000 tons/year
1,740 tons/acre-foot
Beds:
D - 25 feet
C - 11 feet
B - 7 feet of workable coal (sulfur 1.0 percent)

Considering only the "D" Bed (thick coal):

$$1{,}740 \frac{\text{Tons}}{\text{Acre-ft.}} \times 25 \text{ feet} \times .33 \text{ Recovery} = \text{Recoverable } 14{,}335 \frac{\text{Tons}}{\text{Acre}}$$

$$650{,}000 \frac{\text{Tons}}{\text{Year}} \times \frac{1 \text{ Acre}}{14{,}335 \text{ Tons}} = 45.34 \frac{\text{Acres}}{\text{Year}}$$

$$45 \frac{\text{Acres}}{\text{Year}} \times 20 \text{ Years} = 906 \text{ Acres}$$

Colorado Westmoreland owns 120 acres of fee coal, of which only 40 acres contains workable reserves. They have sales for 650,000 T.P.Y. Using the above figure of 14,335 Tons/Acre X 40 Acres (Fee Coal) =

$$573{,}400 \text{ Tons} \times \frac{1 \text{ Month}}{54{,}167 \text{ Tons}} = 10.6 \text{ Months.}$$

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

It will take approximately only 11 months for the company at 650,000 T.P.Y. to extract the coal from the 40 acres of fee, after which they are dependent on Federal reserves.

Colorado Westmoreland has expended millions of dollars in good faith to develop a coal mine by building truck haulage roads, erecting surge coal storage bins, building tail track for unit train loading, installing fan and water containers for sprinkling and bath house facilities, etc. The company needs the reserves to insure an adequate supply of coal to furnish the market demand.

The company wishes to expand their operations to 1,250,000 T.P.Y., which they will probably be able to do after they obtain the coal reserves to justify an increased market demand. They currently have a sales contract for the 650,000 T.P.Y. If it takes 906 acres of land for a 650,000 T.P.Y. operation, it would take 1,800 acres (more or less) for a projected 1.25 million T.P.Y. operation for a single coal bed.

It would cost the company more to mine multiple beds than it would to mine a single bed. If only the upper coal bed is mined, there would be no resulting damage to the lower coal beds.

The above projected need for 1,800 acres is for only a 20-year period. It is certain that the company will wish to continue operations into a second and probably third 20-year lease term. Leases are subject to readjustment and continuance at the close of each 20-year lease term. If this were figured for a 40-year term, it would take 1,800 Acres X 2 = 3,600 Acres for only the upper coal bed for a 1.25 million T.P.Y. operation. Figuring all coal beds as one-third recovery for 40 years:

$$\frac{1 \text{ Ton}}{1{,}740 \text{ Acre Ft.}} \times \frac{1}{43 \text{ Ft.}} \times \frac{1}{33\% \text{ Recovery}} \times 1{,}250{,}000 \text{ Annual} \times 40 =$$

2,025 Acres

The 2,025 acres would be required over a 40-year term at a projected production of 1,250,000 T.P.Y. using total coal thickness of 43 feet.

The company needs the lands described in their application and can justify this need. They have shown good intent by expending large capital expenditures and developing a market for 650,000 T.P.Y. They have requested a lease for the deeper coal along with the coal nearer the outcrop. If added lands are included in the lease, the company would have to pay an increased advance royalty and rental.

A company must have adequate reserves to cover any projected or increased sales beyond the reserves that they hold.

The existence of the "D" seam over the entire application is unknown. The "B" seam is a high sulfur undesirable coal for commercial or industrial fuel.

It is my opinion that the company should be allowed to bid on the lands described in their application.

J. Paul Storrs

J. Paul Storrs

APPENDIX K-2

BLM MEMORANDUM

FILE COPY

IN REPLY REFER TO

CO-932
C-25079

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

COLORADO STATE OFFICE
ROOM 700, COLORADO STATE BANK BUILDING
1600 BROADWAY
DENVER, COLORADO 80202

RECEIVED JUN 17 1977

JUN 20 '77

BLM Montrose Dist.

Memorandum

To: District Manager, Montrose

From: State Director

Subject: Short-Term Criteria Competitive Lease Application C-25079----
Colorado Westmoreland Inc. (CWI)

We have received documentation that the test burn on Colorado Westmoreland's coal from the Orchard Valley mine was successful and the coal supply agreement with Northern Indiana Public Service Company (NIPSCO) is in effect. The 15-year agreement, signed January 14, 1977, calls for CWI to provide NIPSCO with 9 to 10.5 million tons of coal at rates between 600,000 and 700,000 tons per year. The contract also provides for a renewal term of five years. Accordingly, we have concluded from the preceding facts that CWI has met the short-term criteria pursuant to the Secretary's short-term leasing criteria as set forth in I.M. 73-231 of June 6, 1973, the Director's Facsimile Message 76-89 of December 3, 1976, and 43 CFR 3525.3.

On June 1, 1977, the Bureau of Land Management received a memorandum from the Area Mining Supervisor, U. S. Geological Survey (USGS), stating that it will take CWI approximately 11 months at 650,000 tons per year to extract the coal from their 40 acres of fee coal (uppermost "D" seam at 33% recovery), after which CWI is dependent on Federal coal reserves (about April 1978). The USGS rationale is that the uppermost "D" seam will be mined first so as to allow orderly and sequential mining in the future of the lower "C" seam, and possibly the "B" seam, the latter being questionable because of its lower quality.

CWI has approximately 2,500,000 tons of recoverable coal in its private land. This estimation is based on a 65% recovery rate of the uppermost "D" seam, the middle "C" seam, and lower "B" seam. The 65% recovery rate is based on 33% recovery on the advance and 32% recovery on the retreat, which is possible only when the haul entries are no longer needed in any one seam.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

If CWI were to mine its three mineable seams prior to obtaining a Federal coal lease, it would have sufficient reserves to satisfy the terms of its contract to about the end of 1980. However, in doing so, further access to Federal coal from the Orchard Valley Mine may be severely impaired and possibly precluded because of collapse of the main haul entries. It is in the best interest of coal conservation and maximum economic recovery to mine the uppermost "D" seam first. At CWI's present production rate, it will need Federal coal in the "D" seam by April 1978.

Because of CWI's contract with NIPSCO, its limited amount of private coal reserves to meet the terms of that contract, and in the interest of efficient coal mining practices, an effort should be made to sustain and continue its operation into the "D" seam in Federal coal, subject to the provisions of the National Environmental Policy Act. Accordingly, you are directed to continue to proceed towards completion of the Environmental Assessment Record of the proposed actions and alternatives, if any are identified.

When the Environmental Assessment Record is completed, a decision will be made as to whether an Environmental Statement (ES) is needed. If it is determined that an ES is required prior to issuance of the lease, the Westmoreland proposal will be included as one of the site specific proposals analyzed in the West-Central Colorado Coal ES. In the event that a determination is made to issue the lease and associated rights-of-way, etc., following completion of the EAR, the proposal will be addressed in the West-Central Colorado Coal ES as an "existing" project with associated impacts included in the cumulative impacts of all coal development proposals in the region. The lease, if issued, would be subject to further mitigating measures that may be recommended as a result of the West-Central Colorado Coal ES.

cc:
CO-920
Area Mining Supv.,USGS

APPENDIX K-3

NEW ARTICLE

Details of Westmoreland-power company contract

As part of its application to the Bureau of Land Management for federal coal land, Colorado Westmoreland, Inc. (CWI) has placed in the public record its 23-page contract with Northern Indiana Public Service Company (NIPSCO).

The 15-year agreement, signed January 14, 1977, calls for CWI to provide NIPSCO with 9 to 10.5 million tons of coal at a rate of approximately 650,000 tons per year.

The initial cost of the coal is $16 per ton, as of Jan., 1976, with the cost to be reviewed and adjusted every 3 months to take into account increases in CWI's production costs. Such an agreement is called an 'ever-green' contract. Shipping costs are extra and are not mentioned in the contract.

In addition to the price adjustments possible every three months, the contract states "The price payable under this Agreement shall be subject to renegotiation as of the third, eighth, and thirteenth anniversary dates of first shipment, provided that either party has requested renegotiation."

CWI or NIPSCO can cancel the contract if the two companies can't agree on a new price.

The contract can also be cancelled if CWI, by July 1, 1979, does not receive a federal coal lease "sufficient, in the company's opinion, to enable it to perform all of the terms of this Agreement for the balance of the 15-year initial term hereof."

The contract sets out in detail CWI's present costs per ton of coal produced, and the types of increases to be passed on to NIPSCO.

The direct labor cost (salaries, vacation pay, holiday pay, etc.) is $4.17 per ton, with employee benefits (pensions, social security payments, workmen's compensation, medical and health insurance, etc.) $1.63 per ton. Total labor costs, then, are $5.80/ton.

Assuming CWI miners earn $8/hour before benefits and taxes, CWI is assuming a 15 ton/miner-day productivity.

Changes in the cost of labor due to new laws, raises, or a future union contract may be passed on to NIPSCO.

But, no cost increases or decreases may be passed on if CWI's original "estimate of the necessary labor force proves inaccurate." The copy of the contract we have does not include Exhibit A, which specifies that labor force necessary to produce the coal.

The contract specifies that base cost for supplies and for replacement and repair of equipment as $6.60 per ton. This cost, too, will be measured every 3 months, with changes passed through to NIPSCO.

The cost of electric power is taken as 1.94¢ per kilowatt-hour.

The contract states that the electricity costs 25.8¢ per ton, which means it takes 13.3 kw-hr to produce a ton of coal.

Taxes per ton of coal as of Jan. 1, 1976 were 52.8¢. This includes taxes on real estate, coal lands and coal production, licenses, taxes on sales, etc. The 52.8¢ does not include the cost of the state's new severance tax, which presumable will now be passed through to NIPSCO.

Royalty costs as of Jan. 30, 1976 were $1.08 per ton.

Profit, or return on investment, and the cost of general administration and selling are lumped together at $2.27 per ton.

An index, not attached to our copy, will be used to revise this part of the total $16 per ton price as costs change.

If the two firms cannot agree on a revised price, the dispute shall be referred to a 3-person arbitration board.

CWI guarantees in the contract that the coal's heat content will be 11,000 BTU/pound plus or minus 100 BTU; that average ash will not exceed 9.5%; that average sulfur will not exceed 0.65% or 0.6 pounds per million BTU; that moisture will not exceed 11.5%; and that the coal will have a 2,400° or greater fusion temperature.

Schedules and procedures for testing and weighing the coal are specified in the contract. If the heat content varies by more than 100 BTU from the 11,000 BTU figure, the price will be adjusted. NIPSCO can also reject coal if it does not meet the standards.

Strike over

The Westmoreland Coal Company last week announced that an 8-week wildcat strike at its Stonega Division ended May 23.

Westmoreland estimates the strike caused a loss of 800,000 tons of coal due to the strike.

As a result of the strike, the company says payments from the UMWA benefit fund may be curtailed.

Westmoreland president E.B. Leisenring said:

"This single factor of labor unrest will make 1977 a very difficult and unrewarding year for Westmoreland Coal Company, as it will for most of the coal industry."

APPENDIX L

Portions of Preliminary Draft Copy of Fourth Quarterly Report
"Climatic/Air Quality Project for the Orchard Valley Mine, Paonia, Colo."
by Marlatt, Wood, Sestak, and Childs, Marlatt and Associates,
to be Submitted to Thorne Ecological Institute, Sept. 1977

Development of Emission Estimates

1. Mobile Sources

a. To estimate the vehicular contribution to the total suspended particulate (TSP) discharge in the study area, the following expression was used to determine vehicular emission strengths:

$$Q = EF \times VFR \times M \times 1/1800$$

where:

Q = the vehicular emission strength (grams per second)

EF = the pollutant emission factor (grams per vehicle-mile)

VFR = the vehicle flow rate (vehicles per 30 minutes)

M = the miles travelled (miles)

Particulate emission factors (EF) for the four major classes of highway vehicles--light duty vehicle (LDV), light duty trucks (LDT), heavy duty vehicles (HDV), and heavy duty trucks (HDT)--were taken from data published by the U.S. Environmental Protection Agency (EPA AP-42, 1976). Light duty trucks are those with a gross vehicle weight of less than 8500 pounds (3856 kgs). The emission factors used are presented in table L-1. Increased use of non-leaded fuels may result in some decrease in exhaust emissions of particulates in future years; however, since it was not possible to systematically account for this effect in the area under study, the 1977 value was assumed for future years' emissions as well.

Vehicle particulate emissions for all roads in the study area (Highway 133, Paonia local roadways, Stevens Gulch Road, etc.) were determined by this method. Road mileages used were those presented in the previous section and were determined by planimeters from USGS topographic maps. The vehicle flow rate (VFR) for each 30 minute period of the day for each section of roadway was calculated from the traffic volumes, vehicle type distributions, and temporal distributions of traffic presented previously.

Table L-1

Emission Factors (EF) for Total Suspended Particulate Matter by Vehicle Type

Vehicle Type	Emission Factor (grams per mile)
Light Duty Vehicle	.54
Light Duty Truck	.54
Heavy Duty Vehicle	
Exhaust	.91
Tire Wear	.2T*
Heavy Duty Diesel	
Exhaust	1.30
Tire Wear	.2T*

* T = number of tires/4

b. Portions of the roadways in the study area (including some sections of the Colorado Westmoreland tract) are unpaved and entrainment of dust by vehicle traffic over such roads has also been considered. While not a mobile source, per se (the source being the roadway and not the traffic itself), emissions from this source will be discussed in this section for convenience. The amount of dust emitted from an uncontrolled gravel road per vehicle-mile of travel may be estimated (plus/minus 20%) using the following empirical expression (EPA AP-42, 1976):

$$EF = .6 \times (.81s) \times (S/30) \times (365-W/365)$$

where:

EF = the TSP emission factor for unpaved roads (grams per vehicle-mile)

s = the silt content of the road surface material (percent)

S = the average vehicle speed (miles per hour)

W = the mean annual number of days with .01 inches or more of rainfall.

.6 = a factor incorporated into the expression to account for and report only those particles smaller than 30 mm in diameter, which constitute the emissions that may remain indefinitely suspended.

The silt content of gravel roads averages about 12 percent (EPA AP-42, 1976) and the mean number of days with .01 inches or more of precipitation in the Paonia area is 90 (EPA AP-42, 1976). Average vehicle speeds of 25 mph and 30 mph were used for the unpaved portions of the Colorado Westmoreland tract and the gravel roadways in the Paonia vicinity, respectively. The resulting emission factors (EF) used were 1500 grams per vehicle-mile within the Colorado Westmoreland tract and 2000 grams per vehicle-mile for the remaining gravel roads in the area.

The particulate emissions from vehicle travel over unpaved roadways in each box was estimated by the following equation:

$$Q = EF \times VFR \times M \times 1/1800$$

where:

Q = the emission strength (grams per second)

EF = the pollutant emission factor as calculated above (grams per vehicle-mile)

VFR = the vehicle flow rate (vehicles per 30 minutes)

M = the miles of unpaved roadway in each box (miles)

As in determining vehicular emissions, the vehicle flow rate (VFR) for each 30 minute period was calculated from the traffic volume, vehicle type distribution and temporal distribution of traffic over each section of unpaved road.

c. Particulate emissions from locomotives were calculated using the following formula:

$$Q = EF \times FU \times L \times 1/3600$$

where:

Q = the locomotive emission strength (grams per second)

EF = the locomotive emission factor (grams per 1000 gallons of fuel used)

FU = the fuel usage (gallons per hour)

L = the number of locomotive units

The TSP emission factor (EF) for road-haul type locomotives is 11,340 grams per 1000 gallons of fuel used (EPA AP-42, 1976). Typical fuel usage (FU) by locomotives on the unit trains through the study area is 12 to 15 gallons per hour (Denver and Rio Grand Western, 1977). The emission strength for a single locomotive unit is .047 grams per second. Each unit train will include three such locomotives and will spend two to two and a half hours at the loading areas--Colorado Westmoreland silo area (box 3) and the loading areas for the up-valley mines (box 1).

2. Residential Sources

a. Spaceheating requirements may result in considerable emission of particulate matter in the more densely populated areas of the Paonia study region. The "worst case" meteorological conditions assumed for the analysis describe a day with an average temperature of 5 degrees F. This is equivalent to 60 heating degree days for this day. The following equation (Udis, et al., 1976) was used to estimate average fuel usage for each box for the worst case day:

$$FU = H \times DD \times R \times FF$$

where:

FU = the amount of fuel used during the 24 hour worst case day (units are tons for coal and wood, gallons for fuel oil and LPG and cubic feet for natural gas. LPG values are obtained as "equivalent natural gas", based on a heat equivalent of 1 gallon LPG to 100 cubic feet natural gas (EPA APTD-1135, 1973).

H = the number of homes heated with the fuel under consideration

DD = the number of heating degree-days for the worst case day. This factor was set to 60 degree-days for the analysis performed.

R = the average number of rooms per home/5 rooms. An average of 4 rooms per home in boxes 1, 2, and 3, and 5 rooms per home for the rest of the study area was assumed.

FF = the fuel usage factor for the specific fuel under consideration. Values used were (Udis, B, et al., 1976):

Coal - .0012 ton/degree-day
Wood - .0017 ton/degree-day
Fuel Oil - .18 gallon/degree-day
Natural Gas - 22.5 cubic feet/degree-day

The amount of each type of fuel burned in each box during the 24 hour worst case day was thus obtained. Heating was assumed to be continuous through the 24 hour analysis period. Particulate emissions were calculated as follows:

$$Q = EF \times FU \times 1/86{,}400$$

where:

Q = the emission strength (grams per second)

FU = the fuel usage for each type of fuel, as determined, above, over the 24 hour analysis period (tons, gallons, or cubic feet).

EF = the TSP emission factor for the specific fuel under consideration. Values were obtained directly from EPA documents (EPA AP-42, 1976) or, in the case of wood, from studies performed for the EPA (Snowden, W. D., et al., 1975):

Coal - 2721 grams TSP/ton coal burned
Fuel Oil - 4536 grams TSP/1000 gallons burned
Natural Gas - 2268 to 6804 grams TSP/1,000,000 cubic feet burned
LPG - 816 grams TSP/1000 gallons burned
Wood - values used were from test results on pine wood (Snowden, W. D. et. al., 1975)--7.3 grams TSP/kilogram wood burned.

3. Mine Sources

a. Emission estimates for the mines in the vicinity of Somerset, Colorado, are based on current and projected production. Vehicle traffic other than on Highway 133 through the area was not included since the total mileage involved is probably relatively small and the traffic volume involved is unknown. Processes which were assumed to generate particulate emission include receiving, crushing, screening, or truck loading. Emission factors for each process were taken from Colorado Department of Health information (Colorado Department of Health, 1977) and contaminant loads estimated as follows:

$$Q = R + C + STC + L$$

where:

Q = the total TSP emission strength (grams per second)

R = the emissions from receiving operations (grams per second)

C = the emissions from crushing operations (grams per second)

STC = the emissions from screening, transferring and conveying operations (grams per second)

L = the emissions from loading operations (grams per second)

No stockpiles of coal or tailings piles were assumed in the analysis. The receiving and crushing operations have been assumed to be controlled with 60 percent effectiveness, while the remaining operations are uncontrolled. Emissions are assumed continuous throughout the 24 hour period. Emissions from individual operations are as follows (emissions factors from Colorado Department of Health, 1977):

R = PR x 227 grams/ton x .4 x 1/86,400

C = PR x 91 grams/ton x .4 x 1/86,400

STC = PR x 318 grams/ton x 1/86,400

L = PR x 227 grams/ton x 1/86,400

where:

R, C, STC and L are as defined above

PR = production rate of coal (tons per day)

The composite emission factor (EF) for all operations is approximately .68 kg per ton coal produced.

b. Emissions from the Colorado Westmoreland operation have been dealt with in greater detail. Exhaust and tire wear emissions from traffic on the Stevens Gulch road, as well as fugitive dust emissions from the unpaved sections of roadway, were estimated as described in the section on mobile sources. Likewise, exhaust emissions from locomotives have been discussed previously. The remaining sources of particulate matter will include in-mine vehicle exhaust, receiving, crushing, screening, transferring and conveying operations, load out of processed coal into trucks (1977) or train cars (future years) and fugitive dust emissions from tailings or waste disposal sites.

In-mine vehicle exhaust emissions (through mine ventilation area) is described as follows:

Q = (EF x FU x 1/28,800) x .1

where:

Q = the TSP emission strength (grams per second)

EF = the emission factor for diesel equipment. Value used is 13,290 grams per 1000 gallons of fuel used (EPA AP-42, 1976).

FU = the total fuel usage per eight bour shift (gallons per 8 hours). Amounts to be used are 15 gallons per shift in 1977; 60 gallons per shift in 1980; and 75 gallons per shift in 1985 (Guyer, 6, 1977).

.1 = factor included to account for emission control equipment with 90 per cent efficiency.

Process emissions have been determined for the Colorado Westmoreland operation in an analogous manner to that used for the Somerset vicinity mines. However, dust control devices such as fabric filter collection systems or negative pressure areas, will control most operation emissions with a 99 percent efficiency. The loading operation will use adjustable height loaders and a 75 percent efficiency of dust suppression over uncontrolled loading operations has been assumed here. Process emissions are estimated as:

$$Q = R + C + STC + L$$

where:

Q = the total TSP emission strength (grams per second)

R = the emissions from receiving operations (grams per second)

C = the emissions from crushing operations (grams per second)

STC = the emissions from screening, transferring and conveying operations (grams per second)

L = the emissions from loading operations (grams per second)

Individual operations emissions are estimated (factors from Colorado Department of Health, 1977):

$$R = PR \times 227 \text{ grams/ton} \times .01 \times 1/86{,}400$$

$$C = PR \times 91 \text{ grams/ton} \times .01 \times 1/86{,}400$$

$$STC = PR \times 318 \text{ grams/ton} \times .01 \times 1/86{,}400$$

$$L = PR \times 227 \text{ grams/ton} \times .25 \times 1/86{,}400$$

where:

R, C, STC and L are as defined above.

PR = the production rate of coal (tons per day)

The composite emission factor for all operations is .063 kg per ton of coal produced.

Disposal of waste rock or tailings may also result in particulate emissions. Since this analysis deals with a worst case situation, the material disposed of is assumed to be largely tailings, although this will most likely not be the case (Guyer, 1977). An emission factor for fugitive dust from such a pile may be estimated as follows:

$$EF = 3.57 \times 10^{-4} \; (V^3/PE^2)$$

where:

EF = the particulate emission factor (grams per square meter of surface area per second)

V = the mean wind velocity (a value of 1.5 meter per second was used for the worst case meteorological situation)

PE = Thornethwaite's Precipitation-Evaporation Index; 51 for the Paonia area.

Based on a total surface area of two acres after 50 years of operation (Guyer, 1977), the following intermediate surface areas were calculated (table L-2.):

Table L-2

Disposal Area Surface Extent

Year	Surface Area (square meters)
1977	162
1980	649
1985	1461

The fugitive dust emissions arising from wind disturbance of the pile are estimated:

$$Q = EF \times A$$

where:

Q = the TSP emission strength (grams per second)

EF = the emission factor described above (grams per square meter per second)

A = the surface area of the disposal site (square meters)

4. Summary

The following table represents a summary of the total amount of particulate matter emitted into each box from each source category during the 24 hour worst case day. Table L-3 presents total grams of particulate matter emitted during the 24 hour simulation by source and table L-4 indicates the percent contribution of each source category to the total emissions in each box.

Table L-3
Summary of Total Particulate Emissions from Major Sources
for Each Box and Year (grams per day)

Year	Box	Traffic (Highway 133, Paonia and area roadways)		Trains	Residential (space heating)	Mines (other than CWI)	Colorado Westmoreland Mine	Total
		Exhaust	Fugitive Dust					
1977	1	2,874	-	1277	10,195	4,268,160	-	4,282,506
	2	5,343	-	234	3,283	-	-	8,860
	3	6,659	324,000	1329	4,721	-	-	336,709
	4	-	-	-	-	-	186,743	186,743
	5	6,128	530,064	354	203,921	-	-	740,467
	6	130	38,880	-	8,726	-	-	47,736
	7	3,719	741,950	76	9,936	-	-	755,681
	8	3,384	424,008	99	5,409	-	-	432,900
1980	1	3,836	-	2554	10,973	7,620,480	-	7,637,843
	2	7,120	-	447	3,888	-	-	11,455
	3	8,817	396,144	1510	5,499	-	297,216	709,186
	4	-	-	-	-	-	83,437	83,437
	5	8,993	649,728	531	256,124	-	-	915,376
	6	162	51,192	-	9,608	-	-	60,962
	7	4,805	910,224	113	66,027	-	-	981,169
	8	4,361	520,128	149	5,996	-	-	530,634
1985	1	5,437	-	3831	11,750	14,040,000	-	14,061,018
	2	10,100	-	671	4,666	-	-	15,437
	3	12,341	504,144	1692	6,276	-	355,968	880,421
	4	-	-	-	-	-	107,967	107,967
	5	12,134	830,088	709	342,732	-	-	1,185,663
	6	190	58,536	-	10,480	-	-	69,206
	7	6,611	1,162,080	151	144,504	-	-	1,313,346
	8	5,982	663,984	199	39,718	-	-	709,883

Table L-4
Summary of Total Particulate Emissions from Major Sources--
Percent Contribution for Each Box and Year During 24 Hour Worst Case Simulation

Year	Box	Traffic (Highway 133, Paonia and area roadways) Exhaust	Fugitive Dust	Trains	Residential (space heating)	Mines (other than CWI)	Colorado Westmoreland Mine
1977	1	.07		.03	.24	99.76	-
	2	60.31	-	2.64	37.05	-	-
	3	1.98	96.23	.39	1.40	-	-
	4	-	-	-	-	-	100.00
	5	.83	71.58	.05	27.54	-	-
	6	.27	81.45	-	18.28	-	-
	7	.49	98.18	.01	1.32	-	-
	8	.78	97.95	.02	1.25	-	-
1980	1	.05	-	.03	.15	99.77	-
	2	62.16	-	3.90	33.94	-	-
	3	1.24	55.86	.21	.78	-	41.91
	4	-	-	-	-	-	100.00
	5	.98	70.98	.06	27.98	-	-
	6	.27	83.97	-	15.76	-	-
	7	.49	92.77	.01	6.73	-	-
	8	.82	98.02	.03	1.13	-	-
1985	1	.04	-	.03	.08	99.85	-
	2	65.42	-	4.35	30.23	-	-
	3	1.40	57.26	.19	.71	-	40.44
	4	-	-	-	-	-	100.00
	5	1.02	70.01	.06	28.91	-	-
	6	.28	84.58	-	15.14	-	-
	7	.50	88.48	.01	11.01	-	-
	8	.84	93.53	.03	5.60	-	-

Source Inventory

Air quality in the vicinity of the Colorado-Westmoreland tract and the town of Paonia will be affected by a variety of contaminant emission sources in the area. Emissions of particulate matter are expected to increase in future years as local population growth continues and mining activity expansion occurs. Major categories and local sources of particulate emissions expected by 1985 are outlined below.

1. Mobil Sources

   a) The major highway through the area of interest is State Highway 133. Average Daily Traffic (ADT) counts for 1976 and projected ADT for 1977, 1980 and 1985 are shown in Table L-5, along with miles of roadway in each box. The Colorado Department of Highways estimates growth in highway usage over a 20-year period by a factor of 1.8 under normal conditions, to a maximum of 3.5 in some areas experiencing significant coal development (Colorado Department of Highways, 1976.) A growth factor of 3.5 was used in this investigation to project future traffic on Highway 133.

Table L-5 . Average Daily Traffic (ADT) and Highway Mileages for State Highway 133 (Colorado Department of Highways, 1977.)

Box	1976	1977	1980	1985	Miles of Roadway
1	550	619	826	1171	4.2
2	1000	1124	1498	2120	4.3
3	1500	1687	2248	3183	3.2
4	--	--	--	--	--
5	1175	1321	1761	2492	1.6
6	--	--	--	--	--
7	1800	2025	2700	3825	1.5
8	1800	2025	2700	3825	1.3

Much of the traffic in the area between Paonia and currently operating mines in the vicinity of Somerset will be directly related to mining activity in this area. A higher than average percentage of heavy duty vehicles is expected here, since mine supply and delivery trucks will constitute a significant portion of the total traffic volume through boxes 1, 2 and 3. The vehicle type distribution expected in these boxes is shown in Table L-6 .

Table L-6 Vehicle Type Distribution on Highway 133 Through Boxes 1, 2 and 3 (ARCO, 1976.)

Vehicle Type	Percent of Total
Light Duty Vehicles* and Trucks*	55.0
Heavy Duty Vehicles*	35.0
Heavy Duty Diesels*	10.0

*Classification scheme used is that of the U. S. Environmental Protection Agency (EPA AP-42, 1976.)

Traffic on Highway 133 through the remaining area (boxes 5, 7 and 8) is expected to have a higher percentage of light duty traffic than is shown above. The vehicle type distribution assumed for the remainder of Highway 133 is shown in Table L-7.

Table L-7. Vehicle Type Distribution on Highway 133 Through Boxes 5, 7 and 8.

Vehicle Type	Percent of Total
Light Duty Vehicles and Trucks	77.5
Heavy Duty Vehicles	17.5
Heavy Duty Diesels	5.0

Approximately 70% of the total daily traffic on Highway 133 is expected to occur during the day; between 6 a.m. and 6 p.m. Significant usage during the evening hours is also expected--25% of the total volume between 6 p.m. and midnight. The remaining 5% will occur between midnight and 6 a.m.

b) Particulate emissions will also occur from local traffic in Paonia and traffic on the other roads in the area. The contribution to the contaminant load from traffic in the town of Paonia was estimated as the sum of three factors. Traffic counts on Highway 187 into town were obtained from the Colorado Department of Highways for 1976 (Colorado Department of Highways, 1977.) This traffic volume was considered representative of the traffic on the other main road into

Paonia from Highway 133. Additional local traffic was estimated by assuming a daily traffic load from Paonia residents and an additional traffic increment contributed by area residents living outside the town limits and approach-the town from roadways other than Highway 133. Average in town trip lengths associated with each traffic load increment were also estimated. Traffic volume was projected to 1977, 1980 and 1985 with population growth factors. Average Daily Traffic volumes for Paonia are shown in Table L-8.

Table L-8. Average Daily Traffic Volumes for Paonia Local Traffic for 1977, 1980 and 1985.

Source	1977	1980	1985	Trip Length Mileage
Highway 133 Access Roads	2800	4620	6188	1.00
Resident Traffic	475	784	1050	.75
Area Traffic	375	619	829	.75

c) Area traffic, outside the town of Paonia and not including traffic on Highway 133, must also be considered. Road mileage in each box was measured and is shown in Table L-9. Traffic mileage and volume in boxes 1, 2 and 4 on roads other than Highway 133 on the Stevens Gulch Road to the Colorado Westmoreland tract are considered insignificant and have not been included in this analysis.

Table L-9. Roadway Mileages, Excluding Highway 133 and Streets Inside Paonia Town Limits. (From USGS Topographic Maps, 7.5 Minute Series.)

Box	Paved (Miles	Dirt (Miles
1	---	---
2	---	---
3	10	6
4	---	---
5	10	5
6	4.5	1.5
7	7	7
8	10	4

An Average Daily Traffic volume for 1976 of 150 cars was assumed to be representative of most of these low volume roadways. (Boxes 5, 7 and 8.) For box 6, a 1976 ADT volume of 40 vehicles was assumed and 75 vehicles per day were assumed for roads other than Highway 133 in box 3. ADT volumes were projected to future years using a 20-year growth factor of 2.5. One-third of the volume on paved roads was assumed for the unpaved sections of roadway. ADT volumes for the years under consideration are shown in Table L-10.

Table L-10. Average Daily Traffic Volumes for Area Roads, Excluding Highway 133 and Paonia Local Roadways for 1977, 1980 and 1985.

	1977		1980		1985	
Box	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	80	27	100	33	125	42
4	--	--	--	--	--	--
5	160	53	195	65	250	83
6	44	14	50	17	60	20
7	160	53	195	65	250	83
8	160	53	195	65	250	83

Traffic distributions at various times of day for Paonia local and area roads will be similar to that on Highway 133.

d) Traffic using the Stevens Gulch road to the Colorado-Westmoreland tract has been considered as part of the total emission load from that mine and will be discussed in detail later in this report.

e) Trains also represent a mobil source of particulate contaminants. Currently, one unit train with three locomotive units makes one round trip through the North Fork Valley daily, loading coal from the operating mines near Somerset. Increased production from these mines is expected to result in two unit train round trips daily through the valley by 1980 and three round trips daily by 1985. (ARCO, 1976.) In addition, Colorado-Westmoreland anticipates the need for one unit train (with three locomotive units) round trip per week to the silo area in box 3 by the end of 1977, and three unit train round trips per week in 1980 and 1985.

2. Residential Sources

a) Combustion of fuel for space heating can be a significant source of particulate pollution. In this analysis, emissions from home heating have been determined from estimates of fuel consumption in each airshed for the "worst case" meteorology previously described. The present and projected population estimates for each box area are shown in Table L-11. Population projections are based on information contained in the 2nd Quarterly Report from Thorne Ecological Institute concerning the Orchard Valley Mine (Socio-economic Section), results of a special census of Delta County performed earlier this year, and a Colorado-Westmoreland study of where present and future employees are most likely to reside.

Table L-11. Population Estimates for the North Fork Airshed for Present and Future Years. (U.S. Bureau of Census 1977; Colorado-Westmoreland, Inc., 1977; Thorne Ecological Institute, 1977.)

Box	1977	1980	1985
1	163	175	187
2	55	67	80
3	108	121	135
4	0	0	0
5	1519	1907	2554
6	54	60	65
7	203	685	1488
8	108	115	353

Total numbers of dwelling units in each box were also determined and projected to future years. These estimates are illustrated in Table L-12. Projections are based on current housing locations and the location of planned developments or those currently under construction. An average factor of 2.71 persons per household was assumed in converting population figures to dwelling unit projections. (U.S. Bureau of Census, 1971.)

Table L-12. Dwelling Units in the North Fork Airshed for Present and Future Years. (Thorne Ecological Institute, 1977; Cheney, J., 1977; U.S. Bureau of Census, 1971.)

Box	1977	1980	1985
1	65	70	75
2	21	25	30
3	40	45	50
4	0	0	0
5	563	706	946
6	20	22	24
7	75	254	551
8	40	43	131

The proportion of fuel type used in each area is also important for the analysis. The percentage of each fuel type used in each box is shown in Table L-13. This information is based primarily on information obtained from the various energy companies that serve the study area and from interviews with knowledgeable people in the area.

Table L-13. Fuel Types Used for Residential Space Heating (Rocky Mountain Natural Gas Company, 1977; Arrow Gas, 1977; Williams Energy Company, 1977; Delta-Montrose Electric Association, 1977; Cheney, 1977; Guyer, 1977.)

1977	Box	Wood	Coal	Natural Gas	LPG	Electric	Fuel Oil
	1	--	100%	--	--	--	--
	2	--	100%	--	--	--	--
	3	--	87.5%	--	12.5%	--	--
	4	--	--	--	--	--	--
	5	41%	41%	3%	--	7%	8%
	6	50%	50%	--	--	--	--
	7	15%	15%	--	40%	30%	--
	8	15%	15%	--	40%	30%	--
1978	1	--	100%	--	--	--	--
	2	--	100%	--	--	--	--
	3	--	89%	--	11%	--	--
	4	--	--	--	--	--	--
	5	41%	41%	3%	--	7%	--
	6	50%	50%	--	--	--	--
	7	22%	57%	--	12%	9%	--
	8	14%	21%	--	37%	28%	--

(Continued)

1985	Box	Wood	Coal	Natural Gas	LPG	Electric	Fuel Oil
	1	--	100%	--	--	--	--
	2	--	100%	--	--	--	--
	3	--	90%	--	10%	--	--
	4	--	--	--	--	--	--
	5	41%	41%	3%	--	7%	8%
	6	50%	50%	--	--	--	--
	7	22%	58%	--	7%	13%	--
	8	35%	35%	--	15%	15%	--

3. Mine Sources

   a) Three coal mines in the vicinity of Somerset are currently in operation and have a high likelihood of expanding their operations in future years. The mines are the Somerset Mine (U.S. Steel), the Hawksnest Mines (Western Slope Carbon), and the Bear Mine (ARCO). Table L-14 shows the estimated current and future production from these mines.

Table L-14. Present and Anticipated Production from Somerset Vicinity Mines in Tons Per Year (Thorne Ecological Institute, 1977.)

Mine	1977	1980	1985
Somerset (U.S. Steel)	1,070,000	1,290,000	1,500,000
Hawksnest (Western Slope Carbon)	250,000	1,000,000	1,000,000
Bear (and new ARCO Mine)	200,000	425,000	2,500,000

Particulate emissions from underground coal mines can occur at various stages of the operation. Mine ventilation may remove in-mine vehicle exhaust and fugitive dust, but this source is usually not significant. (Colorado Department of Health, 1976.) Coal preparation, including receiving operations, crushing screening, transferring and conveying, can allow large amounts of coal dust to enter the atmosphere as suspended particulates if control devices are not used. Stockpiles and truck or train loading operations also contribute to the particulate load in the atmosphere. Since the details of operation of these mines are unknown, and since they are not the primary concern of this study but rather contribute to the regional "background" pollution against which Colorado-Westmoreland's impact on air quality will be measured, the three currently operating mines have been grouped together in the analysis and considered as a single source. Average particulate emissions estimates from mines of this type (based on tonnage produced) have been assumed for purposes of analysis. Mine induced traffic has been included in the Highway 133 emission estimates and will not be treated separately.

b) The Colorado Westmoreland operation is considered as a separate source of particulate emissions and has been examined in greater detail than the other sources analyzed.

1.) Mine induced traffic on the Stevens Gulch road and within the Colorado Westmoreland tract constitutes one of the emission categories considered. This traffic will include employee arrivals and departures, bus traffic from the parking areas to the mine itself, supply, delivery and maintenance traffic and, prior to completion of the overland conveyor, coal removal from the mine site.

The mine operation itself will include three shifts, to change at 7 a.m., 3 p.m. and 11 p.m. The Colorado Westmoreland operation will employ 60 workers per shift in 1977, 90 per shift in 1980, and 100 per shift in 1985 (Stucki, 1977.) Miners are assumed to arrive or depart within a half-hour of the shift change and traffic volumes have been estimated by assuming an average of two workers per vehicle. Approximately 25 nonmine workers will be employed at the Colorado Westmoreland site in 1977; this will increase to 40 by 1980. The nonmine personnel will probably work from 8 a.m. to 4:30 p.m. (Guyer, 1977.)

In addition to the anticipated arrival or departure of the mine employees on a regular basis, there will be some miscellaneous light duty vehicle traffic over the Stevens Gulch and Colorado Westmoreland roads at all times of the day. The volume of miscellaneous traffic to be expected was estimated from traffic counts taken at the guard station at the entrance to the Colorado Westmoreland tract in January 1977. For purposes of analysis, all this traffic was assumed to originate or terminate at the mine offices.

1977	1977 Miners Others Others Buses Delivery Coal	1980	1985
0-030	.5 LDV AF	.5 LDV AF	.5 LDV AF
030-100			
100-130			
130-200			
200-230			
230-300			
300-330			
330-400			
400-430			
430-500			
500-530			
530-600			
600-630	3.1 HDD AE		
630-700	30 LDV AB 2 HDD BG	45 LDV AB 3 HDD BG	50 LDV AB 4 HDD BG
700-730	30 LDV AB .5 LDV AF 2 HDD BG 1.8 HDV AF	45 LDV AB .5 LDV AF 3 HDD BG 3.6 HDV AF	50 LDV AB .5 LDV AF 4 HDD BG 4.3 HDV AF
730-800	25 LDV 4.25 LDV AF 1 HDD BF 1.8 HDV AF	40 LDV AB 4.75 LDV AF 3 HDD BF	40 LDV AB 5.25 LDV AF 1 HDD BF
800-830	AB 4.25 LDV AF 1 HDD BF	1 HDD BF	1 HDD BF
830-900	4.25 LDV AF		
900-930			
930-1000			
1000-1030			
1030-1100			
1100-1130			
1130-1200			
1200-1230			
1230-1300			
1300-1330			
1330-1400			
1400-1430			
1430-1500	30 LDV AB 2 HDD BG	45 LDV AB 3 HDD BG	50 LDV AB 4 HDD BG
1500-1530	30 LDV AB 2 HDD BG	45 LDV AB 3 HDD BG	50 LDV AB 4 HDD BG
1530-1600			
1600-1630	1 HDD BF	1 HDD BF	1 HDD BF
1630-1700	25 LDV AB 4.25 LDV AF 1 HDD BF	40 LDV AB 4.75 LDV AF 1 HDD BF	40 LDV AB 5.25 LDV AF 1 HDD BF
1700-1730	.5 LDV AF	.5 LDV AF	.5 LDV AF
1730-1800	1.8 HDV AF 3.1 HDD AE	3.6 HDV AF	4.3 HDV AF
1800-1830			
1830-1900	.5 LDV AF	.5 LDV AF	.5 LDV AF
1900-1930	.5 LDV AF .5 LDV AF	.5 LDV AF	
1930-2000			
2000-2030			
2030-2100			
2100-2130			
2130-2200			
2200-2230			
2230-2300	30 LDV AB 2 HDD BG	45 LDV AB 3 HDD BG	50 LDV AB 4 HDD BG
2300-2330	30 LDV AB .5 LDV AF 2 HDD BG	45 LDV AB .5 LDV AF 3 HDD BG	50 LDV AB .5 LDV AF 4 HDD BG
2330-2400			

Table L-15

L-20a

Bus trips from the parking lot to the mine were estimated from the number of employees being transported. These trips also correspond to the timing of shift changes.

Miscellaneous heavy duty vehicle traffic was also determined from the January traffic counts. This traffic was assumed to occur between 7 a.m. and 6 p.m. and is expected to increase with the expansion of the mining operation itself.

Coal trucks will be used to remove coal from the mine site until the proposed overland conveyor is in operation. Consequently, they are not a part of the analysis in 1980 or 1985, but are considered part of the total traffic volume for 1977. Coal truck traffic is expected to occur between 6 a.m. and 6 p.m., with an average volume of 75 trips per day.

A diagram of the roadways discussed and points of traffic origin or termination is shown in Figure * . Mileage between points is also shown.

Table L-15 shows the expected traffic distribution over various sections of the Stevens Gulch and Colorado Westmoreland roads by 30-minute periods. Route designations refer to the locations shown in figure * .

In addition to vehicle exhaust, traffic emission of particulates can occur due to pulverization and entrainment of dust particles from unpaved roadways. Roadways beyond point D (Figure *) on the Colorado Westmoreland tract are unpaved and traffic using these sections of road produce an additional load of particulate pollutants.

2.) Contaminant emissions will also occur from the mining and processing operations. In-mine vehicles are expected to burn 15 gallons of diesel fuel per shift in 1977, 60 gallons of diesel per shift in 1980, and 75 gallons per shift by 1985. Emissions from in-mine vehicle exhaust will be vented out of the mine and will constitute a source of pollutants. An unknown quantity of suspended dust may also be vented from the mine, although the amount will probably be fairly small and thus was not included in the analysis.

Estimated total production of coal from the Colorado Westmoreland mine is shown in Table L-16 .

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*Not yet available; will be included in the fourth quarterly report for Thorne Ecological Institute (Marlatt, oral communication).

Table L-16. Present and Future Production from the Orchard Valley Mine in tons per year (Guyer, 1977.)

Year	Production
1977	650,000
1980	1,250,000
1985	1,500,000

Processing and transportation of the coal produced provide additional opportunities for particulate emission. Receiving areas, conveyors, crushing and screening processes and loading operations are all potential sources of pollutants. However, the use of dust control devices, such as negative pressure or baghouse collection systems, at strategic points in the operation should result in relatively small total quantities of particulate matter entering the atmosphere from these operations. In 1977, all of the processing and loading emissions will enter box 4. In future years, the final load-out of coal will be moved to the silo area and particulate emissions resulting from that operation will enter box 3.

3.) Disposal of waste rock may create an additional source of fugitive dust. The total amount of tailings and other waste materials produced over 50 years of operation is not expected to cover an area of more than two acres, 16 to 25 feet deep (Guyer, 1977.) The disposal area will be to the southwest of the crusher facility. Activity producing particulate emissions will include loading of material onto the pile and wind erosion. The total emission from this source is expected to be quite small.

4. Other Sources

Agricultural activities in the North Fork Valley are also expected to contribute to the particulate load of the ambient air. Agricultural burning, pesticide and fertilizer application and vehicle traffic over bare fields all produce significant contaminant emissions. These emissions occur intermittently and are expected to constitute the major source of particulate emissions in the Paonia area during some periods. However, periods of maximum emission from agricultural sources are not likely to occur during the "worst case" meteorological conditions as described previously and also will not coincide with peak emissions from some of the other important sources, such as space heating requirements. Consequently, while agricultural practices do constitute a major source of particulate pollutants, they have not specifically been included in the worst case analysis.

Meterology

The first factor necessary to a computation of ambient air contaminant concentration involves the dispersive ability of the regional atmosphere. The rate of ventilation through an area and the depth of the mixed layer establishes to a large extent the magnitude of pollutant emission that can be tolerated within that area.

The phenomenon of mountain-valley flow in the North Fork Valley has been discussed in detail in a previous report (Thorne Ecological Institute, 1977b). During a warm, sunny day, the heating of the sunlit valley slopes causes the adjacent air to warm and rise. At night, radiative cooling of the valley walls and higher elevations cool the adjacent air, which slides down the slope, draining into the lowest portion of the valley. The shape and orientation of the North Fork Valley is such that the drainage (or Katabatic) flow is the dominant flow for most hours of the day. Information from the meteorological monitoring network established in the study area indicate a fairly common wintertime conditon of approximately 16 hours of downslope (easterly) flow and 8 hours of upslope (westerly) flow through the Paonia area (Thorne Ecological Institute, 1977a). Onset of the upvalley flow occurs most often around 9 AM and the direction is reversed around 5 PM.

Downslope flow often gives rise to a surface temperature inversion. A positive lapse rate, that is, increasing air temperature with height, is present in the lower levels of the regional atmosphere due to cold air draining into the lowest areas of the valley and underlying warmer air. Such a situation in a mountain valley is associated with very light downslope winds. Similar conditions may occur when a large high pressure air mass dominates a region. The subsiding air of a high pressure system is very stable and usually associated with light winds and air stagnation. Studies performed by Holyworth (1964, 1972) indicate that the study area is located within a region where stagnation episodes lasting more than one day can occur with some frequency. In the absence of strong regional air mass movement, such as would occur during a large scale stagnation, the local, thermally driven winds dominate the climate of the North Fork Valley.

From an air quality standpoint, a temperature inversion is an undesirable condition. Because the cold area is always seeking the lowest position with in an inversion, air pollutant emissions will not have an opportunity to mix with air above the inversion. Under these circumstances, the only means of dispersion is by small scale turbulence caused by ground friction and by molecular diffusion. This conditon may be particularly severe in mountain valleys since horizontal dispersion is limited by the valley walls.

Because the temperature inversion defines a discontinuity through which the vertical diffusion of pollutants is prohibited, the depth of the mixed layer is a crucial parameter in the estimation of total allowable pollutant discharge in a region. Since no in situ measurements of mixing heights are available for the study region, assumptions concerning this parameter were made by comparison of the North Fork Valley airshed with other Colorado airsheds for which mixing height data is available (*). Due to the shape and orientation of the airshed, the inversion layer is thought to be much deeper in the narrow upper reaches of the valley than in the lower portions. Where the valley widens, the cold air layer is expected to spread out with a subsequent decrease in the depth of the mixed layer. The mixing heights were chosen to be consistent with a "worst case" event; that is, meteorological conditions allowing the maximum probable concentration of pollutants, and are shown in table L-17.

The four point measurements of windspeed and direction provided by the monitoring network are insufficient to provide complete evaluation of the regional windfield in the complex terrain that characterizes the Paonia study area. A method of mathematical evaluation of wind patterns at many points resulting from the perturbation of the synoptic flow by terrain, temperature and roughness has been developed (Fosberg, Marlott and Krupneck, 1976) and was used to generate windfield maps of the North Fork airshed. Figures * and * illustrate the windfield over the study area, assuming that a 2.0 meter per second (4.5 m.p.h.) wind flow from the northeast or southwest generally predominates the synoptic flow conditions. These light synoptic wind speeds would be consistent with the stagnation conditions that would prevail during a worst case event.

From this analysis, the probable air pollution displacement patterns that would occur when these wind regimes prevail was estimated. Figures * and * indicate areas of stagnation of convergence where pollutants could tend to "pool" during a worst case epsiode.

The meteorological assumptions needed for the simulation include average mixing height (z), average wind speed (u) and direction of flow in each box for each hour of the analysis. Average windspeeds in each box were estimated from the windfield analysis. These assumptions are summarized in table *.

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* Not yet available; will be included in the fourth quarterly report for Thorne Ecological Institute (Marlatt, oral communication).

Table L-17
Meteorological Conditions Used in Worst Case Simulation
Analysis for the North Fork Valley Airshed

Box	Mixing Height (z) (meters)	Wind Speed (u) (meters per second) Upvalley	Downvalley	Direction
1	168	2.5	2.0	Direction of flow downvalley in all boxes between midnight and 9 AM and between 5 PM and midnight. Flow is upvalley in all boxes between 9 AM and 5 PM.
2	168	2.0	2.5	
3	107	2.0	1.8	
4	91	1.0	2.5	
5	91	1.5	1.5	
6	107	2.0	1.5	
7	61	2.0	1.3	
8	61	2.0	1.5	

Air Quality Analysis

Model Description

Procedures for calculating pollutant concentrations within an area must take into account two things--the amount of pollutant emitted into the area in a given period of time and the ability of the regional atmosphere to disperse the pollutant. Ground level concentrations of pollutants may be estimated through the use of mathematical air quality diffusion models which provide the capability to interface the dispersive characteristics of the regional atmosphere with the amount of contaminant matter introduced into the air.

Air quality diffusion models may generally be classed into three categories. A statistical approach to diffusion forms the basis of the Gaussian plume model (Turner, 1970), the gradient theory of diffusion provides the basis of a second technique (Shaw and Munn, 1971) and an assumption of instantaneous, uniform mixing with a constrained area offers the basis for a third set of models (Marlatt, Holben and Renne, 1973.) The first two categories of models are not readily applicable to the situation encountered in the study area. The Gaussian plume model requires detailed meteorological parameter inputs which are not available for the Paonia region. The large number of boundary conditions and its limitation to flat terrain situations also preclude the use of the Gaussion model in this inquiry. The second technique is of limited usefulness in remote areas due to the difficulty in determining realistic diffusivities. The third type of model, however, is particularly suited to use in comples terrain situations, such as exist in the North Fork Valley. For this reason, along with the relative simplicity of meteorological inputs required, a modification of the Ventilated Valley Diffusion Model (Marlatt, Holben and Renne, 1973) will be employed in this analysis.

The ventilated valley model is a mathematical expression for computing the average concentrations of pollutants within a given volume of air over a short period of time. The area to be modeled is represented by a geometric shape of equivalent volume, as is shown in Figure L-1 , whose dimensions are limited by topography and vertically constrained by a temperature inversion at a given height above the valley floor. Continuity of mass requires that the amount of pollutant within the "box" must be equal to the difference between the pollutants emitted into the "box" or brought into the "box" from upwind and the pollutants removed through the downwind "ventilation" areas. Mathematically stated that is:

$$\frac{dm}{dt} = q \times Vrx_{BND} - Vr(\frac{m}{v}) \qquad (1)$$

where: m = the mass of pollutant material in the "box"

v = the volume of the "box"

q = the emission rate of pollutant material from sources located within the "box"

x_{BND} = the concentration of pollutant at the upwind boundary of the "box"

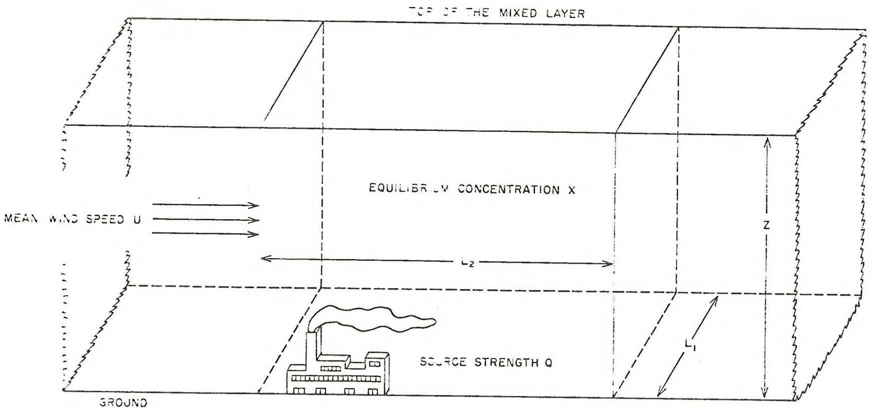

Figure L-1 Ventilated Valley Diffusion Model.
(After Marlatt, Renne, and Holben)

Vr = the ventilation rate (ventilating area (L_1Z) times the mean throughflow speed ($\overline{u}$).

$\frac{m}{v}$ = the contaminant concentration within the "box", often expressed by the equivalent symbol, x.

The general solution of the model is:

$$x = \frac{q + x_{BND} Vr}{Vr} \quad 1-e^{\frac{-Vr}{V} t} = x_{BDG} e^{\frac{-Vr}{V} t} \qquad (2)$$

where: x = equilibrium concentration of the pollutant $(\frac{\text{mass}}{\text{unit volume}})$

x_{BND} = concentration of the pollutant at the volume's upwind boundary $(\frac{\text{mass}}{\text{unit volume}})$

x_{BGD} = concentration of the pollutant eithin the volume at t=0. That is, the volume's background concentration $(\frac{\text{mass}}{\text{unit volume}})$

Vr = the ventilation rate = $\bar{u}L_1Z$ (where $\bar{u}$ is the mean windspeed, L_1 is the crosswind length of the volume and Z is the mixing depth) $(\frac{\text{volume}}{\text{unit time}})$

q = emission rate of pollutant from sources located within the airshed volume $(\frac{\text{mass}}{\text{unit time}})$

t = elasped time

V = volume of the box

e = base of Naperian logorithms.

The model requires values for the following input parameters: mixing height (z), ventilation rate ($\bar{u}$, L, Z), volume of the "box" (V), background pollutant concentration level at the upwind boundary of each "box"(x_{BGD}), the pollutant concentration level at the upwind boundary of each "box" (x_{BND}) and the emission rate (q) of pollutant from contributing sources. The following assumptions are basis to the model's derivation:

1) The source emission rate (s), q (mass per unit time), of any pollutant introduced into the airshed is constant during any functional period of time.

2) There is instantaneous, perfect mixing within the constrained airshed so that the concentration, x (mass per unit volume), of any pollutant is uniform throughout the airshed volume at any point in time.

3) The meteorological state remains constant during each computational period.

4) The total mass of pollutants is conserved--reactivity and disposition of the pollutants are ignored.

5) The throughflow remains constant in direction and speed throughout each computational period.

The model is used to simulate a short term (24-hour) episode during which meteorological conditions inhibiting pollutant dispersal prevail. Values of parameters were thus chosen to be consistent with conditions that would occur during such a "worst case" event.

The actual airshed is assumed to be represented by a geometric shape with a volume equivalent to that of the valley itself. For purposes of analysis, the study area was divided into eight"boxes", the location of which are shown in Figure * . The volumes represented by each box were defined by the bottom and sides of the North Fork Valley and the tributary valleys of Minnesota Creek and Stevens Gulch. The vertical dimension is constrained by a temperature inversion, located at a specific height above the floor of each box (determination of inversion heights used is discussed under the meteorological assumptions required for the analysis.) Volumes and cross-sectional areas at the box interfaces were measured by planimeter from U.S.G.S. topographic maps (7.5 minute series.) The most important box dimensions are summarized in Table L-18.

Table L-18 Dimensions of North Fork Valley Airshed Segments.

Box	Volume (V) (cubic meters)	Length (L_1) (kilometers)	Mixing Height (z) (Meters)
1	$.638 \times 10^9$	6.26	168
2	1.038×10^9	6.44	168
3	$.439 \times 10^9$	5.21	107
4	$.141 \times 10^9$	4.59	91
5	$.472 \times 10^9$	2.40	91
6	$.499 \times 10^9$	5.42	107
7	$.126 \times 10^9$	1.95	61
8	$.182 \times 10^9$	2.04	61

*Not yet available; will be included in the fourth quarterly report for Thorne Ecological Institute (Marlatt, oral communication).

During downslope flow, the Stevens Gulch and Minnesota Creek boxes (4 and 6, respectively), as well as box 3, drain into box 5. When upslope conditions prevail, 75 percent of the flow from box 5 is into box 3, 25 percent into box 4, and 5 percent into box 6. This division of flow is based on the approximate relative cross-sectional area of each valley projected in the circection of wind flow.

Results

The 24-hour "worst case" simulation was run using the meteorological assumptions and emission estimates described in the previous sections. Situations reflecting the contribution to particulate contaminants made by all the sources identified, all sources except the Colorado Westmoreland operation and the Colorado Westmoreland operation alone (processing and loading emissions, mine-induced traffic, mine ventilation and waste disposal) were analyzed for 1977, 1980 and 1985. In addition, a production level of 1,000,000 tons per year of coal was assumed for the Colorado Westmoreland mine in 1985 and 1990, as compared to the 1,500,000 ton production level assumed in the original source inventory. Emissions from processing, loading and mining operations were reduced accordingly and the pollutant levels resulting from Colorado Westmoreland emissions at this production level were also simulated.

Since a variety of assumptions, regarding both meteorological variables and emissions sources, were necessary to formulate the analysis, the pollutant levels described by the simulation were tested against data collected in Paonia on December 20, 1976. Wind speed and direction for each hour were taken from the mechanical weather station located on Cedar Hill above the town of Paonia and were used as the meteorological inputs for box 5. Speeds were adjusted in the other boxes to reflect the velocity differences seen in the windfield analyses (Figures * and * .) Emissions estimates for 1976 levels were used for most sources and 1977 estimates were used where data for 1976 was unavailable. No particulate emissions from the Colorado Westmoreland operation were assumed.

The high volume particulate sampler located in the town of Paonia recorded a 24-hour average concentration of 102 ug/m^3 on December 20, 1976. Concentrations of 230 ug/m^3 in Delta and 106 ug/m^3 in Montrose for the same date indicate that non-dispersive conditions were probably present throughout the region during this time period. The simulation estimated an average concentration in box 5 (Paonia) for the 24-hour period of 111 ug/m^3. It was concluded that if the meteorological assumptions described previously are representative of the worst case situation for this valley, then the worst probable ambient particulate concentrations that can be expected in Paonia in 1977, and potentially in other portions of the study area, can be simulated with some accuracy. Worst probable concentration estimates for future years are additionally contingent upon the reliability of the emission projections used.

The results of the simulation analyses are presented in Table L-19.

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*Not yet available; will be included in the fourth quarterly report for the Thorne Ecological Institute (Marlatt, oral communication).

Table L-19. Simulation Analysis Results. Twenty-four Hour Average Particulate Concentrations for Worst Case Meteorology (Units are miligrams per cubic meter) are presented for each year, box and situation.

1977

Box	All Source Emissions	All Source Emissions Excluding Colo-West Operations	Colo-West Only (650,000 TPY)
1	275.6	274.4	1.3
2	161.8	160.6	1.2
3	177.9	176.7	1.2
4	29.0	11.0	18.0
5	218.8	208.3	10.6
6	20.0	19.6	.5
7	373.9	358.3	15.6
8	264.8	254.5	10.3

1980

Box	All Source Emissions	All Source Emissions Excluding Colo-West Operations	Colo-West Only (650,000 TPY)	Colo-West Only (1,000,000 TPY)
1	475.4	469.6	5.8	4.8
2	269.2	262.6	6.7	5.5
3	298.9	282.5	16.4	13.2
4	23.3	14.9	8.4	7.9
5	348.3	330.4	17.9	14.9
6	27.0	36.4	.5	.5
7	584.1	557.1	27.1	22.4
8	408.8	390.7	18.1	15.0

1985

Box	All Source Emissions	All Source Emissions Excluding Colo-West Operations	Colo-West Only (650,000 TPY)	Colo-West Only (1,000,000 TPY)
1	846.9	837.7	7.0	4.9
2	461.9	453.9	8.0	5.6
3	499.2	479.6	19.6	13.4
4	32.6	31.8	10.8	9.8
5	580.0	558.0	22.0	16.0
6	40.8	40.1	.7	.5
7	955.3	922.1	33.2	24.0
8	664.0	641.8	22.2	15.9

Discussion and Conclusion

The results of the simulation analysis indicate that under the worst case meteorological situation, 24 hour average particulate concentrations in all parts of the main North Fork Valley examined in this analysis could be in excess of current Colorado ambient air standard (150 ug/m^3 TSP) in 1977. Concentrations within the areas represented by boxes 1, 7 and 8 could, in addition, exceed the NAAQS (260 ug/m^3 TSP). The tributary valleys of Minnesota Creek and Stevens Gulch, even under worst case conditions, will remain well within acceptable standards with regard to TSP concentrations.

If population growth and mine expansion occur as projected for the analysis, all portions of the main North Fork Valley studies could show particulate concentrations in excess of acceptable standards (both state and federal) in 1980 and 1985. The Minnesota Creek and Stevens Gulch areas should have acceptable air quality through 1985 even under non-dispersive meteorological conditions.

Particulate emissions resulting directly from the Colorado Westmoreland operation will constitute a significant portion of the total estimated contaminant load only in the Stevens Gulch area. Total 1985 coal production of 1.5 million tons per year would result in ambient particulate concentrations only a few micrograms per cubic meter higher than would occur from a total yearly production of 1.0 million tons. Colorado Westmoreland mine emissions should constitute an even smaller percentage of the total pollution load in the regional atmosphere in future years, relative to the 1977 situation, as other emission sources continue to grow.

While the direct impact on air quality operations is relatively small, expansion of mining operations at the Colorado Westmoreland site, as well as in the area surrounding Somerset, could result in significant indirect impacts. Increases in traffic and residential spaceheating emissions will result from a local population increase in large part associated with the expansion of nearby mining activities.

It can be seen from the emissions summary tables (* and *) that the largest sources of particulate matter included in the analysis are the three currently operating mines in the vicinity of Somerset. In projecting mining emissions to future years, control efficiencies for the various operations were assumed to remain at 1977 levels. In all probability, these mines will institute more rigorous dust control methods as their operations expand. This could have a very significant impact on the ambient particulate concentrations that could result under worst case conditions in future years.

One of the major sources of particulate pollution in the North Fork Valley airshed appears to be dust entrained by traffic over unpaved

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*Not yet available; will be included in the fourth quarterly report for the Thorne Ecological Institute (Marlatt, oral communication).

roadways. Unfortunately, no data are available regarding current traffic volumes over these types of roads in the study area. The figures used were assumptions and can only be considered "order of magnitude" estimates. Similar uncertainties exist with respect to traffic exhaust emissions over the low volume roadways in the area, but the resulting contaminant load from this source is much smaller than that from unpaved road emissions.

The exact nature of the temperature inversion situation in the North Fork Valley is still hypothetical. As yet no data on atmospheric temperature profiles are available from the site, although complete analysis of the thermograph data yield some information regarding the frequency and height of inversions in the Paonia area (box 5). In particular, the actual mixing depth that would occur in the lower boxes (7 and 8) under worst case conditions is uncertain. High concentrations resulted in these boxes during the simulation because very low mixing heights were assumed (61 meters); the volume available for pollutant dispersion was accordingly small. It is conceivable that under such meteorological conditions, strong inversion layers only form in the upper portions of the valley; inversions in the lower boxes may be transient, variable in height throughout the day or even non-existent. The temperature inversion situation, at present, represents the most tentative portion of the analysis and is the major reason why this effort must basically be considered a "first approximation" study.

One other factor which was not considered in the simulation was the non-anthropogenic pariculate load of the regional atmosphere. The "background" concentration against which Colorado Westmoreland's impact was evaluated was considered as a direct result of emissions from other contaminant sources in the area. In reality, some particulate contamination would undoubtedly exist due to natural processes such as dust entrainment, pollen, etc., even in the total absence of man-related activites. The magnitude of this "natural" background concentration in the Paonia area, however, would be difficult to determine since some amount of anthropogenic pollution is always present in the regional atmosphere. Under conditions of low wind speed and relative stability of the lower atmosphere, such as would occur during non-dispersive episodes, the "natural" background probably constitutes a small percentage of the total pollutant load in most of the boxes for the emission situations considered. "Natural" background pollutants could constitute a significant percentage in boxes 4 and 6, which are shown to remain relatively free from large anthropogenic particulate contributions during worst case conditions.

In conclusion, it appears that portions of the main North Fork Valley in the vicinity of Paonia could exceed allowable particulate concentrations under non-dispersive meteorological conditions. This will be particularly true in future years as mining activities in the region expand, resulting in local population increases. The Colorado Westmoreland mine will be responsible for a small decrease in ambient air quality due to activities directly associated with the mining operation.

A more significant impact on air quality may result indirectly from the Colorado Westmoreland operation, as local population increases produce heavier traffic volumes and greater fuel combustion for spaceheating. The analysis also indicates that expansion of other mining activities in the region and population changes associated with these could play a major role in future air quality in the North Fork Valley.

APPENDIX M

NOISE

APPENDIX M

Description of Methodology

General survey information was collected by a GenRad Model 1945 Community Noise Analyzer utilizing a GenRad 1" diameter microphone amplified by an in-line GenRad #1972-9600 preamplifier. Twenty-four hour periods were sampled and were broken into 2, 3, or 4 hour sample rates in order to minimize the effects of data being "blown away" by wind peaks often encountered in 24 hour measurements, particularly in the Paonia area. (The Paonia area is in a narrow valley that culminates at McClure Pass and is prone to diurnal up and down slope thermally induced flows which stimiluate moderate to strong local wind patterns.) In addition, the near range western slope is subject to frequent mountain weather phenomenon accompanied by high winds. The microphone was always used with an adequate windscreen to minimize wind effects. Measurement sites were selected that met EPA classifications for "soft" sites; i.e., no microphone was located on asphalt or unvegetated ground. Specific survey data was taken by tape recording noise emissions from identified dominant noise sources. A UHER IC 4000 Automatic Tape Recorder was used to record noise characteristics sampled by a GenRad ½" diameter microphone amplified by a GenRad #1972-9600 preamplifier. A windscreen was used to minimize wind peaks in readings. Calibrations were made every 24 hours by the use of a GenRad Type 1562-A sound level calibrator. Analysis of the tape recordings was with a GenRad 1933 octave band analyzer/sound level meter. Microphone height was 4 feet ± 1 foot from ground level of the source or location sampled. The GenRad instruments are calibrated yearly to standards traceable to the National Bureau of Standards. Measured distances are approximate as they often were stepped off through unimproved land and brush.

Site Selection Criteria

The first site selected was to represent an in-town situation; preferably in a quiet suburban sector. Proximity to the D. & R. G. W. railroad tracks was another requisite to ensure that non CWI rail traffic would be measured. A street location was desired to account for local automobile traffic. Local citizens repeatedly emphasized that their major complaints (long standing) were barking dogs and "hot" cars with very loud exhausts. A site at 703 Fourth Avenue, across from the park and 500' from the train roadbed was selected. Existing truck traffic could best be measured on Highway 133 to get both coal trucks and normal traffic flows in the town's proximity. A nearly level stretch of highway with no sharp turns between the Stevens Gulch Road and the Rail siding was felt to be adequate. Average speed, due to the heavy truck traffic, is between 35 and 45 MPH (55 MPH posted).

Possible future highway noise levels could have been sampled by shutting down haul truck and construction traffic at the sample site on 133, described above. Since this was impractical except on Sunday, and since it was felt that this might be construed as unrepresentative of typical weekday traffic levels, a site beyond the mine and construction area of influence was deemed significant. A nearly level stretch with no sharp bends was required. Highway 133, 2 miles east of the intersection of Stevens Gulch Road and 133 was selected. It had average speeds in the range of 45 to 65 MPH (50 MPH posted).

A typical situation in the area of the proposed overland conveyor was required to provide the pre-existing background levels. At all locations along the proposed conveyor route, truck noise was easily discerned so an alternate site was chosen on the back of the mountain on private property 800' from CWI's wells. This area is considerably quieter than the conveyor route even without existing truck traffic. An existing generator was shut down for specific periods in order to determine background levels without the influence of the generator engine.

The representative conveyor site was required to be relatively isolated from truck traffic. The possibility of shutting down the trucks was ruled out due to production deadlines. A site next to the Fire Mountain Canal and on the proposed R.O.W. was selected.

Representative readings of a train loading were desired to determine the orchard area's loading impact. A free field measurement was felt to be better in this situation due to the large number of structural and construction noise sources. This site was selected 50' south of the railway roadbed, in a peach orchard 300 feet south of the storage silos.

Specific noise sources were recorded with a tape recorder and were identified with results of the general noise surveys. They included:

* Truck passbys up and down Stevens Gulch Road
* Conveyor belt drive station
* Truck loading operation
* Mine ventilation fan
* Mine conveyor belt drive motors
* Water haul truck
* #C-4 conveyor

* #C-4 conveyor drive station

* Diesel engines

* Coal loading into train cars

* #C-1 conveyor

Conclusions Regarding Results

Approval of the conveyor R.O.W. would remove this source after the construction period. Construction equipment, working on the conveyor route would increase the noise impact temporarily.

APPLICABLE LAWS, ORDINANCES AND REGULATIONS

"Title 25, Article 12 of the Colorado Revised Statutues 1973"

I. Specifies allowable noise levels eminating onto properties surrounding the Colorado Westmoreland, Incorporated, property as a function of their zoning. In this case, the limits point out acceptable noise levels at a point 25 feet inside adjoining property lines as a function of their land use category.

ADJACENT PROPERTY ZONE	DAYTIME LEVEL (7am - 7pm)	NIGHTTIME LEVEL (7pm - 7am)
Residential	55 dB(A)	50 dB(A)
Commercial	60 dB(A)	55 dB(A)
Light Industrial	70 dB(A)	65 dB(A)
Industrial	80 dB(A)	75 dB(A)

Impulsive noise penalized 5 dB(A)
10 dB(A) rise allowed for 15 min/hour from 7 am - 7 p.m.

II. This same statute limits the maximum noise level emission of heavy trucks (10,000 GCWR or GVWR) to 86 dB(A) at 50 feet at speeds below 35 MPH.

"Railroad Noise Emission Standard USEPA, Dec. 31, 1976"

Regulates locomotive and rail cards. Sets maximum allowable noise measured at 30 meters or approximately 100 feet from centerline.

	MANUFACTURED BEFORE 31 December	MANUFACTURED AFTER 1979
Locomotive idle	73 dB(A)	70 dB(A)
Locomotive at other throttle settings	93 dB(A)	87 dB(A)
Locomotive moving	96 dB(A)	90 dB(A)
Rail Cars moving $<$45 mph	88 dB(A)	88 dB(A)
Rail Cars moving $\geq$45 mph	93 dB(A)	93 dB(A)

NOTE: No local or state regulation exists concerning locomotive warning whistles other than CRS zoning statutues which limits rail operations on R.O.W.'s to levels allowed in industrial zones.

"Portable Air Compressor Noise Emission Standards USEPA"

January 1, 1978 Capacity $<$ 250 cfm
July 1, 1978 Capacity $\geq$ 250 cfm

Regulates portable air compressor noise levels measured at 7 meters or approximately 23 feet to 76 dB(A).

NOTE: Regulations soon to be released by the USEPA will regulate wheel and track loaders and wheel and track dozers.

"Medium and Heavy Truck Noise Emission Standard USEPA"

March 31, 1976, and Interstate Motor Carrier Noise, Department of Transportion, Federal Highway Administration, October 29, 1974: 23 CFR Part 772.

Regulates the noise of medium and heavy trucks measured at approximately 50 feet from centerline.

	Current	1978	1982
Under 35 mph	86 dB(A)	83 dB(A)	80 dB(A)
Over 35 mph	90 dB(A)	83 dB(A)	80 dB(A)
Stationary	88 dB(A)	83 dB(A)	80 dB(A)

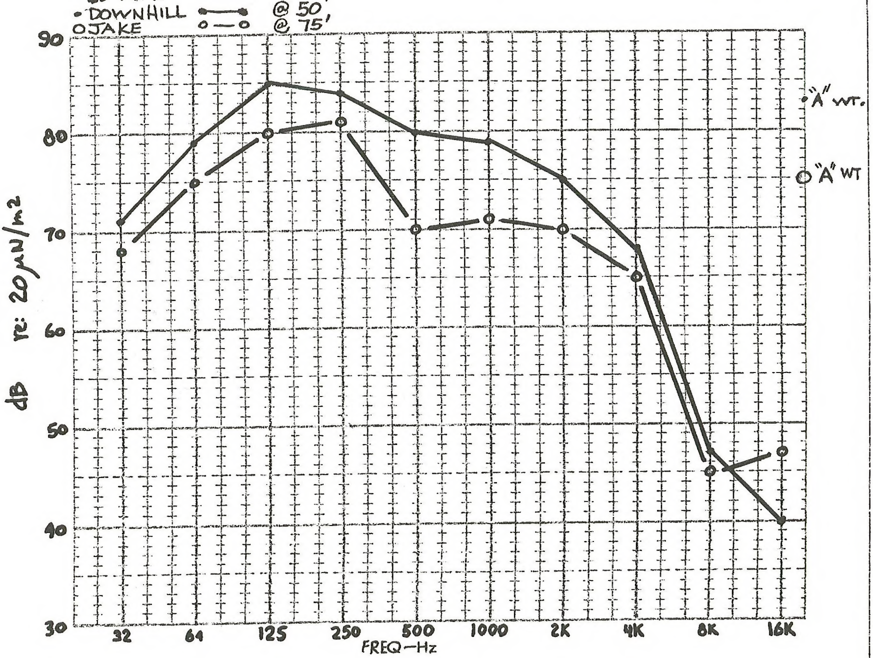
Federal Highway Administration

Design Noise Level/Activity Relationships

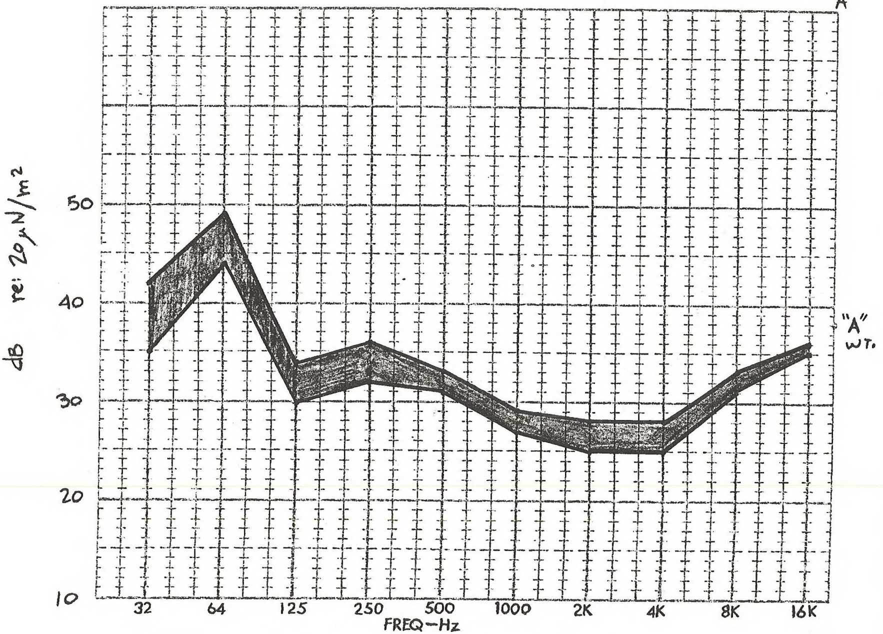
Design dB(A) Levels		
L_{eq}	L_{10}	DESCRIPTION OF ACTIVITY
57 ext.	60 ext.	Serene and quiet tracts of land
67 ext.	70 ext.	Residences, Motels, Schools, Libraries, Churches, Recreation Areas, Parks, Playgrounds, Picnic Areas
72 ext.	75 ext.	Developed Lands not Included Above.

PETERBUILT
350 CUMMINS, TURBO, DUAL EXHAUST, "JAKE"
25 MPH

AUG 8, 1977



AUG 7, 1977



BACKGROUND SPECTRUM MEASURED @ PROPOSED CONVEYOR SITE & CANAL

M-7

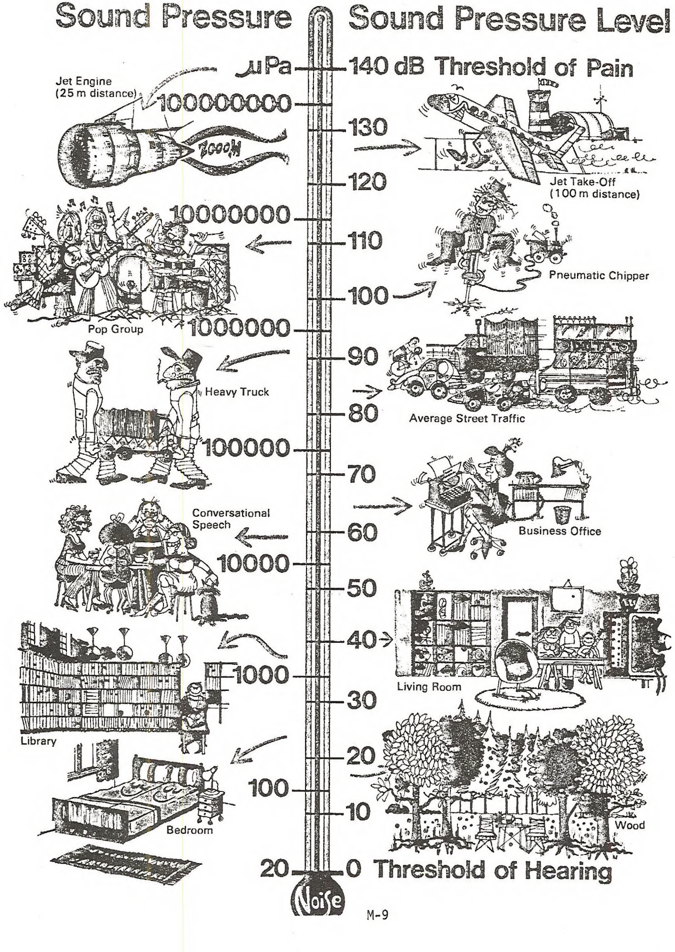
FIRE MOUNTIAN CANAL @ CONVEYOR ROUTE

CAUB 112 @ 1000 Hz
Wt "A"
RESPONSE SLOW

8/7/77 - 8/8/77

BATTERY CHECK

	MAX	$L_{0.1}$	L_1	L_{10}	L_{50}	L_{90}	L_{99}	MIN
	.5/24	1/24	8/24	.5/8	L_2	L_5	L_{20}	L_{EQ}
1	61	59	57	48	38	37	36	32
7am - 11am	46	45	39	43	46	44	43	43
2	62	58	57	44	38	35	34	31
11am - 3pm	42	36	39	37	42	38	41	43
3	60	58	54	45	43	37	35	31
3pm - 7pm	42	40	43	38	42	39	44	50
4	54	50	48	38	30	32	30	28
7pm - 11pm	35	32	31	31	35	31	35	34
5	51	47	45	34	24	23	23	22
11pm - 3am	32	31	25	31	33	31	29	36
6	57	56	52	43	32	25	24	21
3am - 7am	42	43	33	42	42	42	38	41


Sound Pressure
Sound Pressure Level
μPa
140 dB Threshold of Pain
Jet Engine (25 m distance)
100000000
130
Jet Take-Off (100 m distance)
120
10000000
110
Pneumatic Chipper
100
Pop Group
1000000
90
Heavy Truck
80
Average Street Traffic
100000
70
Conversational Speech
Business Office
60
10000
50
40
Living Room
1000
30
Library
20
100
10
Bedroom
Wood
20
0 Threshold of Hearing
Noise

GLOSSARY

GLOSSARY

"A" SCALE OF WEIGHTING. A weighting characteristic which closely approximates the human hearing response by discriminating heavily against the very low frequencies. Knowing a noise source's frequency spectrum is important as differing frequencies have different transmission characteristics.

ALLOTMENT MANAGEMENT PLAN (AMP). A concisely written program of livestock grazing management, including supportive measures if required, designed to attain specific management goals in a grazing allotment.

AMBIENT AIR. The surrounding or outside air.

AUDIBILITY. If a noise can't be heard, it's inaudible and has no adverse impact upon the receiver. A zone of audibility depends upon two factors, (1) the noise level of the source, and (2) the background sound level.

AUDITOR-CONSULTANT. An individual elected by and from the participants in a public meeting held by the BLM. An auditor consultant's function is to represent the desires of the public which elected him or her; follow BLM actions through subsequent meetings; inform the BLM of new local issues and actions; insure proper interpretation and clarification of issues and concerns discussed at public meetings; inform the public of BLM actions; and finally to furnish BLM with needed expertise if and when called upon to do so.

CAISON DRILLING RIG. A truck mounted drill capable of making large diameter holes to shallow depths in order to bury structural supports.

COMPLYING MINING AND RECLAMATION PLAN. A detailed plan for the development of the coal resource and subsequent reclamation of all disturbed areas submitted to the Mining Supervisor for approval prior to commencement of any mining operation, showing the proposed location, method and extent of mining and all related activities necessary to such operation, including steps to be taken to reclaim disturbed areas, mitigate adverse impacts, and to otherwise meet the performance standards and requirements set forth in 43 CFR 3040 and 30 CFR 211.

DAY-NIGHT AVERAGE SOUND LEVEL. (L_{dn}) Weighs nighttime averages 10 dB(A) heaver than daytime averages. Averages are in terms of energy equivalence over 24 hours.

DECIBEL. Logarithmic scale in which each increase of 10 units represents a ten-fold increase in intensity level; abbreviated dB.

dB(A). See Decibel and "A" scale of weighting.

DOUBLING "RULE". For every doubling of distance from the noise source in a "perfect" medium, sound attenuates 6 dB, for every ten-fold increase, sound attenuates 20 dB.

EMISSION. Discharge or release into the atmosphere of one or more air contaminants.

ENERGY MINERALS ACTIVITY RECOMMENDATION SYSTEM. The present coal leasing process which consists of three principal elements: nomination; multiple resource land-use planning; environmental analysis. Presently EMARS is undergoing a review period conducted under the Federal Coal Management Review announced by the Secretary of the Interior July 25, 1977.

FEDERAL COAL LEASING AMENDMENT ACT OF 1975--STAT. 1083. The most recent amendment to the Mineral Leasing Act of 1920. FCLAA of 1975 sets forth new legislation dealing with minimum royalty rates, criteria for land-use planning prior to coal leasing, definitions of diligent and continuous development, and redistributes the apportionment of royalties.

FEE COAL. Privately owned coal rights.

HERTZ. Frequency of sound measured in cycles per second.

INFRASTRUCTURE. Includes transportation, communication, fire protection, utilities, police protection, search and rescue, health systems, education systems, special districts, water systems, and public finance.

METAL SHROUD. A metal cover or screen.

NOISE. Unwanted sound.

PERCENTILE LEVELS. A certain dB(A) level of sound is said to occur or be exceeded a certain percent of the time, usually 10, 50, or 90 percent. The percentile levels are designated L_{10} L_{50} and L_{90} respectively.

POLLUTANT OR AIR CONTAMINANT. Fumes, smoke, particulate matter, vapor, gas, or any combination thereof, but not including water vapor or stream condensate.

PRIMARY STANDARD. Intended to protect public health.

SECONDARY STANDARD. Intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

SECRETARY. The Secretary of the Interior Department.

SOUND. A rapid pressure fluctuation superimposed on the steady barometric pressure.

SOUND INTENSITY. Related to the size (amplitude) of the fluctuation. Measured (generally) in terms of the decibel scale (dB).

SOUND PRESSURE LEVEL. In decibels is 20 times the logarithm of the ratio of the root-mean-square sound pressure in Newtons per meter squared (N/M^2) to 20 UN/M^2.

STORAGE COEFFICIENT. A volume of water, measured as a fraction of a cubic foot, released from storage in each column of the aquifer which has a base of one square foot and a height of the full thickness of the aquifer. Simply, a measure of the porosity of an aquifer which is unconfined.

SURGE TANK. A tank containing both air and water and designed so as to stop irregular pulsations in the flow of a liquid.

TRANSMISSION. The passage of sound through some medium such as air. As this occurs, the sound level attenuates or decreases in amplitude. Micrometeorological and ground conditions can cause additional attenuation. Temperature gradients, wind gradients, and direction, humidity, vegetation and topography can result in attenuation of up to 26dB per doubling of distance upwind and as little as 9dB downwind.

TRANSMISSIVITY. 1. The amount of solar radiation which penetrates through the tree canopy; 2. A measure of the permeability or flow of water (in gallons per day) through an aquifer cross section one foot thick and one mile wide under hydraulic gradient of one foot/mile at field temperature.

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