THE ECONOMY OF THE POWDER RIVER BASIN REGION OF EASTERN WYOMING DESCRIPTION AND ANALYSIS

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John R. McKean
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John R. McKean

Department of Economics
Colorado State University
Fort Collins, Colorado 80523

and

Joseph C. Weber and Ray K. Ericson

Department of Mineral Economics
Colorado School of Mines
Golden, Colorado 80401

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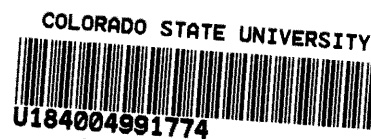Wyoming State Office
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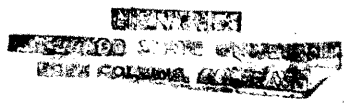Fort Collins, Colorado 80523

Norman A. Evans, Director

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CHAPTER 1

INTRODUCTION

The purpose of this report is to provide a description and analysis
of a regional economy within the State of Wyoming. The intent of the
researchers is to provide policy makers with specific information
contributing to the decision-making and planning processes and to
provide a planning tool having the capability of analyzing a number
of alternative development scenarios in the study region.

THE REGION UNDER STUDY

The Powder River Basin study area consists of eight counties in
northeastern Wyoming: Sheridan, Campbell, Crook, Johnson, Weston,
Natrona, Converse, and Niobrara. These counties comprise an area of
28,989 square miles, or approximately 30 percent of Wyoming's total
area. Within the Powder River Basin, federal government holdings
account for 22.9 percent of the acreage, private holdings account for
68.5 percent and state holdings amount to 8.6 percent.[1] The region's
1980 population was 157,378 inhabitants, or 33.4 percent of the

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[1]Wyoming Department of Economic Planning and Development, Coal and
Uranium Development of the Powder River Basin-An Impact Analysis, 1974,
p. 18.

state total. Total personal income for the region was approximately

$2.4 million which was almost 38 percent of the state total.[3]

The Powder River Basin's economy has historically depended on

three sectors: agriculture, tourism and mining. Agricultural production

is predominantly based on livestock; the eight county region contains

30 percent of the land in Wyoming that is suitable for year-round

grazing. Approximately half of Wyoming's sheep and almost 40 percent

of Wyoming's cattle can be found in the Powder River Basin. The major

cash crop grown in the area is wheat; the basin accounts for nearly 20 percent

of Wyoming's wheat production. Campbell and Crook counties have most of the

region's wheat land. Approximately 26 percent of Wyoming's agricultural em-

ployment occurs in the eight county area.

Natural features like Crook County's Devil's Tower National

Monument, the Big Horn Mountains in Sheridan and Johnson Counties,

and the Black Hills, which are partially located in eastern Crook and

Weston Counties, draw large numbers of tourists to the area. It is

difficult to quantify the employment due to tourism because many of

the services supplied to tourists also serve the local economy.

The Powder River Basin region is rich in mineral resources including

oil, gas, coal, uranium and bentonite. The 1979 production figures for

the eight counties are listed below.

[2]U. S. Bureau of the Census, Census Retrieval and Information
Service Report #2H, 1981, pp. 4-6.

[3]Wyoming Department of Administration and Fiscal Control, Wyoming
Income Report, 1980, p. 11.

1979 MINERAL PRODUCTION[4]

County	Oil (Bbls.)	Gas (MCF)	Coal (Tons)	Uranium (Tons)	Bentonite (Tons)
Campbell	24,689,520	19,731,572	39,322,640	---	---
Converse	7,002,401	13,791,617	3,004,854	1,898,391	---
Crook	2,573,420	103,235	---	---	1,822,662
Johnson	3,219,622	1,038,896	---	98,891	341,796
Natrona	7,538,813	8,199,305	---	474,255	50,898
Niobrara	1,250,981	190,577	---	---	---
Sheridan	187,804	---	3,536,608	---	---
Weston	1,931,340	995,482	---	---	333,752
Total Powder River Basin Prod.	48,393,901	44,050,684	45,864,102	2,471,537	2,549,108
Total Wyoming Prod.	115,678,022	333,322,180	68,792,573	5,512,345	4,479,242
% Wyoming Prod.	41.8%	13.2%	66.7%	44.8%	56.9%

Due to the large amount of natural resources available, mineral production has been a significant factor in the area's economy since the late 1800s. About 67.6 percent of Wyoming's mining employment occurs in the eight county area.

Northeastern Wyoming topography consists of two main features, high plains and mountains. The Powder River Basin is bounded on the east by the Black Hills, and on the west by the Big Horn Mountains. Cloud's Peak, the highest mountain in the Big Horn Mountain Range with an elevation of 13,165 feet, is located on the western border of Johnson County. The high plains generally vary in elevation from 4,500 to 5,000 feet; their

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[4]Mineral Division of the Wyoming Department of Economic Planning and Development, 1980 Wyoming Mineral Yearbook, 1981, p. 89.

low point is 3,125 feet, which occurs in the northeastern corner of the region where the Belle Fourche River leaves the state. Devil's Tower, a unique topographic feature, is also located along the Belle Fourche River in the northeastern corner of the study area. Devil's Tower is 1,200 feet high and 1,700 feet in diameter; it is composed of vertical columns of phonolite, a volcanic rock.

The climate of the Powder River Basin can be classified as semi-arid due to its moderately low, unevenly distributed rainfall. Areas that receive less than 8 inches of rain are classified as semi-desert and have sparse vegetation; areas that receive 8 to 16 inches of rainfall can support some trees. Temperatures vary between extreme cold in winter and extreme heat in the summer. The mean monthly temperature for Gillette is 20.5° F in January and 71.7° F in August; it also receives an average of 14 inches of precipitation per year. The prevailing winds are westerlies, however, mountain structures often change the general weather patterns. Localized weather is frequently the result of their influence. Windy days are common on the high plains; wind speeds can often exceed 40 miles per hour. Thunderstorms, cloudbursts and hailstorms frequently occur during the summer.

The vegetation of the high plains is characterized by extensive grassy plains and sagebrush flats. Plants that are common in this semi-arid region include cactus, buffalo grass and sagebrush. Along the Powder River, bluegrass is the staple range plant; its high nutritive value allows cattle to be restricted in range area without any loss in weight. When irrigated, the Powder River Basin will produce crops, predominantly wheat. Where there is enough water for trees to grow, along stream banks and in the mountains, the most common conifer is the ponderosa pine. Cottonwood

trees are also frequently found on the lower slopes and along stream beds.

Substantial coal resources are found within the Powder River Basin; it is estimated that 89.8 percent of the strippable coal resources found in Wyoming (21.262 billion short tons) lie within the eight county area.[5] The coal in the Powder River Basin is the lowest ranked coal mined in Wyoming. Heat values for the Basin coals average only 8,200 BTU/lb., compared to the 9,000 to 11,000 BTU/lb. found in southern Wyoming coal mines.[6]

The Powder River Basin is a gentle, assymetrical anticline bounded by mountain ranges on its eastern and western margins. It has the least complex structure of any of the Wyoming coal fields; the beds dip less than two degrees on the eastern margin of the basin. The dip of the beds gradually increases as its western edge is approached. The thickest and most continuous coals in the Basin occur in the Tertiany Fort Union and Wasatch Formations, although some subbituminous coals occur in the Cretaceous Mesaverole and Lance Formations. The Fort Union Formation coals are best developed on the northern and eastern sides of the basin; they consist of eight to twelve thick, subbituminous coal beds. One of the most persistant beds, the Wyodak-Anderson bed, ranges between 25 and 125 feet thick, and probably averages 70 feet thick. The Wasatch Formation contains up to eight persistant coals; the thickest Wasatch coal occurs on the western side of the Basin in the Healy coal bed. The Healy coal

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[5]Coal and Uranium Development of the Powder River Basin-An Impact Analysis, op. cit., p. 18.

[6]Gary B. Glass, Wyoming Coal and Their Uses, Geological Survey of Wyoming, 1975, p. 4.

bed is the thickest coal bed in Wyoming, and probably in the U. S. At

Lake De Smet the Healy coal bed exceeds 220 feet in thickness.

The original estimated in-place coal resources of the Powder River

Basin lying between zero and 3,000 feet of overburden is 110,218.95 million

short tons.[7] The remaining strippable subbituminous coal reserves found

in the Powder River Basin as of January 1, 1968, can·be seen below.

STRIPPABLE COAL RESERVES WITHIN THE POWDER RIVER BASIN[8]

Strip Mine Deposit	Strippable Reserves (short tons)
Acme-Kleenburn	32,000,000
Clear Creek	184,900,000
Dave Johnston	135,700,000
Dry Cheyenne	179,500,000
Lake De Smet	1,000,000,000
Spotted Horse	717,000,000
Sussex	13,600,000
Wyodak	19,000,000,000
TOTAL	21,262,700,000

The presence of oil and natural gas in Wyoming is closely tied to

the location at large structural basins, like the Powder River Basin.

Although Wyoming's oil and gas concentrations occur in both structural

and stratigraphic traps, most of the recent discoveries have been in

stratigraphic traps. This is because structural traps generally have

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[7]Coal and Uranium Development of the Powder River Basin-An Impact
Analysis, op. cit., p. 18.

[8]Gary B. Glass, Review of Wyoming Coal Fields, 1976, Public Information
Circular No. 4, Geological Survey of Wyoming, p. 20.

recognizable surface expressions, like the crest of an upwarped anticline; all of these obvious geologic features have previously been drilled. Stratigraphic traps, however, are usually located in the central, undisturbed portion of a basin which makes them more difficult to locate. It has only been with the advent of more sophisticated geophysical equipment that these large stratigraphic traps have been found in the western U. S.; including those located within the Powder River Basin.

The Powder River Basin was the most active area for exploratory drilling during 1977; it accounted for 52.5 percent of all the wells drilled in Wyoming.[9] Drilling activity was concentrated in the central portion of the basin due to the discovery of large oil reserves in stratigraphic traps like the Hartzog Draw. A summary of the drilling activity for the years 1971 to 1977 can be seen below.

DRILLING ACTIVITY IN THE POWDER RIVER BASIN[10]

Year	Total Wells[*]	New Field Wildcats
1977	681 - 52.5%	13 oil, 0 gas
1976	602 - 63%	12 oil, 1 gas
1975	864 - 69%	26 oil, 1 gas
1974	598 - 61%	20 oil, 0 gas
1973	557 - 63%	11 oil, 0 gas
1972	595 - 62%	17 oil, 0 gas
1971	571 - 64%	22 oil, 0 gas

* % is the percent of the total wells drilled in Wyoming

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[9]Barlow & Haun, Inc., Oil and Gas Production, Reserves and Resources in Wyoming, 1978, p. 13.

[10]Ibid, p. 14.

Total (current and future) oil production from the Powder River
Basin is estimated to be 3.559 billion BBL which would amount to 34
percent of the state's total; total current and future gas production
is estimated to be 3.349 billion MCF which would be 4 percent of
Wyoming's total.[11] A summary of cumulative production, remaining reserves
and estimated resources for the Powder River Basin can be seen below.

PRODUCTION, RESERVES AND RESOURCES FOR OIL AND GAS

IN THE POWDER RIVER BASIN[12]

	Estimated Cumulative* Production to 1/78	Estimated Remaining Reserves	Estimated Undiscovered Resources
Oil BBL	1,700,066,419 38.4%	685,900,000 37.6%	528,000,000 to 2,935,000,000 (range) 1,174,000,000 (most likely)
Gas MCF	1,715,318,602 23.7%	430,200,000 4.4%	541,000,000 to 3,010,000,000 (range) 1,204,000,000 (most likely)

* % is the percentage of the total Wyoming base figure.

The Powder River Basin has abundant low grade uranium deposits; the
majority of these deposits are found within the Tertiany Fort Union Formation.
These low grade deposits were formed by migrating uranium-bearing solutions
that altered the original host rock (sandstone); they are termed "roll
front" deposits because the uranium is concentrated along the C-shaped
interface between the oxidized and reduced portions of the sandstone.

[11]Ibid, p. 4.

[12]Ibid.

The iron-oxide staining associated with the oxidation of the sandstone by the uranium-bearing solutions is particularly well developed in the Powder River Basin area.

Although Wyoming is second only to New Mexico in uranium production and reserves, the uncertain future of the nuclear industry in the U. S. has caused cutbacks in production and development. Until a definite nuclear energy policy is developed in the U. S., the uranium industry in Wyoming will be in a state of flux. It is estimated that there are 62,600 tons of uranium resources ($U_3 O_8$) within the Powder River Basin.[13]

Along with the fossil fuels, bentonite is of major economic importance to the Powder River Basin. Bentonite is a sedimentary mineral which contains at least 75 percent of the clay minerals montmorillonite and beidellite. When wet, Wyoming bentonite can swell to as much as fifteen times its original volume. This particular property places the mineral in high demand by the oil industry where it is used as a component in drilling mud to seal wells and to carry well cuttings to the surface. The steel industry also uses bentonite in pelletizing taconite iron ore prior to its shipment to a steal mill.

The study area produced 56.9 percent of Wyoming's 1979 bentonite production; Crook County itself accounted for 40.5 percent of Wyoming's production. Due to expanding markets, the Wyoming bentonite industry is expected to grow at a rate of 10 - 15 percent per year through 1985.[14]

A great deal of the growth in northeastern Wyoming has been caused by the rapid development of the mining sector. The expansion of the mining

[13]U. S. Energy Research and Development Administration, National Uranium Resource Evaluation, Preliminary Report, 1976, p. 47.

[14]1980 Wyoming Mineral Yearbook, op. cit., p. 13.

industry is reflected in the employment figures for the eight counties.

EMPLOYMENT IN THE MINING INDUSTRY

	Year						
County	72*	75*	78*	78**	80**	81**	82**
Campbell	957	1,433	3,010	2,809	3,532	4,033	4,522
Converse	242	672	1,456	1,445	1,523	1,724	1,837
Crook	0	175	364	321	366	370	374
Johnson	141	190	285	428	453	462	478
Natrona	2,911	4,728	6,746	6,316	6,398	6,642	6,853
Niobrara	0	88	30	30	30	30	30
Sheridan	166	140	299	801	897	1,097	1,134
Weston	381	482	554	658	726	746	773

*Wyoming Employment Report, 1980.
**Wyoming Population and Employment Forecast Report, 1980.

The mining sector's expansion has had a significant effect on the population of the eight county area.

POPULATION

County	1970*	Year 1975*	1980**
Campbell	12,957	13,090	24,367
Converse	5,938	8,048	14,069
Crook	4,535	4,883	5,308
Johnson	5,587	5,728	6,700
Natrona	51,264	55,087	71,856
Niobrara	2,924	2,895	2,924
Sheridan	17,852	19,924	25,048
Weston	6,307	6,245	7,106

*Wyoming Handbook, 1977.
**Census Retrieval and Information Service, Report #2H, April 1981.

STATEMENT OF THE PROBLEM

The natural resource base in the region, while relatively abundant in terms of the capability to satisfy local demands, is nonetheless the focal point for regional and extra-regional economic conflict. Ownership of the large deposits of exploitable resources is vested largely with the federal government and corporations headquartered out of state. Water use is governed by state water law, interstate compacts, and international treaty. Thus, from a regional perspective, policies affecting the disposition of the regional resource base are largely determined outside of the region. From this same perspective, there is a need to develop a detailed description of the economy as it presently exists and an analytical framework which is capable of assessing the direct and indirect consequences of alternative scenarios for resource exploitation proposed by the public and private sectors of the economy. This description and analysis constitutes the major thrust of the research reported here.

THE MODEL USED

A tool particularly adapted to these questions is the comprehensive interindustry production model developed by W. W. Leontief. The strength of this model (often termed the input-output model) lies in its capability not only to describe the interdependence existing among sectors of an economy but also in the capacity to demonstrate, sector by sector, the total consequences of any number of development scenarios. The model is thus both descriptive and analytical. The descriptive components are accomodated through the collection of extensive primary data, from firms within the region, and subsequent tabulation of the data in a form consistent with the interindustry framework. The analytical phase consists of the

impact analysis, development of the various multipliers, and consistent forecasting under alternative resource development scenarios.

OUTLINE OF THE REPORT

The remainder of the report consists of a description of the method of the study which is presented in Chapter 2, the analysis of the regional economy, which is the concern of Chapter 3, and the analysis of water use in Chapter 4.

In addition to the main text of the report, there are several appendices. These contain the input-output tables, the sector identification used in the analysis, and a bibliography.

CHAPTER 2

THE METHODOLOGY OF THE STUDY

INTRODUCTION

The national energy and minerals situation has focused an increasing attention on the natural resources in the Powder River Basin region of eastern Wyoming. The exploration, development, and extraction activities associated with these natural resources have generally been viewed as isolated from, or independent of, the remainder of the economic environment. While it is not proposed to perform an ex-post evaluation of the impacts of existing developments, a major product of this research is the provision of the analytical capability for assessing the regional impacts of continued resource developments.

The interindustry model identifies the interdependent structure of an economy. No producing sector is autonomous (independent of the other sectors); rather, each sector interacts with other sectors (industrial, commercial, labor, government) through the purchases of goods and services and the sale of outputs. Structural interdependence means, quite simply, that the activities of one sector have impacts on others. The identification of the nature and magnitude of this interdependence is one of the most useful results of the interindustry model.

The model is driven by what are termed final demands.[1] Final demands (as opposed to intermediate demands) reflect the demand for goods and

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[1]See Chapter 3 for a more complete explanation of the interindustry model.

and services in final form. Thus, final demand sectors use or consume a finished good. Intermediate demands, on the other hand, reflect the demand for goods and services which are processed before becoming available for final consumption. Thus, changes in final demands result in changes in the processing (or intermediate) sectors of the economy. The primary purpose of the interindustry model is to trace these impacts throughout the economy. Tracing these direct and indirect impacts allows the derivation of the multiplier effects on production, income, employment, or water use, and also allows the use of the model in providing consistent forecasts of economic activity.[2]

PROCEDURES FOLLOWED

The discussion of procedures followed in conducting the research may be conveniently condensed into several categories including: the definition of the region, delineation of economic sectors, the data collection effort, selection of the base year, and data processing. Each is discussed, as briefly as possible, in the following pages.

DEFINITION OF THE REGION

The Powder River Basin region of eastern Wyoming, for purposes of this study, was defined as Campbell, Converse, Crook, Johnson, Natrona, Niobrara, Sheridan and Weston counties. This regional definition allows

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[2]The projections are consistent but the underlying assumption in the model of fixed production coefficients qualify the results unless some dynamic adjustment of technology is explicitly involved.

for an analysis of an area most immediately impacted by actual and
potential coal, oil and other mining development.

SECTOR DELINEATIONS

The interindustry model requires the separation of the economy into
various economic entities or "sectors." Total output, by interindustry
accounting procedures, is the aggregate value of all sales or purchases
that take place, i.e., the total sales or purchases during a year. This
total output must be divided up into sectors in order to assess the inter-
industry structural dependence that prevails. The model structures
economic activity into two major components, suppliers (or sellers) and
purchasers (or users). Each of these is further subdivided according to
the following scheme. Suppliers include: 1) intermediate or processing
suppliers who are producers who must purchase inputs to be processed into
output which they sell to final users or as inputs to other processors;
and 2) primary suppliers whose output is not directly dependent on pur-
chased inputs. This latter category includes non-local suppliers (or
imports). Purchasers include: 1) intermediate or processing purchasers
who buy the outputs of suppliers for use as inputs for further processing;
and 2) final purchasers who buy the outputs of suppliers in their final
form and for final use. This latter category includes purchases by non-
local users (or sales to exports). The level of demand by final pur-
chasers, and its composition, are determined outside the processing
sector. Production to meet the exogenously determined final demands
generates intermediate purchases and sales. Primary suppliers and final

purchasers may or may not be one and the same. However, in the inter-industry model, their activities are treated as if they were completely independent of one another.

In summary, the two major divisions of suppliers are the intermediate suppliers, which are called the processing sector, and the primary suppliers, which are referred to as the final payments sector. (The suppliers are conventionally shown along the left border of an interindustry table.) The two major divisions of the purchasers are the intermediate purchasers, which are labeled as the processing sector (just as with the intermediate suppliers) and the final purchasers which are labeled final demand. (The purchasers are conventionally shown along the top of an interindustry or input-output table.) It is within this general framework that a further sector disaggregation must be accomplished.

The ideal sector delineation would allow unique recognition of industries or producer groups which provide a homogenous good or service. This ideal is very difficult to achieve because of the large amounts of time and finances required for detailed disaggregation, disclosure problems, and lack of data. Any of these factors or a combination of them lead to a violation of the homogenous product ideal.[3]

Sector selection, in addition to dependence upon financing, time and data availability, is determined to a large extent by the objectives of the study. Research objectives can often be achieved without detailed

[3]Information obtained from the Wyoming Employment Security Commission cannot be published unless there are at least three firms in a given sector and no two firms account for more than 30 percent of the total employment. Ethical considerations also dictate that the operations of any single enterprise can never be divulged.

disaggregation in all sectors. Since the purpose here is largely to
determine the impacts of coal development and other sectors such as oil,
agriculture, and local government, economic sectors such as trade and
services do not require detailed disaggregation. The final delineation
of the sectoring plan adopted for this study is shown in Table 2-1. A
discussion of the two non-conventional accounting device sectors and how
they are used follows. These sectors are the local and county taxes ac-
count and the transfer account. There is also an explanation of the profit
and depreciation sectors.

The local and county government tax sector is employed as an
accounting device, including all building permit fees, franchise taxes,
local and county liquor license fees, charges for services, intergovern-
mental transfers, and fines and forfeitures. All revenues accruing to
local and county government entities are shown as being paid to this
account (sector). In turn the account distributes the tax monies to the
appropriate agencies.

Thus, the entries in the row for the local and county government
tax sector show the amounts of local taxes and other charges paid by each
respective sector in the Powder River Basin economy. In turn, the column
entries in the local tax account distribute monies for health, education,
social services, roads and bridges operation and maintenance, other
general government activities, and otherwise unallocated bond indenture
sinking funds.

Another accounting device employed in the Powder River Basin inter-
industry model is the transfer sector. This accounting device allows for

TABLE 2-1

SECTOR IDENTIFICATION
POWDER RIVER BASIN REGION OF EASTERN WYOMING, 1979

Sector Number	Sector Description	1972 SIC Codes
Processing Sectors		
1.	AG/LIVESTK	01, 02, 07, 08
2.	COAL-MINES	12
3.	MINES-NEC	10, 14 (excluding 144)
4.	OIL/GAS-PR	13
5.	CONSTR	144, 15, 16, 17
6.	ALL-MFG	20-39
7.	TRANS-COMM	40-48
8.	ELEC/GS-UT	491, 492, 493
9.	WHOLESALE	50, 51
10.	RETAIL	52-59
11.	FIN/INS/RE	60-67
12.	SERVICES (Other Services)	70-79, 81, 83-89
13.	MEDICAL	82
14.	SCHOOLS	80
15.	COLLEGES	80
16.	WAT/SAN	494, 495
17.	LOC-ROADS	
18.	LOC-GOV	91-97
19.	LOC-TAXES	
20.	HOUSEHOLDS	-

two unique and distinctive characteristics that are not usually found in other regional interindustry studies. First, the assumption that transfer payments cancel in the net is dropped. Second, the model handles financial balances in such a manner as to give rise to a definition of regional income more analogous to the definition of national income. There are several reasons for this. (The reader is referred to the gross flows in the appendix for the positioning of the transfer sector and the relative magnitudes of its row and column values.)

First, insurance premiums were divided so that a value equal to loss experiences was separated from other revenues. This value equal to loss experiences was then prorated among the various sectors in accordance with their premium payments and directly charged into the transfer row. Thus, the loss experience is not part of the total gross output of the insurance and real estate sector. The transfer column in turn is shown as making the claim payments to the various sectors, construction, retail trade, health medical care services, services N.E.C., households, and imports.

Second, the State of Wyoming generated revenues in the Powder River Basin region of eastern Wyoming that exceeded the value of the state's expenditures in the region. This final surplus is shown as an outlay by the state sector to the transfer account row. Similarly, the federal government generated a surplus in the tri-county region. The accounting for this was to have the federal government column charge the surplus to the transfer row. Thus, the federal government's financial surplus is removed from the region.

Second, transfer payments to households are handled through the transfer account.[4] Taxes collected in the region are always shown as being paid to the respective government accounts, i.e., local and county tax accounts, State of Wyoming, or federal government. Any intergovernmental transfer is shown as a sale by the recipient and a purchase by the grantor. In turn, the account that grants the transfer payment(s) to the household sector is shown as making a purchase from the transfer account row in the amount of the transfer payment(s). The transfer account column then makes the payment to the household account.

Third, financial capital finds its way into the tri-county region by means other than local financial institutions.[5] When interest payments are made on this outside finance, the dollars involved leave the region. To account for this, the total gross output of the regional financial institutions was increased so that all interest payments in the region could be shown as being made to the finance sector. The finance sector then charged the transfer row with the amount of the increase and the transfer column charged the same to the imports from Wyoming other than the tri-county region.

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[4] At the county and state levels these transfer payments are monies distributed for social services, to unemployment compensation insurance claims and pensions. Federal government transfer payments include bonus payments under the food stamp program, direct payments to households under the social security program, such as disability, retirement, and survivor benefits, railroad retirement benefits, black lung benefits, veterans and military pensions, federal employee retirement benefits, and medicare payments.

[5] An example would be the sale of bonds in an open market by a school district.

Fourth, interest paid by local financial institutions on savings accounts and certificates of deposit was charged against the transfer account row. The transfer account column distributed this interest to the profit and rents row entry.

The transfer account was used to close profits, interest, rents and the like into the household sector. To accomplish this, the transfer account column was given a credit at the intersection with the profit sector.

Finally, the transfer account row was used to export the region's net capital shortage, mineral research and development, and dividends paid to area residents by out-of-the-region firms.

Where enterprise accounting was employed, the profit sector includes after-tax profits, charges to reserves for bad debts, capital loss amortization, and outlays for rents and royalties.[6] Where government fund accounting was employed, the profit sector includes surplus of current revenues over current[7] expenditures[8], the value of capital expenditures appropriated out of current revenues, contributions to bond indenture sinking funds out of current revenues, net charges out of current revenues to any other reserve fund (e.g., contingency funds), and rent payments.

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[6]Except in the case where rents (e.g., agricultural land leases) and royalties (e.g., oil and gas) were paid to the Wyoming and federal governments. In these instances the amounts are shown as being paid directly to the respective governments.

[7]Current in the sense that they occurred in 1979.

[8]An exception to this is in the Wyoming and federal government sectors; see the explanation of the transfer sector.

The depreciation sector includes both depreciation and net inventory depletions. Inventory depletions are, relatively speaking, insignificant and are placed with depreciation charges. Similarly, the net inventory accumulation values were incorporated in the investment sector.

With the exception of the intersection of the household row and the transfer column and the household on household cell, the household row represents wages and salaries paid subject to withholding.

QUESTIONNAIRE DESIGN AND USE

Previous experience with questionnaires employed to obtain primary information for interindustry models suggested that a questionnaire, as such, should not be used in the pursuit of the primary data. The reason behind this is that no firm accounts for expenditure and revenue patterns on an SIC basis, the language ultimately employed in an interindustry model. Rather, a firm's books are designed around process or product activities. The use of a questionnaire, either by mail or by interview, presupposes adequate translation from a firm's accounting language into SIC codes. The typical entrepreneur or manager does not ordinarily work with SIC descriptions, a rather precise and technical language.

Accordingly, a determination was made to conduct all interviews in a basic accounting language tailored to the individual firms involved and for the researcher to make the translation to SIC classification. Thus, the questionnaire form which appears in the appendix represents the format for the final translation by the researcher. A large majority of the

primary data were originally collected in field notes that described the detail behind profit and loss statements for the firms interviewed.

Not all interviews could, however, be conducted as planned. It was found, for example, that some firms would have to refer for legal advice while others did not want to reveal information in the form desired. Even though it was established that the research should not solicit primary data through the mail, it was necessary to design a questionnaire for use both as an interview focal point and as an item that could be left with an interviewed firm.

The questionnaire was designed to fit three sheets of paper. A cover sheet was used to briefly explain the nature of the research and to solicit information on the nature of the firm's product lines, the number of employees, water use, and level of capacity utilization. Outlay patterns, both of a cash flow and a non-cash flow nature, were the concern of the second sheet; information on sales distribution was solicited on the third. Both sales and outlay patterns were disaggregated by Powder River Basin interindustry study sector descriptions and regionalized according to (a) Powder River Basin, (b) Wyoming other than the Powder River Basin region, and (c) activity outside Wyoming. A question on water use was included to provide information on sector-by-sector water withdrawals. The level of production capacity utilization question was used to provide general background information.

SELECTION OF THE BASE YEAR

There is no price index constructed specifically for Wyoming. This effectively removes one criterion (relatively stable prices) from consideration when selecting a base year for Wyoming economic studies. The 1979 base was selected for the initial survey for the following two reasons.

Interviewing for the Powder River Basin interindustry study began in September, 1980. Calendar 1979 was the most recently completed accounting cycle for most firms; it was anticipated that the information from this cycle would be, qualitatively speaking, foremost in the command of the interviewees. Also, activities of relatively new firms were automatically incorporated in the primary data base by soliciting what was then the most current information.

CONDUCT OF THE SURVEY

Interview schedules were arranged by telephone between three days and a week in advance. Every effort was made to gain an interview with the person who would have immediate authority to release information. The length of time spent on an individual interview varied from firm to firm. Several were conducted in less than an hour; some took place over several days. The survey process continued over a three-month period.

PROCESSING THE DATA

Information gathered on the outlay and sales patterns for any given enterprise was tabulated to conform to the sector delineations as defined in Table 2-1. Care was exercised at this step to assure a balance between outlays and sales. Any anomalies were checked and corrected before proceeding further.

The next step was to aggregate questionnaire forms within a sector and to expand the information to represent gross flows. An iterative process was used to accomplish this so that the relative composition of a given sector delineated for the Powder River Basin interindustry model would be more truly reflected.[9] The final iteration produced gross flow patterns for the respective sectors delineated in the model.[10] The gross flows identified in this manner provide the border totals for the initial transactions statement.

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[9]For example: There were three two-digit SIC classifications incorporated in the sector delineation for construction. Accordingly, the questionnaire forms were first aggregated on the basis of the two-digit categories. Regional payroll data from the Wyoming Employment Security Commission were then aggregated on the same basis. The payroll values on the aggregated questionnaire forms represented a given proportion of the regional payroll in each respective SIC classification; based on this ratio the information on the aggregated two-digit level questionnaire sheets was blown up to represent the total pattern for the two-digit delineation. Subsequently, the computed totals at the two-digit level were aggregated to represent the construction sector in the tri-county Wyoming interindustry model.

[10]The gross flow patterns were arrived at in either one of two ways. First there was a method that used payroll data (described in the preceding footnote) when an adequate total gross output value had not been identified. The second method distributed gross flows within the bounds of a total gross output value based on the relative allocation of the flows identified on initially aggregated questionnaire forms.

Reconciling discrepancies in any given transaction cell is to be expected; only if the research yielded perfect knowledge about outlays and sales would this be avoided. A discrepancy can emanate from one of several sources or a combination thereof. The sales or purchases of one industry to or from another industry can be misrepresented, or the total gross output value for individual sectors can be in error. In the former case other rows and columns are affected by the error. In the latter, there is an aggregate distribution error in both outlays and sales for the sector. Each discrepancy is examined individually and reconciled on a case-by-case basis. Fortunately, the sources of relatively large discrepancies could be isolated and remedied through additional examination. Small discrepancies were reconciled by using imports from and exports to the world other than Wyoming as residual accounts.

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Retail Trade   SIC 52, 53, 54, 55, 56, 57, 58, 59

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CHAPTER 3

ANALYSIS OF THE POWDER RIVER BASIN
REGION OF EASTERN WYOMING

INTRODUCTION

The results of the descriptive analysis of the Powder River Basin
region's economy are presented in this chapter. The discussion contained
in the chapter includes: the description of the economy; an analysis of
the nature and magnitude of economic interdependence among processing
sectors; the various business activity and income multipliers; and an
analysis of employment in the region.

The description and analysis of the economy hinges on three major
components of the interindustry model. These are: the gross flows or
transactions table; the table of direct production requirements; and the
table of direct plus indirect production requirements. These tables are
discussed and interpreted in turn. Because of the size of the tables,
they are presented in the appendix.

THE TRANSACTION TABLE

The first essential component of any interindustry study is the
collection and tabulation of data which serve to describe the flows of
commodities from each supplying sector to each purchasing sector. These
flows are typically expressed in terms of the dollar value of transactions
occurring in a specific period of time, normally one year. The information
is arrayed in tabular form with the suppliers (selling sectors) listed at

the top. The information in this table, termed the transactions table, does two things simultaneously: it identifies the estimated dollar value of sales by each sector to each of the other sectors (thus, the distribution of each sector's output), and it identifies the purchases of ingredients of production by each sector from each of the other sectors (the distribution of purchases). In essence, the material contained in the transactions table represents a double-entry system of bookkeeping in which every sale is simultaneously described as a purchase. Thus, the system deliberately double counts. The transactions table for the Powder River Basin economy is found in the appendix. A description of the sector identification labels used throughout the appendix and in the tables of this chapter is also shown in the appendix.

The rows and columns of Table B-1 which are numbered 1-19 identify the processing, or intermediate demand, sectors. Row and Column 20 represent subtotals of activities within the processing sector. This portion of the table describes, in dollar terms, the flow of goods and services necessary to satisfy intermediate demands. Final demands, i.e., demands for goods and services that will not be further processed within the region, are identified in Columns 21-24 and 26-28. Rows 21-24 and 26-29 identify the final payments sector. Final payments include, then, federal and state taxes, wages, profits, rents, losses, net inventory depletions, and payments for goods and services imported from outside the region. The rows and columns numbered 19 and 25 (the local and county government tax account and the transfer account) are accounting devices as described previously. The last row and column of Table B-1 contain, respectively, total outlay (purchases) and total output (sales) for each sector of the regional economy.

The distribution of total output of each sector, according to the sectors in which the output is sold, may be readily discerned by reading across the rows of Table B-1. The bill of purchases by each sector is found by reading down any column of the table. These column entries show the allocation of purchases by cost component.

For example, consider Sector 2, COAL-MINES. Reading across Row 2 of Table B-1 shows that the total output of COAL-MINES was distributed in the following way. $2,066,017 worth of output was sold to MINES-NEC; $32,348 to CONSTR; $42,573 to ALL-MFG; $38,331,242 to ELEC/GS-UT; $45,777 to RETAIL; $69,593 to HOUSEHOLDS and $353,729,112 to EXP-WORLD. Total sales by COAL-MINES to the local processing part of the economy was $40,517,957. Total sales including final demand amounted to $394,316,664.

The distribution of purchases by COAL-MINES by cost category are shown in Column 2 of Table B-1. Purchases by COAL-MINES from CONSTR were estimated at $9,716,933; from ALL-MFG at $1,571,757; from TRANS-COMM at $1,199,901; and so on, down the column. Total purchases by COAL-MINES from the local processing sector amounted to $44,236,215. When purchases from final payments are included, total purchases by COAL-MINES amount to $394,316,664. Total purchases, as required by the accounting format, equal the value of output.

Other information can be obtained directly from the transactions table. The household row, with the exception of the sale by households to the transfer account represents wages paid subject to withholding. This row shows household income. The ten leading contributors to household income in descending order are: OIL/GAS-PR, CONSTR, RETAIL, WHOLESALE, SERVICES, TRANS-COMM, COAL-MINES, MINES-NEC, SCHOOLS, and ALL-MFG. Similarly, sector by sector contributions to taxes may be directly obtained

from Table B-1. The ten sectors showing the greatest dollar outlay for local and county taxes in descending order are: OIL/GAS-PR, COAL-MINES, HOUSEHOLDS, ELEC/GS-UT, AG-LIVESTK, TRANS-COMM, WHOLESALE, RETAIL, MINES-NEC, and ALL-MFG.

Estimates of gross regional income and gross regional product may be obtained from the final payments and final demands portion of the table. Gross regional product is defined as the sum of deliveries to final demand, net of imports. Traditionally, local and county government activities are included as part of final demand. Because this model treats these accounts as part of the processing sector, an adjustment is required. Also, the transfer and tax accounts cannot be counted in final demand, for to do so would be double counting. Thus, the sum of SCHOOLS, COLLEGES, WAT/SAN, LOC-ROADS, LOC-GOV, HOUSEHOLDS, STATE-ROAD, STATE-GOV, FED-GOV, INVESTMENT, EXP-WYOM, and EXP-WORLD, less IMP-WYOM and IMP-WORLD, yields the estimated gross regional product of $5,427,248,311. Gross regional income (which must equal gross regional product) is computed as the sum of final payments less imports. Again, the local and county tax account and the transfer account must be excluded to avoid double counting.

While these items, obtained directly from the transactions table, are used as initial indicators of the relative importance of each sector in the regional economy, the important question of interdependence is not addressed. In order to do so, it is first necessary to isolate the direct relationships existing in the economy.

DIRECT PRODUCTION REQUIREMENTS

The direct production requirements, or coefficients, represent the second major component of the interindustry analysis. These direct

requirements are presented in the appendix. Computation of the direct production requirements is quite simple, given the transactions table, and requires only that each column entry of the transactions table be divided by the respective column total. The resulting coefficients describe the direct purchases necessary from each supplier (at the left of the the table) in order for the purchasing sector (at the head of the column) to produce one dollar's worth of output. The coefficients, then, are interpreted as the direct requirements per dollar of output produced by each sector.

As an example consider the COAL-MINES sector, Sector 2 (Column 2 of the direct requirements table). For every dollar's worth of output produced by COAL-MINES in the region, $.024642 worth of inputs are required from the CONSTR sector; $.003986 from ALL-MFG; $.003043 from TRANS-COMM; and so forth down the column.

It is clear from the table that the largest direct purchase made by the COAL-MINES sector is for IMPORTS with a direct outlay of over 28 cents per each dollar of output produced. This says that a dollar's worth of production by COAL-MINES requires imports valued at 28 cents. The largest local purchase by COAL-MINES is for labor input. About 14 cents out of each dollar is spent for labor. Each column of Table B-2 is interpreted in this manner.

These direct impacts identify only a portion of the total economic impacts that would accompany a change in final demands for the output of a given sector. There are additional, or indirect, impacts which can be quite important. Assessment of all direct and indirect impacts of these exogenous (final demand) changes is made possible through the third analytical component of interindustry analysis. This component is the table of direct plus indirect production requirements.

DIRECT PLUS INDIRECT IMPACTS

The concept of interdependence can be established with a brief example. Suppose that the export demand for coal production increases. There will be immediate, or direct, responses of the following type: coal production will have to increase. In order for coal production to increase, inputs must be obtained from sectors such as transportation, utilities for power and labor. These are direct impacts. As transportation and utilities increase their output to meet the increasing requirements in the coal sector, their own requirements for productive ingredients increase, e.g., services, labor, petroleum and natural gas and coal. The chain of events goes on. The total impacts are readily estimated through the input-output framework and are presented in the appendix, in Tables B-3 and B-4.

Before proceeding to a discussion of the table, a few comments regarding the treatment of households are in order. Households may be treated as either a part of the processing sector of the economy or as a part of the final demand component. In the first instance, households are treated in precisely the same manner as any other production sector. The estimate of the direct and indirect production impacts of a change in final demand includes the induced production impacts which derive from increased household incomes and increased consumption. In the latter, with households a component in final demand, the induced impacts of successive rounds of consumer spending are omitted. For purposes of this report, the discussion of economic interdependencies and the subsequent business and income multiplier analysis is based upon models which

include households both as a member of the processing sector of the economy and as a final demand sector.

The direct plus indirect coefficients are interpreted as the production required or generated in all sectors of the economy in order to sustain the delivery of one dollar's worth of output to final demand by any single sector. It should be carefully noted that these coefficients reflect production generated per dollar of final demand as opposed to requirements per dollar of output. This, of course, reflects the fact that the model is driven by changes in final demand.

For purposes of interpretation, consider the COAL-MINES sector. Suppose that the export demand for mined coal increased by $1 million. What is the estimated impact that this increase will have on the entire Powder River Basin region of the eastern Wyoming economy? The answer to this question may be obtained directly by reading down Column 2 of the table and summing the individual sector impacts. Thus, the increase of $1 million in the final demand for coal generates a direct plus indirect production valued at $800 in AG/LIVESTK; $1,006,300 in COAL-MINES; $10,900 in OIL/GAS-PR; $31,500 in CONSTR; and so on down the column. Any column of this table is interpreted in this same manner. The sum of the entries in Column 2 shows the total production generated locally as a result of the increase in export demands for COAL-MINES. Thus, the total business activity generated per dollar increase in final demand for coal is 1.51, or, in our example assuming a $1 million increase, 1.51 million worth of business activity results. These column sums are one of the various multiplier concepts which are derived from input-output analysis.

BUSINESS MULTIPLIERS

The column sums of the direct plus indirect requirements table are termed business activity (or production) multipliers. They identify the total value of production in the region which results from a dollar's worth of output delivered to final demand. Table 3-1 presents the business multipliers. These estimates indicate that the greatest business activity generated per dollar of delivery to final demand is by the LOC-TAXES sector. The business multiplier for this sector is 2.97 which indicates that, as the "final demand" for local government services increases by $1, a total production of $2.97 is generated in the local economy. Other sectors of the economy which have relatively large business multipliers are: RETAIL, COLLEGES, ELEC/GS-UT, LOC-ROADS, SCHOOLS, WHOLESALE and SERVICES. These sectors show the greatest degree of interdependence with other sectors of the regional economy. At the margin, these sectors generate the greatest business activity per dollar of output delivered to final demand. The phrase, "at the margin," is important as a qualification in the use of these multipliers. It implies a word of caution concerning the implications of the multipliers. In using the business multipliers, the argument should be stated in terms of the impacts of an equal dollar increase in final demands, local taxes will generate more business activity in the local economy than will any other private sector. However, a large exogenous increase in local government services is less likely to occur than is a large increase in coal export (which indirectly changes local tax collections). The first column of Table 3-1 shows the business multipliers with households in final demand; the second column shows the business multipliers with households endogenous (part of the processing sector).

TABLE 3-1

BUSINESS ACTIVITY MULTIPLIERS, POWDER RIVER BASIN
REGION OF EASTERN WYOMING, BY SECTOR, 1979

(In dollars of business activity generated in the Powder River Basin
region of Eastern Wyoming per dollar of output delivered to final demand.)

	SECTOR	BUSINESS MULTIPLIERS	
		TYPE I	TYPE II
1.	AG/LIVESTK	1.49	1.79
2.	COAL-MINES	1.20	1.51
3.	MINES-NEC	1.15	1.41
4.	OIL/GAS-PR	1.33	1.62
5.	CONSTR	1.30	1.88
6.	ALL-MFG	1.58	1.78
7.	TRANS-COMM	1.28	1.87
8.	ELEC/GS-UT	1.79	2.17
9.	WHOLESALE	1.33	2.11
10.	RETAIL	1.24	2.37
11.	FIN/INS/RE	1.08	1.39
12.	SERVICES	1.16	1.99
13.	MEDICAL	1.15	1.90
14.	SCHOOLS	1.24	2.11
15.	COLLEGES	1.17	2.22
16.	WAT/SAN	1.24	1.51
17.	LOC-ROADS	1.40	2.12
18.	LOC-GOV	1.27	1.88
19.	LOC-TAXES	2.26	2.99
20.	HOUSEHOLDS	----	1.78

INCOME MULTIPLIERS

Other multiplier effects can also be estimated from the interindustry model. For example, there are income multipliers which relate to changes in income paid to the household sector. The following discussion concerns the Type I and Type II income multipliers which are shown in Table 3-2.

The Type I and Type II income multipliers are estimated ratios: Type I is the ratio of the direct plus indirect income to the direct income paid households; Type II is the ratio of direct plus indirect plus induced income to direct income. Thus, while the business activity multipliers are related to changes in sales to final demand, the income multipliers are related to changes in income paid to the household sector. The Type I multiplier describes the direct plus indirect income increases emanating from an additional dollar of direct income paid to households. The Type II multiplier takes into account not only the direct plus indirect changes in income, but also the induced income increases generated by additional consumer spending. Accordingly, the Type II income multiplier identifies the direct plus indirect plus induced income generated by an additional dollar of income paid directly to households.

Attention is drawn to the comparatively higher income multiplier value estimates for the agricultural sector. The reason for this relatively high value is straightforward. The Powder River Basin interindustry study allocated proprietorship and partnership net incomes to the profit account. As a result, labor inputs (household account) for agriculture and livestock, are somewhat understated because this sector is characterized by a relatively high incidence of proprietorship and partnership enterprises with relatively little hired help. By understating the value (contribution) of labor inputs

TABLE 3-2

INCOME MULTIPLIERS, POWDER RIVER BASIN
REGION OF EASTERN WYOMING, BY SECTOR, 1979

(In dollars of income generated per dollar of direct income paid households)

	SECTOR	INCOME MULTIPLIERS	
		TYPE I	TYPE II
1.	AG/LIVESTK	2.3824	2.8176
2.	COAL-MINES	1.2872	1.5224
3.	MINES-NEC	1.3017	1.5395
4.	OIL/GAS-PR	1.4541	1.7197
5.	CONSTR	1.3091	1.5483
6.	ALL-MFG	2.8007	3.3123
7.	TRANS-COMM	1.1850	1.4015
8.	ELEC/GAS-UT	2.1057	2.4903
9.	WHOLESALE	1.1993	1.4184
10.	RETAIL	1.0977	1.2982
11.	FIN/INS/RE	1.1196	1.3241
12.	SERVICES	1.0874	1.2860
13.	MEDICAL	1.1106	1.3135
14.	SCHOOLS	1.1024	1.3038
15.	COLLEGES	1.0694	1.2647
16.	WAT/SAN	1.7023	2.0132
17.	LOC-ROADS	1.3227	1.5643
18.	LOC-GOV	1.3010	1.5387

for this sector, the value (contribution) of other inputs, relative to labor, became larger. And, with direct income being the denominator of the Type I and Type II income multiplier ratios, the multiplier estimate for this sector is of the relatively high magnitude observed. By contrast, the relatively high multiplier values for the ALL-MFG, ELEC/GS-UT, and WAT/SAN sectors exist because these sectors exhibit greater interdependence in the Powder River Basin economy.

EMPLOYMENT ANALYSIS

Direct employment requirements as is the case with direct business activity and direct income payments are, by themselves, of limited use for assessing the impacts of various changes in economic activity in the Powder River Basin region. This limitation arises because direct require-ments differ from total requirements, the difference being indirect requirements that emanate from sectoral interdependence. The interindustry model provides a framework within which both direct and indirect employment requirements can be addressed. Basic to the analysis are data on employment levels in the respective sectors and the table of direct plus indirect requirements per dollar of output delivered to final demand.

Before proceeding with the analysis some discussion on the table of direct and indirect requirements per dollar of delivery to final demand is warranted. When the household sector is included as a processing sector in the interindustry model it becomes simply another producer. To treat households in this manner is consistent within the interindustry framework, but it imposes a critical assumption on household purchase patterns. Specifically, household purchases are expressed as a linear function of income; the marginal and the average propensities to consume are assumed

to be one and the same. To change this limiting assumption, the household sector must be treated as a part of final demand.

Treating the household sector in this manner removes the assumption that household purchases are a linear function of income. Specifically, because the interindustry model is a final demand driven model, treating the household sector as any other producing sector implies the level of employment was dependent only on the level of state and federal government expenditures, investment expenditures, inventory accumulation, and exports. By treating households exogenously, this assumption is expanded to include a dependency on the level of household expenditures. Direct and indirect requirements per dollar of delivery to final demand, which are used in the employment analysis for the Powder River Basin region of eastern Wyoming are shown in the appendix. The estimated employment levels and corresponding employment coefficients (expressed as the number of employees per dollar of total gross output) used in the analysis are presented in Table 3-3.

To assess the total employment impacts of exogenous changes in final demand, the respective tables of direct and indirect requirements per dollar of delivery to final demand, was pre-multiplied by a diagonal matrix of direct labor use requirements (where the elements of the diagonal were the employment coefficients shown in Table 3-3). Summing down the respective columns of the resulting matrix yielded the estimates of the direct and indirect labor requirements per dollar delivered to final demand. Table 3-4 presents the estimates.

The interpretation of the entries in Table 3-4 is demonstrated by an example from the COAL-MINES sector. As the final demand for the output of coal expands by $1, there will be a direct expansion of employment in that sector as well as those sectors responsible for supplying production

TABLE 3-3

TOTAL EMPLOYMENT AND EMPLOYMENT COEFFICIENTS,
POWDER RIVER BASIN REGION OF EASTERN WYOMING, BY SECTOR, 1979

(In number of workers in the Powder River Basin region of eastern Wyoming
and workers per thousand dollars of output.)

	Sector	Total Employment	Workers Per Thousand $ Total Output
1.	AG/LIVESTK	635	.00324
2.	COAL-MINES	2,195	.00557
3.	MINES-NEC	2,831	.00583
4.	OIL/GAS-PR	9,195	.00499
5.	CONSTR	9,159	.01526
6.	ALL-MFG	3,174	.00243
7.	TRANS-COMM	3,563	.01352
8.	ELEC/GS-UT	897	.00487
9.	WHOLESALE	4,792	.02073
10.	RETAIL	12,220	.06587
11.	FIN/INS/RE	2,672	.01177
12.	SERVICES	7,563	.04207
13.	MEDICAL	2,794	.02611
14.	SCHOOLS	3,589	.02935
15.	COLLEGES	696	.06938
16.	WAT/SAN	193	.00559
17.	LOC-ROADS	430	.02911
18.	LOC-GOV	1,376	.02005

TABLE 3-4

DIRECT PLUS INDIRECT LABOR REQUIREMENTS PER THOUSAND DOLLARS
OF OUTPUT DELIVERED TO FINAL DEMAND AND PER ADDED WORKER HIRED,
POWDER RIVER BASIN REGION OF EASTERN WYOMING, BY SECTOR, 1979

Sector	Direct + Indirect Labor Requirement Per Thousand Dollars of Final Demand		Direct + Indirect Labor Requirement Per Added Worker	
	TYPE I	TYPE II	TYPE I	TYPE II
1. AG/LIVESTK	.01024	.01296	3.16	4.00
2. COAL-MINES	.00834	.01122	1.50	2.01
3. MINES-NES	.00823	.01056	1.41	1.81
4. OIL/GAS-PR	.00812	.01076	1.63	2.16
5. CONSTR	.02053	.02581	1.35	1.69
6. ALL-MFG	.00623	.00808	2.56	3.33
7. TRANS-COMM	.01687	.02220	1.25	1.64
8. ELEC/GS-UT	.01090	.01433	2.24	2.94
9. WHOLESALE	.02646	.03350	1.28	1.62
10. RETAIL	.06986	.08008	1.06	1.22
11. FIN/INS/RE	.01314	.01597	1.12	1.36
12. SERVICES	.04488	.05232	1.07	1.24
13. MEDICAL	.02894	.03577	1.11	1.37
14. SCHOOLS	.03211	.03996	1.09	1.36
15. COLLEGES	.07212	.08170	1.04	1.18
16. WAT/SAN	.01101	.01347	1.97	2.41
17. LOC-ROADS	.03547	.04206	1.22	1.44
18. LOC-GOV	.02627	.03174	1.31	1.58

ingredients to the coal mining sector. The sectors supplying ingredients to the coal mining sector will in turn require production ingredients from others and this will further expand indirect employment impacts; and so forth. The magnitude of the direct and indirect employment impacts, .01122, shows the total employment generated in the entire Powder River Basin economy as this single sector, coal mining, increases by $1,000, its deliveries to final demand. That is to say that an increase of $1 million in the final demands, e.g., exports to other parts of Wyoming or out of state, for coal would result in an estimated additional employment of 11.2 persons in the Powder River Basin region. All remaining entries in Table 3-4 have analogous interpretations for their respective sectors. Thus, the leading sectors in terms of direct and indirect employment generation in the region's economy are: COLLEGES, RETAIL, SERVICES, LOC-ROADS, and SCHOOLS. Table 3-4 also shows the total employment impact of exogenous changes in workers hired. This information is found simply by dividing the direct plus indirect labor requirements per thousand dollars of final demand (in Table 3-4) by the workers per thousand dollars of final demand shown in Table 3-3. The workers added per worker hired column shows that for each worker hired by coal mining, 2.01 workers are hired throughout the Powder River Basin's economy. Thus, the multiplier for exogenous changes in coal mine employment is 2.01.

CHAPTER 4

EXTENSIONS OF THE BASIS ANALYSIS:
REGIONAL WATER REQUIREMENTS

INTRODUCTION

The previous chapter presented what may be appropriately called the results of traditional applications of the Leontief interindustry model. In addition to the descriptive analysis and the attendant development of various multipliers, application of the model can be extended to other questions. The I-O technique, because of the detailed analysis of interdependence among economic sectors, is readily adaptable to an examination of resource use associated with economic activity in the region. This chapter is concerned with an analysis of water withdrawal and consumptive use in the eastern Wyoming regional economy. Other resource impacts, e.g., water and air quality impacts, land use, and growth of various types of energy consumption, could also be studied, providing adequate data are available.

WATER USE ANALYSIS

The water use analysis requires data pertaining to water withdrawals and consumptive use on a sector-by-sector basis. It is further required that these data be related to economic activity on a per dollar sales basis. These data, particularly for consumptive use, are difficult to obtain on a sector-by-sector basis and for a rather small regional economy.

Water use by commercial establishments is very small relative to
agriculture, the extractive industries, electricity generation, and
manufacturing. Little detailed information is available from secondary
sources for the commercial sectors and, thus, most coefficients are based
upon results from our Wyoming survey and past surveys and Water Resources
Council[1] estimates. The Water Resources Council Report provides no detail
among commercial establishments. WRC data were also at variance with other
data in the agricultural and manufacturing sectors. The primary data
source for the agricultural sector was the Census of Agriculture.[2] The
withdrawal rate per dollar of output estimated from Census data was almost
twice the size of the rate estimated from Water Resources Council data.
Because of the indirect procedure required to convert the secondary data
to a useful form for the input-output analysis, the exact source of the
discrepancy is not easily traced. Water use estimates for the extractive
sectors are based mainly upon the Census of Mineral Industries.[3] Unfortunately,

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[1]The Nation's Water Resources, 1975-2000, Vol. 3: Analytical Data
Appendix II, Annual Water Supply and Use Analysis, Table II-4, Annual
Water Requirements for Offstream Uses, Base Conditions, No/So Platte
Region, Subregion 1007, Dec. 1978; and as above, Analytical Data Appendix
I, Social, Economic and Environmental Data, and Table I-2, Earnings by
Major Sectors, No/So Platte Region, Subregion 1007, December 1978, Second
National Water Assessment by the U. S. Water Resources Council.

[2]1974 Census of Agriculture, Vol. I, Part 50, Wyoming, State and
County Data, U. S. Department of Commerce, Bureau of the Census, Table 3,
page IV-8; Table 13, page IV-12; Table 3, page IV-26, Table 13, page IV-30;
Table 3, page IV-116, Table 13, page IV-120.

[3]1972 Census of Mineral Industries, Subject Series, Water Use in
Mineral Industries, MIC72(1)-2, September 1975, Table 2B, Gross Water Used
and Water Intake, By Source and Kind, for Geographic Areas and Major
Industry Groups and as above, Table 2C, Gross Water Used and Water Intake,
By Source and Kind, for Water Use Regions and Major Industry Groups; and
as above, Table IC, Selected Water Use Statistics for Water Use Regions:
1972; September 1975.

disclosure problems limit the available data to rather large regions in some cases. Withdrawal and consumptive use figures vary considerably among regions and their accuracy for a relatively small region is questionable. Water use in manufacturing is taken from the Census of Manufacturers.[4] In a few cases, disclosure prevents the use of regional water data. However, the magnitude of the error involved in the computation of the weighted average coefficients for the region is probably quite small.

Estimates of withdrawal and consumptive use rates by sector are shown in Table 4-1. Where more than one data source is available, generally, the larger values are shown. In most cases, the larger numbers are derived from the source which is considered to be more authoritative for the region.

Table 4-2 presents the estimated withdrawals and consumptive use for each of the processing sectors of the regional economy in millions of gallons. Oil and Gas Production, Ag/Livestock and Mines N.E.C. account for over 95.9 percent of withdrawals and over 98.6 percent of consumptive use in the region.

Estimates of total withdrawal and total consumptive use of water are useful from a purely descriptive point of view. However, the model allows also the analysis of direct and indirect water use which parallels the previous discussion of direct and indirect production. The purpose of such analysis is to isolate the effect of economic interdependence on water requirements. The specific question to be addressed is that of determining the likely impact of expanding final demand in any or all processing

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[4]1972 Census of Manufacturers, Water Use in Manufacturing, Special Report Series, September 1975, Table 2C, Gross Water Used and Water Intake, by Source and Kind, For Water Use Regions and Major Industry Groups: 1973; and as above, Table 5C, Gross Water Used Including Recirculated, Total Water Intake, and Treated and Untreated Water Discharged, By Point of Discharge, For Water Use Regions and Major Industry Groups: 1973.

sectors on the regional water requirements. The key element in the assessment is the derivation of the direct plus indirect water requirements per dollar of output delivered to final demand.

The calculation of water multipliers is not difficult once the direct water requirements and the table of direct plus indirect production requirements have been obtained. The matrix of direct and indirect production coefficients is premultiplied by a diagonal matrix consisting of the direct water requirements along the diagonal and zeros elsewhere. The columns of the resulting matrix are summed in order to obtain the direct plus indirect water requirements per dollar of output delivered to final demand by each sector. These requirements for the Powder River Basin economy are shown in Table 4-3. The importance of considering indirect as well as direct water requirements in the planning perspective can be readily seen by comparing Table 4-1 and Table 4-3. Consider, for example, the direct withdrawal and consumptive use requirements for COAL-MINES in Table 4-1. The direct requirements are 15.5 and 1.02 gallons for each dollar of output. However, as the final demand for output of the coal sector expands by one dollar, there is a total direct plus indirect water requirement of 37 gallons (withdrawal) and 8 gallons (consumptive) generated throughout the economy. The indirect impacts, because of the significant interdependence within and between coal and other sectors, are far more important than the direct requirements. Applying only the direct water requirements to assumed increases in deliveries to final demand can obviously result in the understatement of water use.

TABLE 4-1

ESTIMATED WITHDRAWAL AND CONSUMPTIVE USE REQUIREMENTS BY SECTOR,
POWDER RIVER BASIN REGION OF EASTERN WYOMING

(In Gallons Per Dollar of Output)

Sector	Withdrawal	Consumptive Use
1. AG/LIVESTOCK	1,550[5]	609[6]
2. COAL-MINES	15.5[3]	1.02[4]
3. MINES-NEC	306.1[3]	30.6[4]
4. OIL/GAS-PR	1,031[3]	529.2[4]
5. CONSTR	.4[6]	.4[6]
6. ALL-MFG	27.6[2]	8.9[2]
7. TRANS-COMM	2.1[6]	.1[6]
8. ELEC/GS-UT	26.7[6]	13.6[4]
9. WHOLESALE	2.3[6]	.6[6]
10. RETAIL	3.9[6]	1.0[4]
11. FIN/INS/RE	4.9[6]	1.2[4]
12. SERVICES	3.5[6]	.9[4]
13. MEDICAL	5.1[6]	1.3[4]
14. SCHOOLS	1.5[6]	.4[4]
15. COLLEGES	1.5[6]	.4[4]
16. WAT/SAN	0	0
17. LOC-ROADS	0	0
18. LOC-GOV	1.0	.1
19. LOC-TAXES	0	0
20. HOUSEHOLDS	3.2	.32
21. STATE-ROAD	0	0
22. STATE-GOV	1.0	.1
23. FED-GOV	1.0	.1

[1]Water Resources Council, based on ratio of withdrawal to wages and profits.

[2]Census of Water Use in Manufacturing, ratio of withdrawal or consumptive use to value of shipments.

[3]Census of Mineral Industries, ratio of withdrawal to value of shipments.

[4]Water Resources Council, ratio of consumption to withdrawal.

[5]Census of Agriculture, ratio of consumptive use to value of shipments.

[6]Survey data or estimated on per capita basis.

TABLE 4-2

TOTAL WATER USE BY SECTOR,
POWDER RIVER BASIN REGION OF EASTERN WYOMING, 1979
(In Millions of Gallons)

Sector	Withdrawal	Consumptive Use
1. AG/LIVESTK	303,800	119,300
2. COAL-MINES	6,112	402
3. MINES-NEC	148,800	14,870
4. OIL/GAS-PR	1,897,000	973,500
5. CONSTR	240	240
6. ALL-MFG.	36,000	11,610
7. TRANS-COMM	554	26
8. ELEC/GS-UT	49,150	2,504
9. WHOLESALE	532	139
10. RETAIL	724	186
11. FIN/INS/RE	1,112	272
12. SERVICES	629	162
13. MEDICAL	546	139
14. SCHOOLS	183	49
15. COLLEGES	15	4
16. WAT/SAN	0	0
17. LOC-ROADS	0	0
18. LOC-GOV	69	7
19. LOC-TAXES	0	0
20. HOUSEHOLDS	4,035	404
21. STATE-ROAD	0	0
22. STATE-GOV	76	8
23. FED-GOV	254	25

TABLE 4-3

DIRECT PLUS INDIRECT WATER REQUIREMENTS,
POWDER RIVER BASIN REGION OF EASTERN WYOMING, 1978
(In Gallons Per Dollar of Output Delivered to Final Demand)

	Sector	Withdrawal	Consumptive Use
1.	AG/LIVESTK	1617	635
2.	COAL-MINES	37	8
3.	MINES-NEC	355	52
4.	OIL/GAS-PR	1164	591
5.	CONSTR	32	14
6.	ALL-MFG	497	243
7.	TRANS-COMM	53	20
8.	ELEC/GS-UT	532	131
9.	WHOLESALE	58	23
10.	RETAIL	49	18
11.	FIN/INS/RE	17	5
12.	SERVICES	44	16
13.	MEDICAL	31	10
14.	SCHOOLS	53	16
15.	COLLEGES	41	14
16.	WAT/SAN	16	5
17.	LOC-ROADS	47	18
18.	LOC-GOV	27	9
19.	LOC-TAXES	41	13
20.	HOUSEHOLDS	44	16

APPENDICES

APPENDICES

APPENDIX A

SECTOR IDENTIFICATION,
POWDER RIVER BASIN REGION OF EASTERN WYOMING

Sector	1972 SIC Codes
1. AG/LIVESTK	01, 02, 07, 08
2. COAL-MINES	12
3. MINES-NEC	10, 14 (excluding 144)
4. OIL/GAS-PR	13
5. CONSTR	144, 15, 16, 17
6. ALL-MFG	20-39
7. TRANS-COMM	40-48
8. ELEC/GAS-UT	491, 192, 493
9. WHOLESALE	50, 51
10. RETAIL	52-59
11. FIN/INS/RE	60-67
12. SERVICES	70-79, 81, 83-89
13. MEDICAL	82
14. SCHOOLS	80
15. COLLEGES	80
16. WAT/SAN	494, 495
17. LOC-ROADS	
18. LOC-GOV	91-97
19. LOC-TAXES	
20. HOUSEHOLDS	--
21. STATE-ROAD	
22. STATE-GOV	
23. FED-GOV	
24. TRANSFERS	
25. PROFITS	
26. DEPREC	
27. IMP-WYOM	
28. IMP-WORLD	

APPENDIX B

INPUT-OUTPUT TABLES FOR THE
POWDER RIVER BASIN REGION OF EASTERN WYOMING, 1979

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TABLE B-1

POWDER RIVER BASIN REGION OF EASTERN WYOMING, TRANSACTIONS TABLE, 1979 DOLLARS

NAME OF I-O MODEL IS: POWDER RIVER BASIN REGION

TRANSACTIONS AMONG SECTORS (purchases by sectors shown at top from sectors shown at left...last rows are resource inputs)

DOLLARS

		1 AG/LIVESTK	2 COAL-MINES	3 MINES-NEC	4 OIL/GAS-PR	5 CONSTR	6 ALL-MFG	7 TRANS-COMM	8 ELEC/GS-UT	9 WHOLESALE	10 RETAIL
1	AG/LIVESTK	4367010.	0.	462207.	0.	0.	3832928.	0.	0.	334360.	8992.
2	COAL-MINES	0.	0.	2066017.	0.	32348.	42573.	0.	38331242.	0.	45777.
3	MINES-NEC	56640.	0.	5943962.	0.	0.	150417.	0.	0.	0.	0.
4	OIL/GAS-PR	0.	0.	12428285.	156731732.	0.	503406540.	1044619.	31084484.	0.	0.
5	CONSTR	109480.	9716933.	0.	26508676.	60479211.	6007955.	168224.	159408.	1414125.	1386071.
6	ALL-MFG	4581090.	1571757.	2316528.	28120493.	14267670.	1858231.	8882254.	209138.	11605434.	2653457.
7	TRANS-COMM	1231440.	1199901.	7313729.	8601984.	2214287.	3003860.	11306307.	842007.	4324517.	10619827.
8	ELEC/GS-UT	2380990.	7340903.	2856915.	64314097.	878921.	29795885.	6196510.	18238853.	2407012.	2288543.
9	WHOLESALE	12131265.	2070890.	8449406.	15785214.	31428750.	2435475.	3478741.	28164.	4125158.	789522.
10	RETAIL	812537.	1109661.	5449137.	1878504.	1392020.	904544.	851210.	147929.	2523079.	509920.
11	FIN/INS/RE	35226763.	567642.	895950.	15317353.	12563085.	2755714.	9556685.	89264.	10698396.	4299220.
12	SERVICES	4861090.	3045597.	3135681.	11079422.	14213949.	1843700.	1440142.	155459.	11713847.	5993238.
13	MEDICAL	0.	316813.	0.	48604.	0.	64510.	0.	0.	0.	124251.
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	COLLEGES	2790.	61693.	120080.	42592.	372577.	11445.	256658.	0.	158204.	50191.
16	WAT/SAN	206010.	101878.	13813.	85240.	107074.	460463.	144705.	11403.	419630.	223570.
17	LOC-ROADS	0.	0.	0.	0.	126149.	0.	0.	0.	158204.	0.
18	LOC-GOV	0.	0.	0.	1201638.	210708.	167580.	745088.	103876.	364936.	294197.
19	LOC-TAXES	6534730.	17132547.	2060886.	56990546.	620473.	1652155.	6049850.	10281874.	4755140.	3152742.
20	SUBTOTALS	72501835.	44236215.	53512596.	386706104.	138907226.	558393984.	50120993.	99683101.	55002042.	32439518.
21	HOUSEHOLDS	13867890.	54467379.	54001581.	206412486.	149751010.	53385760.	73576589.	18608932.	84149922.	107090070.
22	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23	STATE-GOV	736260.	34651383.	2343382.	41810117.	3686155.	1378365.	2900249.	767500.	4525541.	1539096.
24	FED-GOV	2776240.	49733599.	17151971.	291336100.	18083416.	19134385.	16002211.	3718153.	7913603.	10233047.
25	TRANSFERS	4902747.	79003.	124695.	2131820.	1748489.	383531.	1330068.	12424.	1488968.	598352.
26	PROFITS	12388740.	65084746.	27853610.	442876516.	20857907.	25903180.	27677041.	28196319.	35143043.	17705936.
27	DEPREC	30505340.	34457531.	23601220.	82869584.	8421825.	11640160.	17570526.	14971745.	12756639.	5035441.
28	IMP-WYOM	6096245.	15890879.	9359616.	154847436.	82554480.	504207620.	4177160.	1082051.	2227663.	363533.
29	IMP-WORLD	52193434.	95715928.	298057108.	230588608.	176197812.	129768224.	70194750.	17053774.	27952028.	10510352.
30	TOTALS	195968732.	394316664.	486005780.	1839578784.	600208320.	1304195216.	263549588.	184094002.	231159454.	185515348.

		1	2	3	4	5	6	7	8	9	10
1	EMPLOYMENT	0.6349E 03	0.2195E 04	0.2831E 04	0.9172E 04	0.9159E 04	0.3174E 04	0.3563E 04	0.8971E 03	0.4792E 04	0.1222E 05
2	WITHDRAWAL	0.3038E 12	0.6112E 10	0.1488E 12	0.1897E 13	0.2401E 09	0.3600E 11	0.5535E 09	0.4915E 11	0.5317E 09	0.7235E 09
3	CONSUMP.	0.1193E 12	0.4022E 09	0.1487E 11	0.9735E 12	0.2401E 09	0.1161E 11	0.2635E 08	0.2504E 10	0.1387E 09	0.1855E 09

TABLE B-1
(continued)

TRANSACTIONS AMONG SECTORS (purchases by sectors shown at top from sectors shown at left...last rows are resource inputs)

DOLLARS

		11	12	13	14	15	16	17	18	19	20
		FIN/INS/RE	SERVICES	MEDICAL	SCHOOLS	COLLEGES	WAT/SAN	LOC-ROADS	LOC-GOV	LOC-TAXES	SUBTOTALS
1	AG/LIVESTK	0.	0.	0.	50000.	0.	0.	0.	0.	0.	9055497.
2	COAL-MINES	0.	0.	0.	0.	0.	0.	0.	0.	0.	40517957.
3	MINES-NEC	0.	0.	0.	0.	0.	0.	123870.	0.	0.	6274889.
4	OIL/GAS-PR	50155.	0.	0.	0.	0.	0.	0.	0.	0.	704745816.
5	CONSTR	1399920.	685260.	2064540.	2800020.	218635.	43808.	1737336.	3874444.	0.	118774046.
6	ALL-MFG	83443.	3348965.	70850.	0.	10345.	5100.	350210.	184925.	0.	80119890.
7	TRANS-COMM	3439730.	4456155.	484165.	2223200.	229030.	18410.	19950.	335110.	0.	61863609.
8	ELEC/GS-UT	1045376.	3119700.	941392.	6376800.	209900.	392930.	223125.	704184.	0.	149712038.
9	WHOLESALE	62233.	297158.	3715164.	2583099.	50468.	547548.	1508090.	1680169.	0.	91166514.
10	RETAIL	203889.	558733.	213450.	21152.	3575.	0.	0.	0.	0.	16579340.
11	FIN/INS/RE	4260691.	2144505.	1419644.	7377257.	324313.	830372.	191480.	2318771.	0.	110837105.
12	SERVICES	2243154.	5601510.	770628.	91000.	231070.	2993170.	219540.	5553620.	0.	75185817.
13	MEDICAL	0.	0.	2343571.	0.	0.	200.	0.	125990.	0.	3023939.
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	85599086.	85599086.
15	COLLEGES	145712.	10575.	0.	0.	5500.	0.	0.	0.	0.	1238017.
16	WAT/SAN	108979.	0.	173600.	184651.	14440.	1960650.	0.	217615.	11148819.	15582540.
17	LOC-ROADS	0.	0.	0.	0.	0.	0.	0.	0.	8248235.	8532588.
18	LOC-GOV	3725.	533915.	0.	0.	0.	0.	0.	106570.	49728262.	53460495.
19	LOC-TAXES	916646.	690940.	204300.	0.	0.	0.	0.	0.	0.	111042829.
20	SUBTOTALS	13963653.	21447416.	12401304.	21707179.	1297276.	6792188.	4373601.	15101398.	154724402.	1743312032.
21	HOUSEHOLDS	35583114.	76240310.	40722350.	53928000.	5567820.	3087900.	4564280.	17845500.	0.	1052850912.
22	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23	STATE-GOV	354234.	220065.	1463667.	6794000.	795400.	218270.	344673.	1735480.	0.	106263837.
24	FED-GOV	20346202.	4870445.	2380342.	2251930.	265160.	322260.	225150.	1151450.	0.	467895676.
25	TRANSFERS	51443994.	298465.	197582.	1026743.	458063.	115568.	26650.	322719.	0.	66689881.
26	PROFITS	42363772.	43990785.	31634840.	27838981.	502065.	20818142.	714644.	31444396.	0.	902994680.
27	DEPREC	8805298.	5064855.	2533920.	912000.	77780.	1497600.	0.	532300.	0.	261253770.
28	IMP-WYOM	60467.	2582177.	1056321.	729291.	405877.	154408.	425281.	473807.	0.	786694312.
29	IMP-WORLD	54054512.	25062526.	14625246.	7083459.	662362.	1488239.	4098989.	0.	0.	1215307376.
30	TOTALS	226975248.	179777046.	107015572.	122271583.	10031803.	34494575.	14773268.	68607050.	154724402.	6603262528.

1	EMPLOYMENT	0.2671E 04	0.7563E 04	0.2794E 04	0.3589E 04	0.6960E 03	0.1930E 03	0.4300E 03	0.1376E 04	0.	0.
2	WITHDRAWAL	0.1112E 10	0.6292E 09	0.5458E 09	0.1834E 09	0.1505E 08	0.	0.	0.6861E 08	0.	0.
3	CONSUMP.	0.2724E 09	0.1618E 09	0.1391E 09	0.4891E 08	0.4013E 07	0.	0.	0.6861E 07	0.	0.

TABLE B-1
(continued)

TRANSACTIONS AMONG SECTORS (purchases by sectors shown at top from sectors shown at left...last rows are resource inputs)

DOLLARS

		21 HOUSEHOLDS	22 STATE-ROAD	23 STATE-GOV	24 FED-GOV	25 TRANSFERS	26 INVESTMENT	27 EXP-WYOM	28 EXP-WORLD	29 TOTALS
1	AG/LIVESTK	4364230.	0.	384970.	15000.	0.	0.	0.	182149034.	195968732.
2	COAL-MINES	69593.	0.	0.	0.	0.	0.	0.	353729112.	394316664.
3	MINES-NEC	0.	0.	0.	21614000.	0.	0.	0.	458116892.	486005780.
4	OIL/GAS-PR	688842.	0.	0.	22993000.	0.	0.	0.	1111151120.	1839578784.
5	CONSTR	4642599.	38100165.	0.	3599327.	0.	435092180.	0.	0.	600208320.
6	ALL-MFG	33202042.	0.	54470.	21547313.	0.	0.	0.	1169271504.	1304195216.
7	TRANS-COMM	32200949.	0.	563471.	2703866.	0.	0.	0.	166217692.	263549588.
8	ELEC/GS-UT	27344856.	0.	3602.	905494.	0.	0.	6128011.	0.	184094002.
9	WHOLESALE	2368566.	1446415.	0.	26794.	0.	0.	136151164.	0.	231159454.
10	RETAIL	135217902.	0.	27465.	399255.	0.	0.	33291383.	0.	185515348.
11	FIN/INS/RE	114375200.	607899.	309895.	845145.	0.	0.	0.	0.	226975248.
12	SERVICES	56970909.	2922260.	109583.	789310.	9914390.	0.	33884775.	0.	179777046.
13	MEDICAL	55173317.	0.	765956.	25656930.	22395430.	0.	0.	0.	107015572.
14	SCHOOLS	6461983.	0.	29112574.	1097940.	0.	0.	0.	0.	122271583.
15	COLLEGES	1006750.	0.	7524111.	223304.	0.	0.	39621.	0.	10031803.
16	WAT/SAN	7139646.	0.	11505719.	266670.	0.	0.	0.	0.	34494575.
17	LOC-ROADS	0.	554980.	5685700.	0.	0.	0.	0.	0.	14773268.
18	LOC-GOV	0.	0.	9346818.	5790750.	0.	0.	8987.	0.	68607050.
19	LOC-TAXES	16855369.	0.	0.	0.	26826204.	0.	0.	0.	154724402.
20	SUBTOTALS	498082756.	43631719.	65394334.	108474098.	59136024.	435092180.	209503946.	3440635360.	6603262528.
21	HOUSEHOLDS	3974989.	8353380.	3212241.	20538190.	171924120.	0.	0.	0.	1260853840.
22	STATE-ROAD	0.	0.	4125000.	0.	0.	0.	0.	0.	4125000.
23	STATE-GOV	68511352.	125301.	356559.	33951230.	0.	0.	0.	0.	209208282.
24	FED-GOV	217462156.	542970.	50065.	2260690.	0.	0.	0.	0.	688211552.
25	TRANSFERS	15918508.	84605.	2480754.	83563225.	0.	0.	0.	0.	168736974.
26	PROFITS	44114120.	0.	159731.	531954.	-62016094.	0.	0.	0.	885784384.
27	DEPREC	0.	0.	0.	152313.	0.	0.	0.	0.	261406084.
28	IMP-WYOM	6573792.	407889.	1112.	79996.	0.	0.	39742929.	0.	833500032.
29	IMP-WORLD	406215144.	25638646.	81282.	4233479.	0.	0.	468584712.	0.	2120060640.
30	TOTALS	1260852832.	78784510.	75861078.	253785178.	169044050.	435092180.	717831592.	3440635360.	************

1	EMPLOYMENT	0.	0.4820E 03	0.2130E 03	0.1150E 04	0.	0.	0.	0.	0.
2	WITHDRAWAL	0.4035E 10	0.	0.7586E 08	0.2538E 09	0.	0.	0.	0.	0.
3	CONSUMP.	0.4035E 09	0.	0.7586E 07	0.2538E 08	0.	0.	0.	0.	0.

TABLE B-2

POWDER RIVER BASIN REGION OF EASTERN WYOMING
DIRECT REQUIREMENTS PER DOLLAR OF OUTPUT, 1979

NAME OF I-O MODEL IS: POWDER RIVER BASIN REGION

DIRECT INPUT COEFFICIENTS (% of purchases by sector at top of table from sectors at the left)

		1 AG/LIVESTK	2 COAL-MINES	3 MINES-NEC	4 OIL/GAS-PR	5 CONSTR	6 ALL-MFG	7 TRANS-COMM	8 ELEC/GS-UT	9 WHOLESALE	10 RETAIL
1	AG/LIVESTK	0.022284	0.	0.000951	0.	0.	0.002939	0.	0.	0.001446	0.000048
2	COAL-MINES	0.	0.	0.004251	0.	0.000054	0.000033	0.	0.208216	0.	0.000247
3	MINES-NEC	0.000289	0.	0.012230	0.	0.	0.000115	0.	0.	0.	0.
4	OIL/GAS-PR	0.	0.	0.025572	0.085200	0.	0.385990	0.003964	0.168851	0.	0.
5	CONSTR	0.000559	0.024642	0.	0.014410	0.100764	0.004607	0.000638	0.000866	0.006118	0.007471
6	ALL-MFG	0.023377	0.003986	0.004766	0.015286	0.023771	0.001425	0.033702	0.001136	0.050205	0.014303
7	TRANS-COMM	0.006284	0.003043	0.015049	0.004676	0.003689	0.002303	0.042900	0.004574	0.018708	0.057245
8	ELEC/GS-UT	0.012150	0.018617	0.005878	0.034961	0.001464	0.022846	0.023512	0.099074	0.010413	0.012336
9	WHOLESALE	0.061904	0.005252	0.017385	0.008581	0.052363	0.001867	0.013200	0.000153	0.017846	0.004256
10	RETAIL	0.004146	0.002814	0.011212	0.001021	0.002319	0.000694	0.003230	0.000804	0.010915	0.002749
11	FIN/INS/RE	0.179757	0.001440	0.001843	0.008327	0.020931	0.002113	0.036261	0.000485	0.046281	0.023174
12	SERVICES	0.024805	0.007724	0.006452	0.006023	0.023682	0.001414	0.005464	0.000844	0.050674	0.032306
13	MEDICAL	0.	0.000803	0.	0.000026	0.	0.000049	0.	0.	0.	0.000670
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	COLLEGES	0.000014	0.000156	0.000247	0.000023	0.000621	0.000009	0.000974	0.	0.000684	0.000271
16	WAT/SAN	0.001051	0.000258	0.000028	0.000046	0.000178	0.000353	0.000549	0.000062	0.001815	0.001205
17	LOC-ROADS	0.	0.	0.	0.	0.000210	0.	0.	0.	0.000684	0.
18	LOC-GOV	0.	0.	0.	0.000653	0.000351	0.000128	0.002827	0.000564	0.001579	0.001586
19	LOC-TAXES	0.033346	0.043449	0.004240	0.030980	0.001034	0.001267	0.022955	0.055851	0.020571	0.016995
20	HOUSEHOLDS	0.070766	0.138131	0.111113	0.112206	0.249498	0.040934	0.279176	0.101084	0.364034	0.577257
21	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	STATE-GOV	0.003757	0.087877	0.004822	0.022728	0.006141	0.001057	0.011005	0.004169	0.019578	0.008296
23	FED-GOV	0.014167	0.126126	0.035292	0.158371	0.030129	0.014671	0.060718	0.020197	0.034234	0.055160
24	TRANSFERS	0.025018	0.000200	0.000257	0.001159	0.002913	0.000294	0.005047	0.000067	0.006441	0.003225
25	PROFITS	0.063218	0.165057	0.057311	0.240749	0.034751	0.019861	0.105016	0.153163	0.152029	0.095442
26	DEPREC	0.155664	0.087385	0.048562	0.045048	0.014032	0.008925	0.066669	0.081327	0.055185	0.027143
27	IMP-WYOM	0.031108	0.040300	0.019258	0.084175	0.137543	0.386604	0.015850	0.005878	0.009637	0.001960
28	IMP-WORLD	0.266336	0.242739	0.613279	0.125349	0.293561	0.099501	0.266344	0.092636	0.120921	0.056655

TABLE B-2
(continued)

		11 FIN/INS/RE	12 SERVICES	13 MEDICAL	14 SCHOOLS	15 COLLEGES	16 WAT/SAN	17 LOC-ROADS	18 LOC-GOV	19 LOC-TAXES	20 HOUSEHOLDS
1	AG/LIVESTK	0.	0.	0.	0.000409	0.	0.	0.	0.	0.	0.003461
2	COAL-MINES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.000055
3	MINES-NEC	0.	0.	0.	0.	0.	0.	0.008385	0.	0.	0.
4	OIL/GAS-PR	0.000221	0.	0.	0.	0.	0.	0.	0.	0.	0.000546
5	CONSTR	0.006168	0.003812	0.019292	0.022900	0.021794	0.001270	0.117600	0.056473	0.	0.003682
6	ALL-MFG	0.000368	0.018628	0.000662	0.	0.001031	0.000148	0.023706	0.002695	0.	0.026333
7	TRANS-COMM	0.015155	0.024787	0.004524	0.018182	0.022830	0.000534	0.001350	0.004884	0.	0.025539
8	ELEC/GS-UT	0.004606	0.017353	0.008797	0.052153	0.020923	0.011391	0.015103	0.010264	0.	0.021688
9	WHOLESALE	0.000274	0.001653	0.034716	0.021126	0.005031	0.015873	0.102082	0.024490	0.	0.001879
10	RETAIL	0.000898	0.003108	0.001995	0.000173	0.000356	0.	0.	0.	0.	0.107243
11	FIN/INS/RE	0.018772	0.011929	0.013266	0.060335	0.032328	0.024073	0.012961	0.033798	0.	0.090713
12	SERVICES	0.009883	0.031158	0.007201	0.000744	0.023034	0.086772	0.014861	0.080948	0.	0.045184
13	MEDICAL	0.	0.	0.021899	0.	0.	0.000006	0.	0.001836	0.	0.043759
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	0.553236	0.005125
15	COLLEGES	0.000642	0.000059	0.	0.	0.000548	0.	0.	0.	0.	0.000798
16	WAT/SAN	0.000480	0.	0.001622	0.001510	0.001439	0.056839	0.	0.003172	0.072056	0.005663
17	LOC-ROADS	0.	0.	0.	0.	0.	0.	0.	0.	0.053309	0.
18	LOC-GOV	0.000016	0.002970	0.	0.	0.	0.	0.	0.001553	0.321399	0.
19	LOC-TAXES	0.004039	0.003843	0.001909	0.	0.	0.	0.	0.	0.	0.013368
20	HOUSEHOLDS	0.156771	0.424083	0.380527	0.441051	0.555017	0.089518	0.308955	0.260112	0.	0.003153
21	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	STATE-GOV	0.001561	0.001224	0.013677	0.055565	0.079288	0.006328	0.023331	0.025296	0.	0.054337
23	FED-GOV	0.089641	0.027092	0.022243	0.018417	0.026432	0.009342	0.015240	0.016783	0.	0.172472
24	TRANSFERS	0.226650	0.001660	0.001846	0.008397	0.045661	0.003350	0.001804	0.004704	0.	0.012625
25	PROFITS	0.186645	0.244696	0.295610	0.227682	0.050047	0.603519	0.048374	0.458326	0.	0.034988
26	DEPREC	0.038794	0.028173	0.023678	0.007459	0.007753	0.043416	0.	0.007759	0.	0.
27	IMP-WYOM	0.000266	0.014363	0.009871	0.005965	0.040459	0.004476	0.028787	0.006906	0.	0.005214
28	IMP-WORLD	0.238152	0.139409	0.136665	0.057932	0.066026	0.043144	0.277460	0.	0.	0.322175

TABLE B-2
(continued)

		21 STATE-ROAD	22 STATE-GOV	23 FED-GOV	24 TRANSFERS	25 INVESTMENT	26 EXP-WYOM	27 EXP-WORLD
1	AG/LIVESTK	0.	0.005075	0.000059	0.	0.	0.	0.052941
2	COAL-MINES	0.	0.	0.	0.	0.	0.	0.102809
3	MINES-NEC	0.	0.	0.085167	0.	0.	0.	0.133149
4	OIL/GAS-PR	0.	0.	0.090600	0.	0.	0.	0.322949
5	CONSTR	0.483600	0.	0.014183	0.	1.000000	0.	0.
6	ALL-MFG	0.	0.000718	0.084904	0.	0.	0.	0.339842
7	TRANS-COMM	0.	0.007428	0.010654	0.	0.	0.	0.048310
8	ELEC/GS-UT	0.	0.000047	0.003568	0.	0.	0.008537	0.
9	WHOLESALE	0.018359	0.	0.000106	0.	0.	0.189670	0.
10	RETAIL	0.	0.000362	0.001573	0.	0.	0.046378	0.
11	FIN/INS/RE	0.007716	0.004085	0.003330	0.	0.	0.	0.
12	SERVICES	0.037092	0.001445	0.003110	0.058650	0.	0.047204	0.
13	MEDICAL	0.	0.010097	0.101097	0.132483	0.	0.	0.
14	SCHOOLS	0.	0.383762	0.004326	0.	0.	0.	0.
15	COLLEGES	0.	0.099183	0.000880	0.	0.	0.000055	0.
16	WAT/SAN	0.	0.151668	0.001051	0.	0.	0.	0.
17	LOC-ROADS	0.007044	0.074949	0.	0.	0.	0.	0.
18	LOC-GOV	0.	0.123210	0.022818	0.	0.	0.000013	0.
19	LOC-TAXES	0.	0.	0.	0.158694	0.	0.	0.
20	HOUSEHOLDS	0.106028	0.042344	0.080927	1.017037	0.	0.	0.
21	STATE-ROAD	0.	0.054376	0.	0.	0.	0.	0.
22	STATE-GOV	0.001590	0.004700	0.133779	0.	0.	0.	0.
23	FED-GOV	0.006892	0.000660	0.008908	0.	0.	0.	0.
24	TRANSFERS	0.001074	0.032701	0.329268	0.	0.	0.	0.
25	PROFITS	0.	0.002106	0.002096	-0.366864	0.	0.	0.
26	DEPREC	0.	0.	0.000600	0.	0.	0.	0.
27	IMP-WYOM	0.005177	0.000015	0.000315	0.	0.	0.055365	0.
28	IMP-WORLD	0.325427	0.001071	0.016681	0.	0.	0.652778	0.

TABLE B-3

POWDER RIVER BASIN REGION OF EASTERN WYOMING,
DIRECT AND INDIRECT REQUIREMENTS PER DOLLAR OF OUTPUT DELIVERED TO
FINAL DEMAND (HOUSEHOLDS IN THE PROCESSING SECTOR)

NAME OF I-O MODEL IS: POWDER RIVER BASIN REGION

(I-A) INVERSE MATRIX

		1 AG/LIVESTK	2 COAL-MINES	3 MINES-NEC	4 OIL/GAS-PR	5 CONSTR	6 ALL-MFG	7 TRANS-COMM	8 ELEC/GS-UT	9 WHOLESALE	10 RETAIL
1	AG/LIVESTK	1.0237	0.0008	0.0017	0.0008	0.0016	0.0035	0.0016	0.0010	0.0036	0.0029
2	COAL-MINES	0.0054	1.0063	0.0074	0.0108	0.0037	0.0101	0.0091	0.2363	0.0071	0.0090
3	MINES-NEC	0.0003	0.0000	1.0124	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
4	OIL/GAS-PR	0.0199	0.0110	0.0366	1.1133	0.0215	0.4366	0.0336	0.2158	0.0364	0.0260
5	CONSTR	0.0065	0.0316	0.0029	0.0217	1.1168	0.0145	0.0068	0.0166	0.0142	0.0166
6	ALL-MFG	0.0352	0.0124	0.0127	0.0247	0.0427	1.0135	0.0492	0.0146	0.0703	0.0414
7	TRANS-COMM	0.0205	0.0126	0.0240	0.0142	0.0215	0.0106	1.0616	0.0182	0.0429	0.0899
8	ELEC/GS-UT	0.0258	0.0301	0.0149	0.0519	0.0172	0.0481	0.0434	1.1347	0.0337	0.0417
9	WHOLESALE	0.0676	0.0097	0.0200	0.0132	0.0623	0.0081	0.0179	0.0080	1.0237	0.0113
10	RETAIL	0.0270	0.0258	0.0303	0.0223	0.0452	0.0160	0.0461	0.0292	0.0675	1.0843
11	FIN/INS/RE	0.2138	0.0263	0.0219	0.0322	0.0666	0.0219	0.0808	0.0330	0.1040	0.1035
12	SERVICES	0.0445	0.0224	0.0181	0.0202	0.0520	0.0133	0.0301	0.0216	0.0841	0.0763
13	MEDICAL	0.0090	0.0103	0.0077	0.0087	0.0173	0.0062	0.0176	0.0115	0.0232	0.0343
14	SCHOOLS	0.0245	0.0286	0.0067	0.0241	0.0082	0.0122	0.0215	0.0484	0.0217	0.0233
15	COLLEGES	0.0004	0.0004	0.0005	0.0002	0.0011	0.0002	0.0014	0.0003	0.0013	0.0011
16	WAT/SAN	0.0060	0.0055	0.0020	0.0046	0.0037	0.0029	0.0059	0.0084	0.0080	0.0089
17	LOC-ROADS	0.0023	0.0027	0.0006	0.0022	0.0009	0.0011	0.0019	0.0045	0.0025	0.0019
18	LOC-GOV	0.0141	0.0162	0.0036	0.0144	0.0044	0.0072	0.0146	0.0284	0.0132	0.0136
19	LOC-TAXES	0.0425	0.0498	0.0106	0.0417	0.0113	0.0207	0.0352	0.0851	0.0344	0.0352
20	HOUSEHOLDS	0.1994	0.2103	0.1711	0.1930	0.3863	0.1356	0.3913	0.2517	0.5163	0.7494

TABLE B-3
(continued)

		11 FIN/INS/RE	12 SERVICES	13 MEDICAL	14 SCHOOLS	15 COLLEGES	16 WAT/SAN	17 LOC-ROADS	18 LOC-GOV	19 LOC-TAXES	20 HOUSEHOLDS
1	AG/LIVESTK	0.0008	0.0021	0.0019	0.0026	0.0026	0.0007	0.0020	0.0015	0.0021	0.0043
2	COAL-MINES	0.0027	0.0082	0.0057	0.0164	0.0099	0.0046	0.0076	0.0057	0.0116	0.0079
3	MINES-NEC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0085	0.0000	0.0005	0.0000
4	OIL/GAS-PR	0.0062	0.0238	0.0136	0.0239	0.0202	0.0079	0.0279	0.0140	0.0197	0.0234
5	CONSTR	0.0092	0.0102	0.0270	0.0319	0.0312	0.0041	0.1368	0.0676	0.0470	0.0102
6	ALL-MFG	0.0079	0.0379	0.0193	0.0210	0.0255	0.0089	0.0437	0.0203	0.0214	0.0370
7	TRANS-COMM	0.0244	0.0479	0.0251	0.0426	0.0517	0.0108	0.0237	0.0239	0.0333	0.0441
8	ELEC/GS-UT	0.0128	0.0394	0.0272	0.0784	0.0474	0.0218	0.0362	0.0273	0.0556	0.0373
9	WHOLESALE	0.0024	0.0063	0.0408	0.0273	0.0115	0.0188	0.1148	0.0315	0.0327	0.0075
10	RETAIL	0.0235	0.0624	0.0567	0.0630	0.0767	0.0201	0.0541	0.0441	0.0533	0.1230
11	FIN/INS/RE	1.0413	0.0694	0.0671	0.1224	0.1059	0.0465	0.0710	0.0792	0.1003	0.1189
12	SERVICES	0.0223	1.0630	0.0378	0.0351	0.0636	0.1062	0.0514	0.1094	0.0650	0.0639
13	MEDICAL	0.0093	0.0245	1.0448	0.0258	0.0315	0.0081	0.0217	0.0198	0.0224	0.0530
14	SCHOOLS	0.0061	0.0124	0.0102	1.0123	0.0128	0.0041	0.0104	0.0078	0.5634	0.0190
15	COLLEGES	0.0009	0.0006	0.0005	0.0006	1.0013	0.0002	0.0006	0.0005	0.0006	0.0011
16	WAT/SAN	0.0026	0.0049	0.0061	0.0067	0.0073	1.0619	0.0045	0.0068	0.0326	0.0093
17	LOC-ROADS	0.0005	0.0009	0.0008	0.0009	0.0009	0.0003	1.0009	0.0006	0.0541	0.0013
18	LOC-GOV	0.0032	0.0091	0.0048	0.0059	0.0059	0.0023	0.0052	1.0055	0.3269	0.0081
19	LOC-TAXES	0.0092	0.0174	0.0138	0.0169	0.0167	0.0057	0.0143	0.0104	1.0139	0.0233
20	HOUSEHOLDS	0.2076	0.5454	0.4998	0.5750	0.7019	0.1302	0.4833	0.4002	0.4855	1.1827

TABLE B-4
POWDER RIVER BASIN REGION OF EASTERN WYOMING,
DIRECT AND INDIRECT REQUIREMENTS PER DOLLAR OF OUTPUT
DELIVERED TO FINAL DEMAND (HOUSEHOLDS IN FINAL DEMAND)

NAME OF I-O MODEL IS: POWDER RIVER BASIN REGION

(I-A) INVERSE MATRIX

		1 AG/LIVESTK	2 COAL-MINES	3 MINES-NEC	4 OIL/GAS-PR	5 CONSTR	6 ALL-MFG	7 TRANS-COMM	8 ELEC/GS-UT	9 WHOLESALE	10 RETAIL
1	AG/LIVESTK	1.0230	0.0000	0.0010	0.0001	0.0002	0.0030	0.0001	0.0000	0.0017	0.0001
2	COAL-MINES	0.0041	1.0049	0.0063	0.0095	0.0011	0.0092	0.0065	0.2346	0.0036	0.0040
3	MINES-NEC	0.0003	0.0000	1.0124	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
4	OIL/GAS-PR	0.0159	0.0068	0.0332	1.1095	0.0139	0.4340	0.0259	0.2109	0.0262	0.0112
5	CONSTR	0.0048	0.0298	0.0014	0.0200	1.1135	0.0133	0.0034	0.0145	0.0097	0.0102
6	ALL-MFG	0.0290	0.0058	0.0073	0.0187	0.0306	1.0093	0.0370	0.0068	0.0541	0.0180
7	TRANS-COMM	0.0130	0.0048	0.0176	0.0070	0.0072	0.0056	1.0470	0.0088	0.0236	0.0620
8	ELEC/GS-UT	0.0195	0.0235	0.0095	0.0458	0.0050	0.0438	0.0311	1.1267	0.0174	0.0181
9	WHOLESALE	0.0663	0.0084	0.0189	0.0120	0.0599	0.0073	0.0155	0.0064	1.0204	0.0066
10	RETAIL	0.0054	0.0031	0.0118	0.0015	0.0034	0.0014	0.0037	0.0020	0.0116	1.0032
11	FIN/INS/RE	0.1938	0.0052	0.0047	0.0128	0.0278	0.0083	0.0415	0.0077	0.0521	0.0282
12	SERVICES	0.0337	0.0111	0.0089	0.0098	0.0312	0.0059	0.0090	0.0080	0.0562	0.0358
13	MEDICAL	0.0000	0.0009	0.0000	0.0001	0.0000	0.0001	0.0000	0.0003	0.0000	0.0007
14	SCHOOLS	0.0213	0.0252	0.0040	0.0210	0.0020	0.0100	0.0152	0.0443	0.0134	0.0113
15	COLLEGES	0.0002	0.0002	0.0003	0.0001	0.0008	0.0000	0.0011	0.0001	0.0008	0.0004
16	WAT/SAN	0.0044	0.0039	0.0007	0.0031	0.0006	0.0018	0.0029	0.0065	0.0040	0.0030
17	LOC-ROADS	0.0021	0.0024	0.0004	0.0020	0.0005	0.0010	0.0015	0.0043	0.0020	0.0011
18	LOC-GOV	0.0127	0.0148	0.0025	0.0130	0.0018	0.0063	0.0119	0.0266	0.0097	0.0085
19	LOC-TAXES	0.0386	0.0456	0.0072	0.0379	0.0036	0.0180	0.0275	0.0801	0.0242	0.0204

		11 FIN/INS/RE	12 SERVICES	13 MEDICAL	14 SCHOOLS	15 COLLEGES	16 WAT/SAN	17 LOC-ROADS	18 LOC-GOV	19 LOC-TAXES
1	AG/LIVESTK	0.0000	0.0001	0.0001	0.0005	0.0000	0.0000	0.0003	0.0001	0.0003
2	COAL-MINES	0.0013	0.0046	0.0024	0.0125	0.0053	0.0034	0.0044	0.0031	0.0084
3	MINES-NEC	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0085	0.0000	0.0005
4	OIL/GAS-PR	0.0021	0.0130	0.0037	0.0125	0.0063	0.0043	0.0183	0.0060	0.0101
5	CONSTR	0.0074	0.0055	0.0227	0.0270	0.0251	0.0025	0.1327	0.0642	0.0428
6	ALL-MFG	0.0014	0.0208	0.0037	0.0030	0.0035	0.0032	0.0336	0.0078	0.0062
7	TRANS-COMM	0.0167	0.0276	0.0065	0.0212	0.0256	0.0041	0.0057	0.0090	0.0152
8	ELEC/GS-UT	0.0063	0.0222	0.0114	0.0602	0.0253	0.0161	0.0210	0.0146	0.0403
9	WHOLESALE	0.0011	0.0029	0.0377	0.0237	0.0071	0.0176	0.1117	0.0290	0.0296
10	RETAIL	0.0010	0.0034	0.0026	0.0007	0.0007	0.0006	0.0018	0.0008	0.0008
11	FIN/INS/RE	1.0204	0.0145	0.0168	0.0646	0.0354	0.0284	0.0224	0.0390	0.0515
12	SERVICES	0.0111	1.0335	0.0108	0.0041	0.0257	0.0965	0.0253	0.0878	0.0388
13	MEDICAL	0.0000	0.0000	1.0224	0.0000	0.0000	0.0000	0.0000	0.0019	0.0006
14	SCHOOLS	0.0028	0.0037	0.0022	1.0031	0.0016	0.0012	0.0027	0.0014	0.5556
15	COLLEGES	0.0007	0.0001	0.0001	0.0001	1.0006	0.0000	0.0002	0.0001	0.0001
16	WAT/SAN	0.0009	0.0006	0.0022	0.0021	0.0018	1.0605	0.0007	0.0037	0.0788
17	LOC-ROADS	0.0003	0.0004	0.0002	0.0003	0.0002	0.0001	1.0004	0.0002	0.0536
18	LOC-GOV	0.0017	0.0053	0.0014	0.0020	0.0011	0.0010	0.0019	1.0027	0.3235
19	LOC-TAXES	0.0051	0.0067	0.0039	0.0056	0.0029	0.0021	0.0048	0.0025	1.0043

TABLE B-5

POWDER RIVER BASIN REGION OF EASTERN WYOMING,
SALES COEFFICIENTS

NAME OF I-O MODEL IS: POWDER RIVER BASIN REGION

SALES COEFFICIENTS (% of sales by sector at left of table to sectors at top)

		1 AG/LIVESTK	2 COAL-MINES	3 MINES-NEC	4 OIL/GAS-PR	5 CONSTR	6 ALL-MFG	7 TRANS-COMM	8 ELEC/GS-UT	9 WHOLESALE	10 RETAIL
1	AG/LIVESTK	0.022284	0.	0.002359	0.	0.	0.019559	0.	0.	0.001706	0.000046
2	COAL-MINES	0.	0.	0.005239	0.	0.000082	0.000108	0.	0.097209	0.	0.000116
3	MINES-NEC	0.000117	0.	0.012230	0.	0.	0.000309	0.	0.	0.	0.
4	OIL/GAS-PR	0.	0.	0.006756	0.085200	0.	0.273653	0.000568	0.016898	0.	0.
5	CONSTR	0.000182	0.016189	0.	0.044166	0.100764	0.010010	0.000280	0.000266	0.002356	0.002309
6	ALL-MFG	0.003513	0.001205	0.001776	0.021562	0.010940	0.001425	0.006811	0.000160	0.008899	0.002035
7	TRANS-COMM	0.004673	0.004553	0.027751	0.032639	0.008402	0.011398	0.042900	0.003195	0.016409	0.040295
8	ELEC/GS-UT	0.012934	0.039876	0.015519	0.349355	0.004774	0.161851	0.033659	0.099074	0.013075	0.012431
9	WHOLESALE	0.052480	0.008959	0.036552	0.068287	0.135961	0.010536	0.015049	0.000122	0.017846	0.003415
10	RETAIL	0.004380	0.005982	0.029373	0.010126	0.007504	0.004876	0.004588	0.000797	0.013600	0.002749
11	FIN/INS/RE	0.155201	0.002501	0.003947	0.067485	0.055350	0.012141	0.042105	0.000393	0.047135	0.018941
12	SERVICES	0.027040	0.016941	0.017442	0.061629	0.079064	0.010255	0.008011	0.000865	0.065158	0.033337
13	MEDICAL	0.	0.002960	0.	0.000454	0.	0.000603	0.	0.	0.	0.001161
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	COLLEGES	0.000278	0.006150	0.011970	0.004246	0.037140	0.001141	0.025584	0.	0.015770	0.005003
16	WAT/SAN	0.005972	0.002953	0.000400	0.002471	0.003104	0.013349	0.004195	0.000331	0.012165	0.006481
17	LOC-ROADS	0.	0.	0.	0.	0.008539	0.	0.	0.	0.010709	0.
18	LOC-GOV	0.	0.	0.	0.017515	0.003071	0.002443	0.010860	0.001514	0.005319	0.004288
19	LOC-TAXES	0.042235	0.110729	0.013320	0.368336	0.004010	0.010678	0.039101	0.066453	0.030733	0.020377
20	HOUSEHOLDS	0.010999	0.043199	0.042829	0.163708	0.118770	0.042341	0.058355	0.014759	0.066740	0.084935
21	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	STATE-GOV	0.003519	0.165631	0.011201	0.199849	0.017620	0.006588	0.013863	0.003669	0.021632	0.007357
23	FED-GOV	0.004034	0.072265	0.024923	0.423323	0.026276	0.027803	0.023252	0.005403	0.011499	0.014869
24	TRANSFERS	0.029056	0.000468	0.000739	0.012634	0.010362	0.002273	0.007882	0.000074	0.008824	0.003546
25	PROFITS	0.013986	0.073477	0.031445	0.499982	0.023547	0.029243	0.031246	0.031832	0.039674	0.019989
26	DEPREC	0.116697	0.131816	0.090286	0.317015	0.032217	0.044529	0.067215	0.057274	0.048800	0.019263
27	IMP-WYOM	0.007314	0.019065	0.011229	0.185780	0.099046	0.604928	0.005012	0.001298	0.002673	0.000436
28	IMP-WORLD	0.024619	0.045148	0.140589	0.108765	0.083110	0.061210	0.033110	0.008044	0.013185	0.004958

TABLE B-5
(continued)

SALES COEFFICIENTS (% of sales by sector at left of table to sectors at top)

		11 FIN/INS/RE	12 SERVICES	13 MEDICAL	14 SCHOOLS	15 COLLEGES	16 WAT/SAN	17 LOC-ROADS	18 LOC-GOV	19 LOC-TAXES	20 HOUSEHOLDS
1	AG/LIVESTK	0.	0.	0.	0.000255	0.	0.	0.	0.	0.	0.022270
2	COAL-MINES	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.000176
3	MINES-NEC	0.	0.	0.	0.	0.	0.	0.000255	0.	0.	0.
4	OIL/GAS-PR	0.000027	0.	0.	0.	0.	0.	0.	0.	0.	0.000374
5	CONSTR	0.002332	0.001142	0.003440	0.004665	0.000364	0.000073	0.002895	0.006455	0.	0.007735
6	ALL-MFG	0.000064	0.002568	0.000054	0.	0.000008	0.000004	0.000269	0.000142	0.	0.025458
7	TRANS-COMM	0.013052	0.016908	0.001837	0.008436	0.000869	0.000070	0.000076	0.001272	0.	0.122182
8	ELEC/GS-UT	0.005678	0.016946	0.005114	0.034639	0.001140	0.002134	0.001212	0.003825	0.	0.148537
9	WHOLESALE	0.000269	0.001286	0.016072	0.011175	0.000218	0.002369	0.006524	0.007268	0.	0.010246
10	RETAIL	0.001099	0.003012	0.001151	0.000114	0.000019	0.	0.	0.	0.	0.728877
11	FIN/INS/RE	0.018772	0.009448	0.006255	0.032502	0.001429	0.003658	0.000844	0.010216	0.	0.503910
12	SERVICES	0.012477	0.031158	0.004287	0.000506	0.001285	0.016649	0.001221	0.030892	0.	0.316898
13	MEDICAL	0.	0.	0.021899	0.	0.	0.000002	0.	0.001177	0.	0.515563
14	SCHOOLS	0.	0.	0.	0.	0.	0.	0.	0.	0.700073	0.052849
15	COLLEGES	0.014525	0.001054	0.	0.	0.000548	0.	0.	0.	0.	0.100356
16	WAT/SAN	0.003159	0.	0.005033	0.005353	0.000419	0.056839	0.	0.006309	0.323205	0.206979
17	LOC-ROADS	0.	0.	0.	0.	0.	0.	0.	0.	0.558322	0.
18	LOC-GOV	0.000054	0.007782	0.	0.	0.	0.	0.	0.001553	0.724827	0.
19	LOC-TAXES	0.005924	0.004466	0.001320	0.	0.	0.	0.	0.	0.	0.108938
20	HOUSEHOLDS	0.028221	0.060467	0.032297	0.042771	0.004416	0.002449	0.003620	0.014154	0.	0.003153
21	STATE-ROAD	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	STATE-GOV	0.001693	0.001052	0.006996	0.032475	0.003802	0.001043	0.001648	0.008295	0.	0.327479
23	FED-GOV	0.029564	0.007077	0.003459	0.003272	0.000385	0.000468	0.000327	0.001673	0.	0.315982
24	TRANSFERS	0.304877	0.001769	0.001171	0.006085	0.002715	0.000685	0.000158	0.001913	0.	0.094339
25	PROFITS	0.047826	0.049663	0.035714	0.031429	0.000567	0.023502	0.000807	0.035499	0.	0.049802
26	DEPREC	0.033684	0.019375	0.009693	0.003489	0.000298	0.005729	0.	0.002036	0.	0.
27	IMP-WYOM	0.000073	0.003098	0.001267	0.000375	0.000487	0.000185	0.000510	0.000568	0.	0.007887
28	IMP-WORLD	0.025497	0.011822	0.006899	0.003341	0.000312	0.000702	0.001933	0.	0.	0.191605

TABLE B-5
(continued)

SALES COEFFICIENTS (% of sales by sector at left of table to sectors at top)

		21 STATE-ROAD	22 STATE-GOV	23 FED-GOV	24 TRANSFERS	25 INVESTMENT	26 EXP-WYOM	27 EXP-WORLD
1	AG/LIVESTK	0.	0.001964	0.000077	0.	0.	0.	0.929480
2	COAL-MINES	0.	0.	0.	0.	0.	0.	0.897069
3	MINES-NEC	0.	0.	0.044473	0.	0.	0.	0.942616
4	OIL/GAS-PR	0.	0.	0.012499	0.	0.	0.	0.604025
5	CONSTR	0.063478	0.	0.005997	0.	0.724902	0.	0.
6	ALL-MFG.	0.	0.000042	0.016522	0.	0.	0.	0.896546
7	TRANS-COMM	0.	0.002138	0.010259	0.	0.	0.	0.630688
8	ELEC/GS-UT	0.	0.000020	0.004919	0.	0.	0.033287	0.
9	WHOLESALE	0.006257	0.	0.000116	0.	0.	0.588992	0.
10	RETAIL	0.	0.000148	0.002152	0.	0.	0.179454	0.
11	FIN/INS/RE	0.002678	0.001365	0.003724	0.	0.	0.	0.
12	SERVICES	0.016255	0.000610	0.004390	0.055148	0.	0.188482	0.
13	MEDICAL	0.	0.007157	0.239750	0.209273	0.	0.	0.
14	SCHOOLS	0.	0.238098	0.008980	0.	0.	0.	0.
15	COLLEGES	0.	0.750026	0.022260	0.	0.	0.003950	0.
16	WAT/SAN	0.	0.333552	0.007731	0.	0.	0.	0.
17	LOC-ROADS	0.037567	0.384864	0.	0.	0.	0.	0.
18	LOC-GOV	0.	0.136237	0.084405	0.	0.	0.000131	0.
19	LOC-TAXES	0.	0.	0.	0.173381	0.	0.	0.
20	HOUSEHOLDS	0.006625	0.002548	0.016289	0.136355	0.	0.	0.
21	STATE-ROAD	0.	1.000000	0.	0.	0.	0.	0.
22	STATE-GOV	0.000599	0.001704	0.162284	0.	0.	0.	0.
23	FED-GOV	0.000789	0.000073	0.003285	0.	0.	0.	0.
24	TRANSFERS	0.000501	0.014702	0.495228	0.	0.	0.	0.
25	PROFITS	0.	0.000180	0.000601	-0.070013	0.	0.	0.
26	DEPREC	0.	0.	0.000583	0.	0.	0.	0.
27	IMP-WYOM	0.000489	0.000001	0.000096	0.	0.	0.047682	0.
28	IMP-WORLD	0.012093	0.000038	0.001997	0.	0.	0.221024	0.

APPENDIX C

SURVEY FORM
USED FOR THE INTERINDUSTRY STUDY

Colorado School of Mines

golden, colorado 80401 • (303) 279-0300

mineral economics department

Wyoming has been chosen as the location for analysis of business activity by
the Colorado School of Mines. The intent is to ascertain upcoming economic
trends in your region as the future need for energy and mineral resources unfold.
Our ability to develop an outlook of coming events in regional business activity
must be based on a knowledge of local economic trends. A successful study requires
an on-the-ground approach. Accordingly, our work always begins by interviewing
firms and other economic units in your area about their joint finanacial roles as
purchaser and as seller in the area economy. From this information comes an
understanding of your area's economic structure and outlook.

To help us in our review of current business activity, we are inviting your
participation. Involvement of participants usually does not exceed one conven-
iently scheduled interview in which a member of our team visits with you or a
designated member of your firm. We use the opportunity of the interview to learn
about the way in which your organization interacts with other segments of the
regional economy. The process is straightforward and every team member is
experienced in administering the questions.

We have accumulated ten years of experience and worked with hundreds of firms
in similar studies. In the past, our participation rates have been high partly
because the results from our efforts are of interest locally and also because
we adhere strictly to tight rules of confidentiality and hold all information
in confidence. In fact, by necessity of our analysis, all information collected
through interviews has to be combined and revised before our efforts can be
completed. By this process, all information from individual sources becomes
untracable.

We hope you will participate. We will be telephoning in a few days to arrange
a convenient time when we may call on you.

Sincerely,

Ray K. Ericson Ph.D.
Mineral Economist

RE/jk

CATEGORIES OF PURCHASES: groupings of firms, organizations, individuals from whom you purchase or pay expenses (includes accounting entities, e.g. depreciation, etc., which may be expensed)	PURCHASES IN N.HEAST WYOMING Casper, Gillette, Sheridan, Douglas, Buffalo, etc ($ or % of tot exp)	PURCHASES FROM OTHER WYOMING COUNTIES ($ or % of tot exp)	PURCHASES OUTSIDE WYOMING ($ or % of tot exp)
1. LIVESTOCK, AGRICULTURE AND FORESTRY: ranchers, farmers, feedlots, dairies, veternarians, etc.			
2. COAL MINES: coal mining companies; coal mining services contracting to develop and/or operate; welders, drillers, etc.			
3. CRUDE OIL, GAS AND RELATED SERVICES (not refineries nor bulk wholesalers): producers, exploration, drillers, fracing specialists, 'mud', logging, etc			
4. MINING AND MILLING FIRMS (metals and nonmetals): uranium, metals, contractors services such as exploration, development, operation, etc.:			
5. CONSTRUCTION FOR MAINTAINANCE AND REPAIR (construction to maintain status quo): buildings, roads, bridges, excavation, plumbing, heating, electric and all trades			
6. CONSTRUCTION FOR NEW CAPACITY (construction for new capacity):same companies as listed for maintainance-type construction			
7. MANUFACTURING (nearly all products bot directly from manuf'r or manuf'r reps); refiners, publishers, ready-mix cement, all machinery, fabricated metals, processed foods, lumber, chemicals, trans. eqp., instruments, etc.			
8. TRANSPORTATION/COMMUNICATION: railroad, trucking and storage, airlines, bus, pipeline companies, telephone, radio and t.v., post office			
9. ELECTRICITY AND GAS UTILITIES:			
10. WHOLESALE TRADE: all goods purchase through wholesalers (e.g. vehicles and parts, furniture, lumber, elec. goods, office supplies, fuel, food, machines, chemicals, etc.)			
11. RETAIL: all goods purchased from retailers (e.g. hardware, department stores, grocers, restaurants, service stations, auto dealers, furniture, pharmacy, etc.)			
12. FINANCE, INSURANCE, AND REAL ESTATE: interest expense (no principal), insurance, real estate and stockbrokers (commissions only), bank fees, etc.			
13. ALL OTHER SERVICES: lodging, legal, computer, ad agencies, accountants, photocopying, vehicle repair, theatres and entertainment, laundry, etc.			
14. EDUCATIONAL SERVICES: primary, secondary, colleges, technical, professional, libraries, etc.:			
15. HEALTH SERVICES: (direct payments to clinics,doctors dentists, hospitals, labs etc.)			
16. WATER, SEWER AND TRASH REMOVAL			
17. LOCAL AND COUNTY ROADS			
18. LOCAL AND COUNTY GOVERNMENT (property & sales taxes)			
19. LOCAL AND COUNTY GOVERNMENT (permits, licenses etc.)			
20. HOUSEHOLDS (gross payments subject to withholding)			
21. WYOMING STATE GOVERNMENT (all taxes, permits, fees)			
22. FEDERAL GOVERNMENT (all taxes, permits, license fees, employers FICA, unemployment insurance etc.)			
23. RENTS, DIVIDENDS, RETAINED EARNINGS:			
24. DEPRECIATION ALLOWANCE			
25. TOTAL EXPENDITURES AND OUTLAYS			

Please indicate the value of your establishment's net inventory change in 1979 (this may be positive or negative. NET INVENTORY CHANGE: $ _____.
What was the total number of employees you had at any one time in 1979? Full Time: _____ Part Time: _____

Sales Analysis

CATEGORIES OF SALES: groupings of firms, organizations, individuals to whom you sell.	SALES IN NORTHEAST WYOMING Casper, Gillette, Sheridan, Douglas, Buffalo, etc ($ or % of tot sold)	SALES FROM OTHER WYOMING COUNTIES ($ or % of tot sold)	SALES OUTSIDE WYOMING ($ or % of tot sold)
1. LIVESTOCK, AGRICULTURE AND FORESTRY: ranchers, farmers, feedlots, dairies, veterinarians, etc.			
2. COAL MINES: coal mining companies; coal mining services contracting to develop and/or operate; welders, drillers, etc.			
3. Crude Oil, GAS AND RELATED SERVICES (not refineries nor bulk wholesalers): producers, exploration, drillers, fracing specialists, 'mud', logging, etc.			
4. MINING AND MILLING FIRMS (metals and nonmetals): uranium, metals, contractors services such as exploration, development, operation, etc.			
5. CONSTRUCTION FOR MAINTENANCE AND REPAIR (Construction to maintain status quo): buildings, roads, bridges, excavation, plumbing, heating, electric and all trades			
6. CONSTRUCTION FOR NEW CAPACITY (construction new capacity): same companies as listed for maintenance-type construction			
7. MANUFACTURING (nearly all products sold directly or through manuf'r reps): refiners, publishers, ready mix cement, all machinery, fabricated metals, processed foods, lumber, chemicals, trans. eqp., instruments, etc.			
8. TRANSPORTATION/COMMUNICATION: railroad, trucking and storage, airlines, bus, pipeline companies, telephone, radio and t.v., post office			
9. ELECTRICITY AND GAS UTILITIES:			
10. WHOLESALE TRADE: all goods sold to wholesalers (e.g. vehicles and parts, furniture, lumber, elec. goods office supplies, fuel, food, machines, chemicals, etc.)			
11. RETAIL: all goods sold to retailers (e.g. hardware department stores, grocers, restaurants, service stations, autodealers, furniture, pharmacy, etc.)			
12. FINANCE, INSURANCE, AND REAL ESTATE: interest income (no principal), insurance, real estate and stockbrokers (commission only), banks, etc.			
13. ALL OTHER SERVICES: lodging, legal, computer, ad agencies, accountants, photo copying, vehicle repair, theatres and entertainment, laundry, etc.			
14. HEALTH SERVICES: medical, dental, hospitals, labs, patient care facilities.			
15. EDUCATIONAL SERVICES: primary, secondary, colleges technical, professional, libraries, etc.			
16. WATER, SEWER AND TRASH REMOVAL:			
17. LOCAL AND COUNTY GOVERNMENT			
18. HOUSEHOLDS: (sales for private consumption)			
19. WYOMING STATE GOVERNMENT			
20. FEDERAL GOVERNMENT			
TOTAL			

At what level of capacity did your establishment operate during 1979? LEVEL OF CAPACITY UTILIZATION _____ %
What is your establishment's total water use for all phases of your operations?(Note: Please use any unit of measurements; e.g., gallons per day, 1000 gallons per day, feet per year, etc.)

TOTAL WATER INTAKE: _____

Please estimate the dollar value of your depletion allowance for 1979.

DEPLETION ALLOWANCE: _____

APPENDIX D

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COLORADO WATER RESOURCES RESEARCH INSTITUTE

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CR 42	Theory and Experiments in the Prediction of Small Watershed Response	12/72	5.00
CR 43	Experiments in Small Watershed Response	12/72	5.00
CR 56	Evaluation and Implementation of Urban Drainage and Flood Control Projects	6/74	8.00
CR 65	Urban Drainage and Flood Control Projects: Economic, Legal and Financial Aspects	7/75	10.00
CR 83	Modelling the Dynamic Response of Floodplains to Urbanization in Eastern New England	1/78	6.50
CR 95	Drought-Induced Problems and Responses of Small Towns and Rural Water Entities in Colorado: The 1976-1978 Drought	6/80	4.00

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D. EFFECTS OF POLLUTANTS

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		Date	Price
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IS	10	Proceedings of a Workshop on Revegetation of High-Altitude Distrubed Lands	7/74	3.00
IS	11	Surface Rehabilitation of Land Distrubances Resulting from Oil Shale Development	6/74	Free
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IS	21	Proceedings: High Altitude Revegetation Workshop No. 2	8/76	4.00
IS	25	Surveillance Data - Plains Segment of the Cache La Poudre River, Colorado 1970-77	1/78	5.00
IS	28	Proceedings of a Workshop on Revegetation of High-Altitude Distrubed Lands, No. 3	6/68	4.00
IS	40	Proceedings of the Workshop on Instream Flow Habitat Criteria and Modeling	12/79	5.00
IS	42	Proceedings: High-Altitude Revegetation Workshop No. 4	6/80	4.00
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CR	75	Physical and Economic Effects on the Local Agricultural Economy of Water Transfer to Cities	10/76	3.00
CR	78	Selecting and Planning High Country Reservoirs for Recreation Within a Multi-purpose Management Framework	7/77	6.00
CR	81	Achieving Urban Water Conservation: Testing Community Acceptance	9/77	5.00
CR	91	Economic Benefits from Instream Flow in a Colorado Mountain Stream	6/79	5.00
CR	95	Drought-Induced Problems and Responses of Small Towns and Rural Water Entities in Colorado: The 1976-1978 Drought	6/80	4.00
CR	103	Empirical Application of a Model for Estimating the Recreation Value of Water in Reservoirs Compared to Instream Flow	12/80	3.00
CR	106	Urban Lawn Irrigation and Management Practices for Water Saving with Minimum Effect on Lawn Quality	5/81	6.00

I.   INSTITUTIONAL PROBLEMS

		Date	Price
X-740A	Ground Water Management District Director's Handbook	1970	.25
SR 5	A Guide to Colorado Water Law	9/78	2.50

J. PLANNING AND ANALYSIS METHODOLOGY

		Date	Price
CR 11	Organizational Adaptation to Change in Public Objectives for Water Management of Cache La Poudre River System	6/69	3.00
CR 13	Economics of Groundwater Development in the High Plains of Colorado	6/69	1.50
CR 17	An Exploration of Components Affecting and Limiting Policymaking Options in Local Water Agencies	11/68	5.00
CR 22	An Exploration of Components Affecting and Limiting Policymaking Options in Local Water Agencies	6/70	3.00
CR 27	Local Water Agencies, Communication Patterns, and the Planning Process	9/71	5.00
CR 37	Searching the Social Science Literature on Water: A Guide to Selected Information Storage and Retrieval Systems - Preliminary Version	9/72	5.00
CR 38	Water Quality Management Decisions in Colorado	6/72	5.00
CR 45	Mathematical Modeling of Water Management Strategies in Urbanizing River Basins	6/73	7.50
CR 46	Evaluation of Urban Water Management Policies in the Denver Metropolitan Area	6/73	7.50
CR 47	Coordination of Agricultural and Urban Water Quality Management in the Utah Lake Drainage Area	6/73	7.50
CR 56	Evaluation and Implementation of Urban Drainage and Flood Control Projects	6/74	8.00
CR 61	Economic and Institutional Analysis of Colorado Water Quality Management	3/75	5.00
CR 62	Feasibility and Potential of Enhancing Water Recreation Opportunities on High Country Reservoirs	6/75	4.00
CR 70	An Economic Analysis of Water Use in Colorado's Economy	12/75	5.00
CR 74	The Relevance of Technological Change in Long Term Water Resources Planning	10/76	3.50
CR 75	Physical and Economic Effects on the Local Agricultural Economy of Water Transfer to Cities	10/76	3.00
CR 78	Selecting and Planning High Country Reservoirs for Recreation Within a Multi-purpose Management Framework	7/77	6.00
CR 82	Development of a Subsurface Hydrologic Model and Use for Integrated Management of Surface and Subsurface Water Resources	12/77	3.00
CR 85	Development of a Drainage and Flood Control Management Program for Urbanizing Communities - Part I	9/78	2.00
CR 86	Development of a Drainage and Flood Control Management Program for Urbanizing Communities - Part II	9/78	7.00
CR 87	Development of a Stream-Aquifer Model Suited for Management	9/78	3.00
CR 89	Synthesis and Calibration of a River Basin Water Management Model	10/78	3.00
CR 90	Models for System Water Planning with Special Reference to Water Reuse	6/78	5.00
CR 91	Economic Benefits from Instream Flow in a Colorado Mountain Stream	6/79	5.00
CR 93	Application of Geomorphic Principles to Environmental Management	2/80	3.00
CR 101	An Empirical Application of a Model for Estimating the Recreation Value of Instream Flow	10/80	3.00
CR 102	Measuring Benefits and the Economic Value of Water in Recreation on High Country Reservoirs	9/80	3.00
CR 103	Empirical Application of a Model for Estimating the Recreation Value of Water in Reservoirs Compared to Instream Flow	12/80	3.00
CR 105	Municipal Water Use in Northern Colorado: Development of Efficiency-of-Use Criterion	9/80	4.00
CR 106	Urban Lawn Irrigation and Management Practices for Water Saving with Minimum Effect on Lawn Quality	5/81	6.00
CR 108	Waterlogging Control for Improved Water and Land Use Efficiencies: A Systematic Analysis	12/80	5.00
SR 1	Design of Water and Wastewater Systems for Rapid Growth Areas (Boom Towns - Mountain Resorts)	7/76	4.00
SR 3	Irrigation Development Potential in Colorado	5/77	4.00

			Date	Price
IS	19	The Environmental Quality Objective of Principles and Standards for Planning	8/75	7.00
IS	38	Public Participation Practices of the U.S. Army Corps of Engineers	7/79	3.00
IS	40	Proceedings of the Workshop on Instream Flow Habitat Criteria and Modeling	12/79	5.00
IS	41	Exploring Ways of Increasing the Use of South Platte Water		Free
IS	43	An Evaluation of the Cache la Poudre Wild and Scenic River Draft Environmental Impact Statement and Study Report	8/80	5.00
TR	6	Colorado Environmental Data Systems (abridged)	10/72	5.00
TR	7	Manual for Training in the Application of Principles and Standards (Water Resources Council)	12/74	10.00
TR	8	Models Designed to Efficiently Allocate Irrigation Water Use Based on Crop Response to Soil Moisture Stress	5/77	4.00
TR	9	The 1972 Federal Water Pollution Control Act's Area-Wide Planning Provision: Has Executive Implementation Met Congressional Intent?	11/77	5.00
TR	10	Efficiency of Wastewater Disposal in Mountain Areas	1/78	5.00
TR	18	An Interactive River Basin Water Management Model: Synthesis and Application	3/80	4.00
TR	20	Development of Methodologies for Determining Optimal Water Storage Strategies	9/80	2.00
TR	26	An Input-Output Analysis of Sportsman Expenditures in Colorado	1/81	4.00
TR	29	An Economic Input-Output Study of the High Plains Region of Eastern Colorado	2/82	7.00
TR	32	Hydrologic and Pumping Data for Colorado's Ogallala Aquifer Region	2/82	7.00
TR	33	Projected Population, Employment, and Economic Output in Colorado's Eastern High Plains, 1979-2020	2/82	7.00
TR	34	Energy and Water Scarcity and the Irrigated Agricultural Economy of the Colorado High Plains: Direct Economic-Hydrologic Impact Forecasts (1979-2020)	2/82	7.00
S-TB127		A Simulation Model for Analyzing Timber-Water Joint Production in the Colorado Rockies	1975	1.25

K. WATER CONVEYANCE AND CONTROL WORKS

CR	6	Stabilization of Alluvial Channels	6/69	3.00
CR	7	Stability of Slopes with Seepage	6/69	3.00
SR	1	Design of Water and Wastewater Systems for Rapid Growth Areas (Boom Towns - Mountain Resorts)	6/76	4.00
S-496S		Farm Irrigation Structures	1956	.50
S-TB76		Parshall Measuring Flumes of Small Sizes	1957	.25
X-426A		Parshall Flumes of Large Size	1961	.50
S-TB120		Selection and Installation of Cutthroat Flumes for Measuring Irrigation and Drainage Water	1976	1.25
S-TB126		A Shunt-Line Metering System for Irrigation Wells	1977	.75
S-522S		Weed Seed and Trash Screens for Irrigation Water	1966	.35

.L. OTHER

		Date	Price
IS 1	Inventory of Environmental Resources Research in Progress - Colorado State University	1/71	Free
IS 3	Inventory of Environmental Resources Research in Progress - Colorado State University	7/72	Free
IS 5	Directory of Environmental Research Faculty - Colorado State University	12/72	Free
IS 8	Inventory of Current Water Resources Research at Colorado State University	7/73	Free
IS 23	Inventory of Colorado's Front Range Mountain Reservoirs	5/77	5.00
IS 30	The Larimer-Weld Council of Governments 208 Water Quality Plan: An Assessment and Suggestions· for Future Directions	8/78	2.00
TR 2	Estimated Average Annual Water Balance for Piceance and Yellow Creek Watersheds	8/74	Free
S-504S	Colorado's Ground Water Problems	1967	.35
S-512S	Ground Water in the Bijou Valley	1961	.25
S-GS757	Public Water Supplies of Colorado 1959-1960	1961	1.25