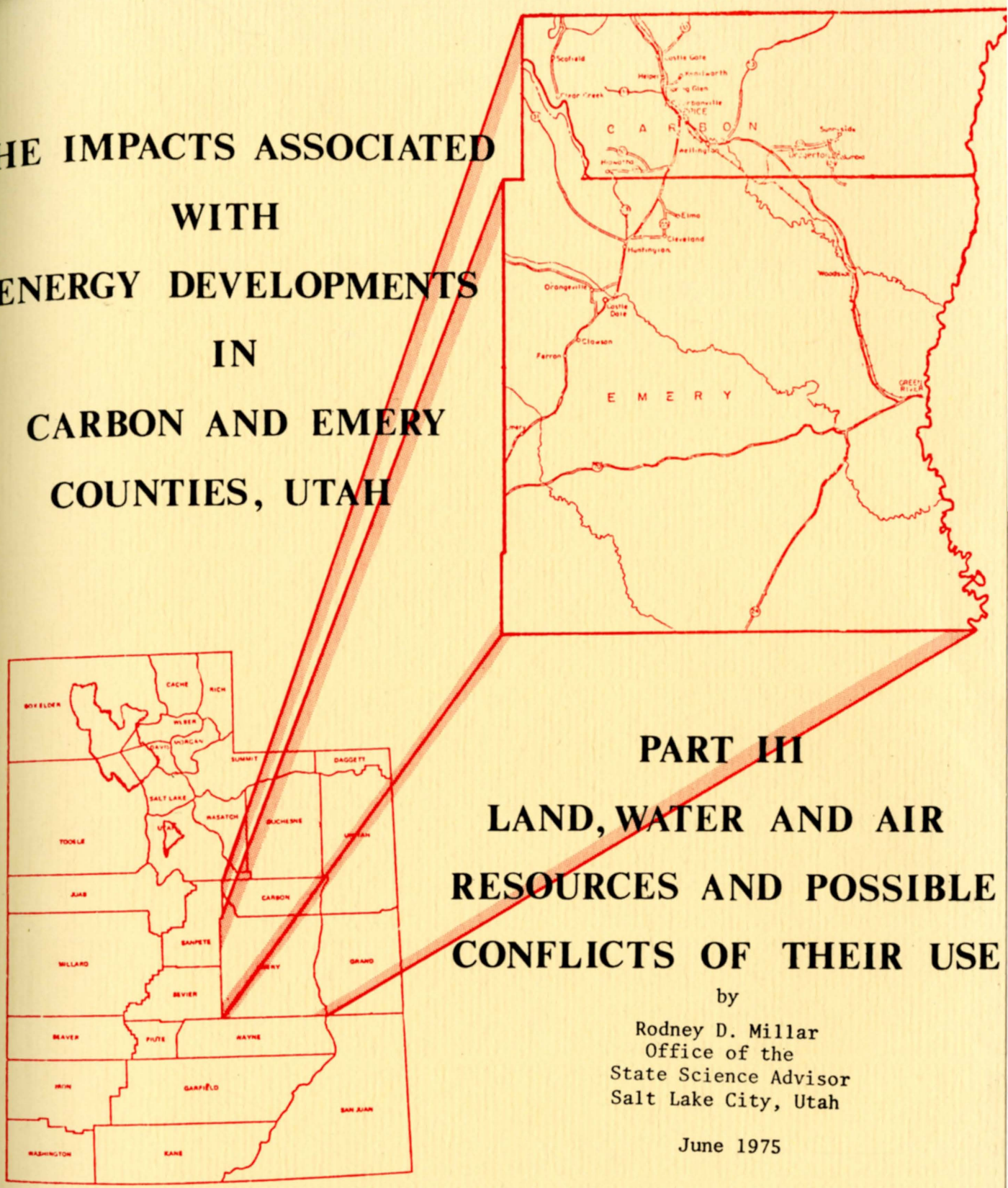
1975

The Impacts Associated With Energy Developments in Carbon and Emery Counties, Utah Part III: Land, Water and Air Resources and Possible Conflicts of Their Use

Rodney D. Millar

THE IMPACTS ASSOCIATED WITH ENERGY DEVELOPMENTS IN CARBON AND EMERY COUNTIES, UTAH



PART III

LAND, WATER AND AIR RESOURCES AND POSSIBLE CONFLICTS OF THEIR USE

by

Rodney D. Millar
Office of the
State Science Advisor
Salt Lake City, Utah

June 1975

Prepared in Cooperation with
The Intermountain Region - USDA, Forest Service
The Utah State Office - USDI, Bureau of Land Management
The Utah State Advisory Council on Science and Technology

and Funded by

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This series of reports on Carbon and Emery counties was prepared under the direction of the Office of the State Science Advisor. All inquiries and comments should be directed to this office at the following address:

Office of the State Science Advisor
3008 Merrill Engineering Building
University of Utah
Salt Lake City, Utah
84112

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INTRODUCTION

This study was initiated as a result of serious concern by various people in both State and Federal government about the future impacts of energy developments in Utah. A cooperative agreement was made between the U.S. Bureau of Land Management, the U.S. Forest Service, the State Planning Coordinator's Office, and the State Advisory Council on Science and Technology, to assess the social-cultural, economic, and natural resource problems which are likely to result from the energy developments currently started in the Carbon-Emery county area of Utah. The emphasis of this part of the study is on the present situation vs. the forecasted or projected conflicts-in-use of the natural resources of Carbon and Emery counties.

There are four sections to this part of the study. Section one, two, and three are basically inventories of the land, water, and air resources present in Carbon and Emery counties. Section four discusses the significant conflicts, which may arise, in the use of these resources resulting from the tremendous increase in both industrial and demographic growth. This growth is due to the increase in coal production and electric power generation in Carbon and Emery counties.

The data used in this part of the study were obtained from many published and unpublished sources, both private and public and from interviews with private individuals and public officials.

SECTION 1

LAND

Carbon and Emery Counties have a total land area of 5915 square miles which is 7 percent of the total land area of Utah. Figure 1.1 shows the location of these counties in the state of Utah. In order to discuss the land, five general areas will be covered; namely, topography and climate, population, natural resources, land ownership, and land use.

Topography and Climate

The topography of an area affects not only climatic factors but also land use, vegetative cover and runoff. Figure 1.2 shows the general topography of the study area. From this figure it can be seen that the Carbon-Emery area is bordered by mountains on the west, north, and northeast sides, and by plains on the south.

The Carbon-Emery area lies principally in the West Colorado Hydrologic Area and is composed of the Nine Mile Creek, Price, San Rafael, Dirty Devil River, and lower Green hydrologic sub-basins.

The climate of the study area varies from a mountain-forest climate to an extreme arid desert climate. While the climate varies according to topography there are two factors which can be singled out that play important roles in determining the climate of an area. These are normal annual precipitation and potential evapotranspiration. Figure 1.3 shows the normal annual precipitation for the study area. Precipitation varies from less than 6 inches per year in low lying

FIGURE 1.1

State of Utah

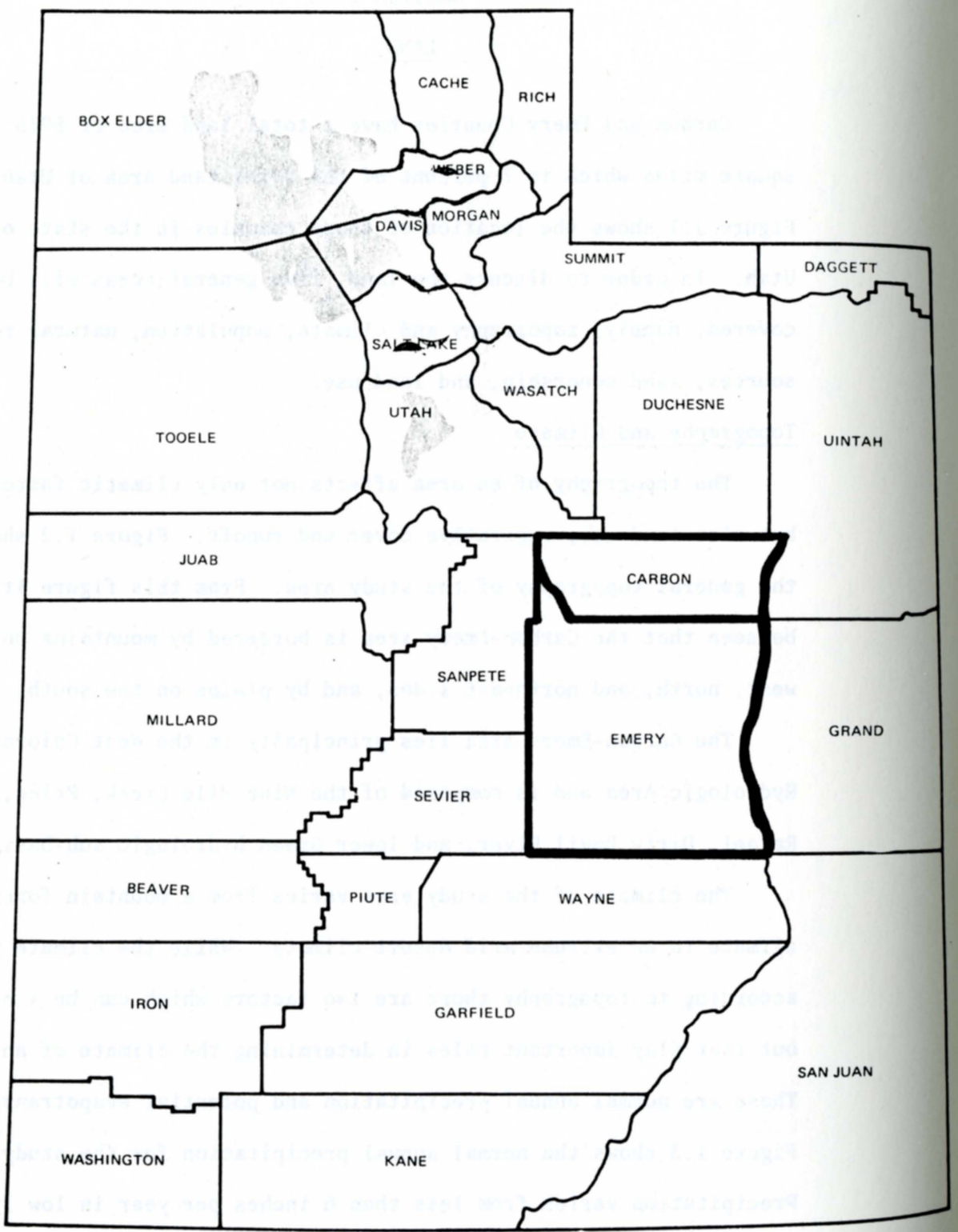
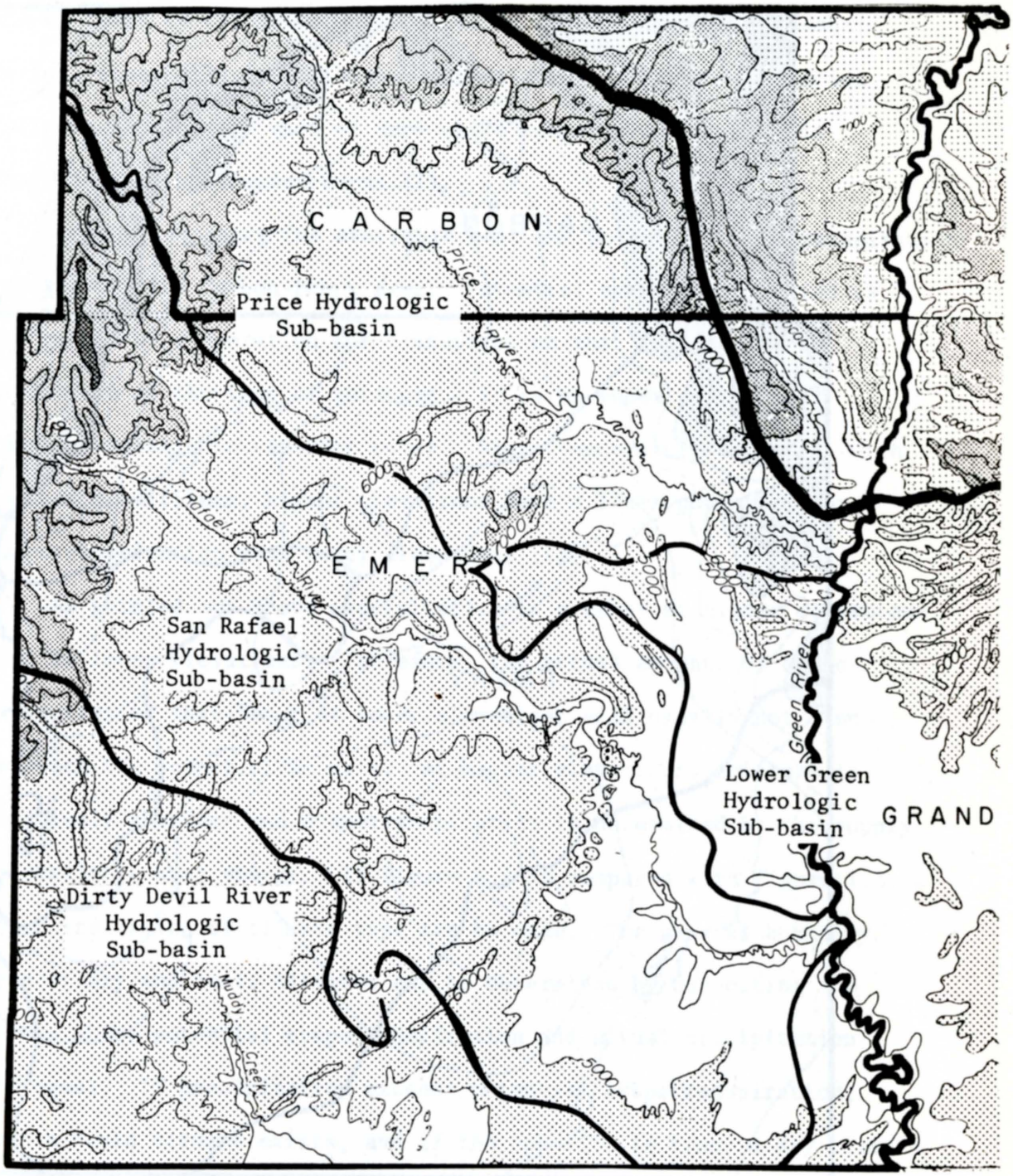


FIGURE 1.2

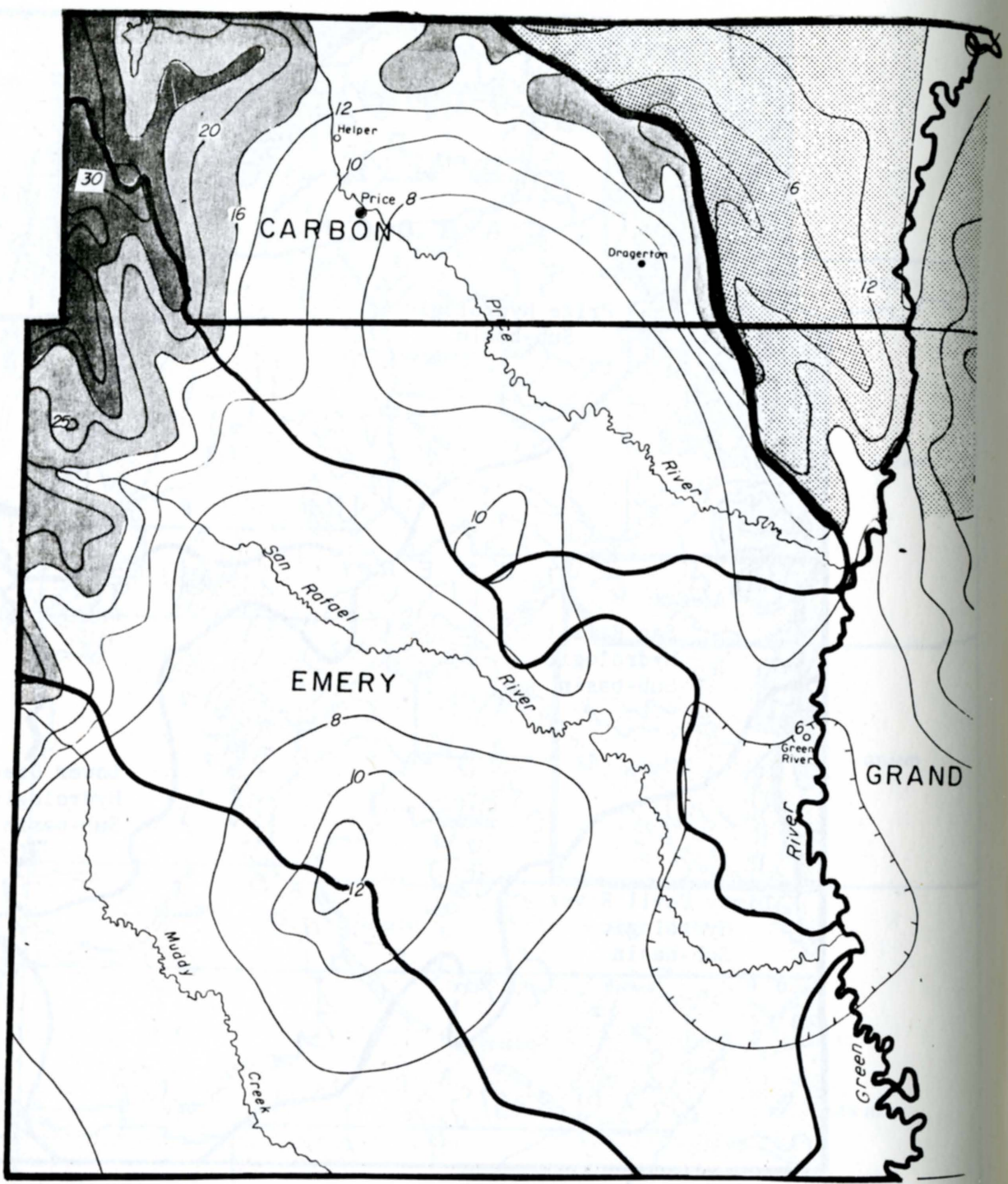
TOPOGRAPHY



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, September 1971.

FIGURE 1.3

NORMAL ANNUAL PRECIPITATION



EXPLANATION

—10— Isohyetal line (inches)

10 Inches or less

10 – 16 Inches

16 – 25 Inches

Over 25 Inches

Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, September 1971.

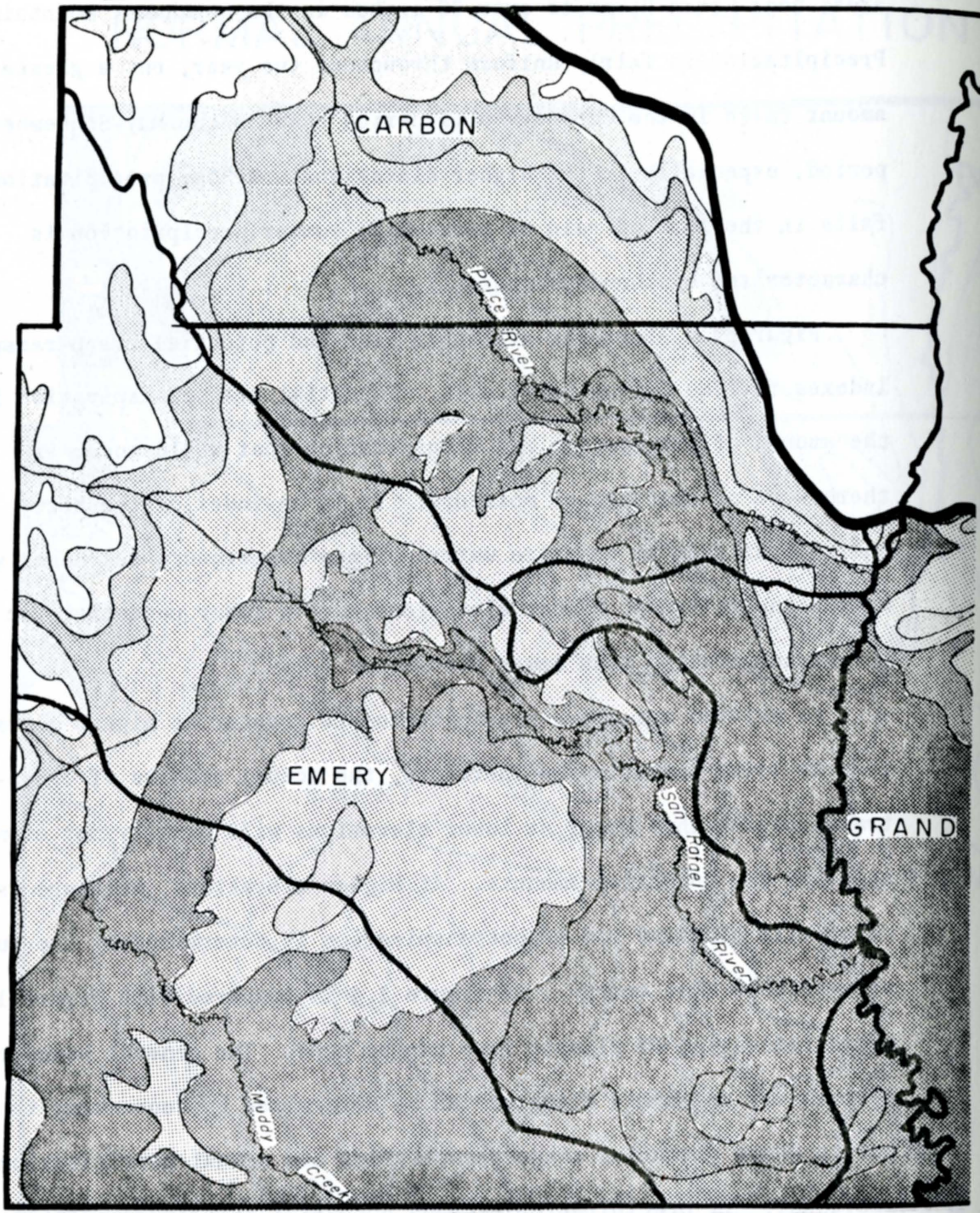
areas near Green River to over 30 inches in the northwest mountains. Precipitation is fairly uniform throughout the year, but a greater amount falls in the October-April period than in the May-September period, especially in the higher elevations. Winter precipitation falls in the form of rain or snow while summer precipitation is characterized by thunderstorms (1).

Figure 1.4 shows the available heat and potential evapotranspiration indexes for the Carbon-Emery area. Potential evapotranspiration is the amount of evaporation and transpiration that would occur if there were no shortage of moisture. It is an index of the heat energy available to vaporize water. Since temperature decreases with increasing altitude, higher elevations have a lower potential for evapotranspiration than lower elevations (1).

As pointed out above precipitation is greater at higher elevations than at lower elevations. Therefore, the actual amounts of evapotranspiration that occur at lower elevations will usually not even approach the potential amounts. At higher elevations, moisture is relatively abundant and evapotranspiration is determined by the supply of available heat energy. If figure 1.4 is compared with figure 1.3, a rough indication of climate type can be made. The general boundary between dry and humid climates can be determined by connecting the points where potential evapotranspiration and actual precipitation are equal. If precipitation exceeds potential evapotranspiration, then a humid climate exists, and if the opposite is true, a dry climate exists. In a dry climate, permanent streams cannot originate because

FIGURE 1.4

AVAILABLE HEAT AND POTENTIAL EVAPOTRANSPIRATION INDEXES



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972.

EXPLANATION

FROST FREE PERIOD HEAT UNITS	ANNUAL POTENTIAL EVAPOTRANSPIRATION
Less than 2,000	Less than 18 Inches
2,000 – 3,000	18 – 21 Inches
3,000 – 4,000	21 – 24 Inches
4,000 – 5,000	24 – 27 Inches
5,000 – 6,000	27 – 30 Inches
6,000 – 7,000	30 – 33 Inches

no surplus water exists to maintain a constant groundwater table (1).

Population

Between 1950 and 1970 both Carbon and Emery counties experienced a decline in population. In Carbon County the decrease was 26% and in Emery County the decrease was 7.4% (2). This decrease in population was the result of out migration of young people who were forced to go elsewhere to find employment. This was a result of decreased demand for coal which eliminated jobs in mines (3). Since 1970 the situation has reversed itself and the population of both counties has increased. Table 1.1 shows the population of each county for the years 1960 to 1970 and some estimates for 1973, 1974 (3,4).

Along with an increase in coal mining, Utah Power and Light Company has constructed the Huntington Generating Plant Unit #1 and construction has started on the North Emery Generating Plant. These activities have resulted in an increase in population in recent years, with a greater increase yet to come. It is expected that population will double in the next ten years in Carbon and Emery counties (5).

Natural Resources

The natural resources in the Carbon-Emery area consist primarily of water, land, and minerals. Water is discussed in detail in another section of this study. This section will be a discussion of soil, vegetable and mineral resources of Carbon and Emery counties.

Soils. The soils of the Carbon-Emery area are used chiefly

TABLE 1.1

Population

CARBON COUNTY	1960	1970	1973[a]	1974[a]	Pop. Density (persons/sq. mile)
Castle Gate	321	205			
Clear Creek	123	31			
East Carbon City					
Columbia	419	235			
Dragerton	2,959	1,614			
Helper	2,459	1,964	2,000		
Hiawatha	439	166			
Price	6,802	6,218	6,300		
Scofield	158	71			
Sunnyside	1,740	485			
Wellington	1,066	922			
All Others	4,649	3,736			
Carbon County Total	21,135	15,647	17,000	17,700	10.6
EMERY COUNTY					
Castle Dale	617	541			
Cleveland	261	244			
Elmo	175	141			
Emery	326	216			
Ferron	386	663			
Green River	1,075	1,033	1,035		
Huntington	787	857	1,200		
Orangeville	571	511			
All Others	1,397	995			
Emery County Total	5,546	5,137	6,100	6,200	1.2
Total Study Area	26,681	20,784	23,100	23,900	4.0

a - Estimates

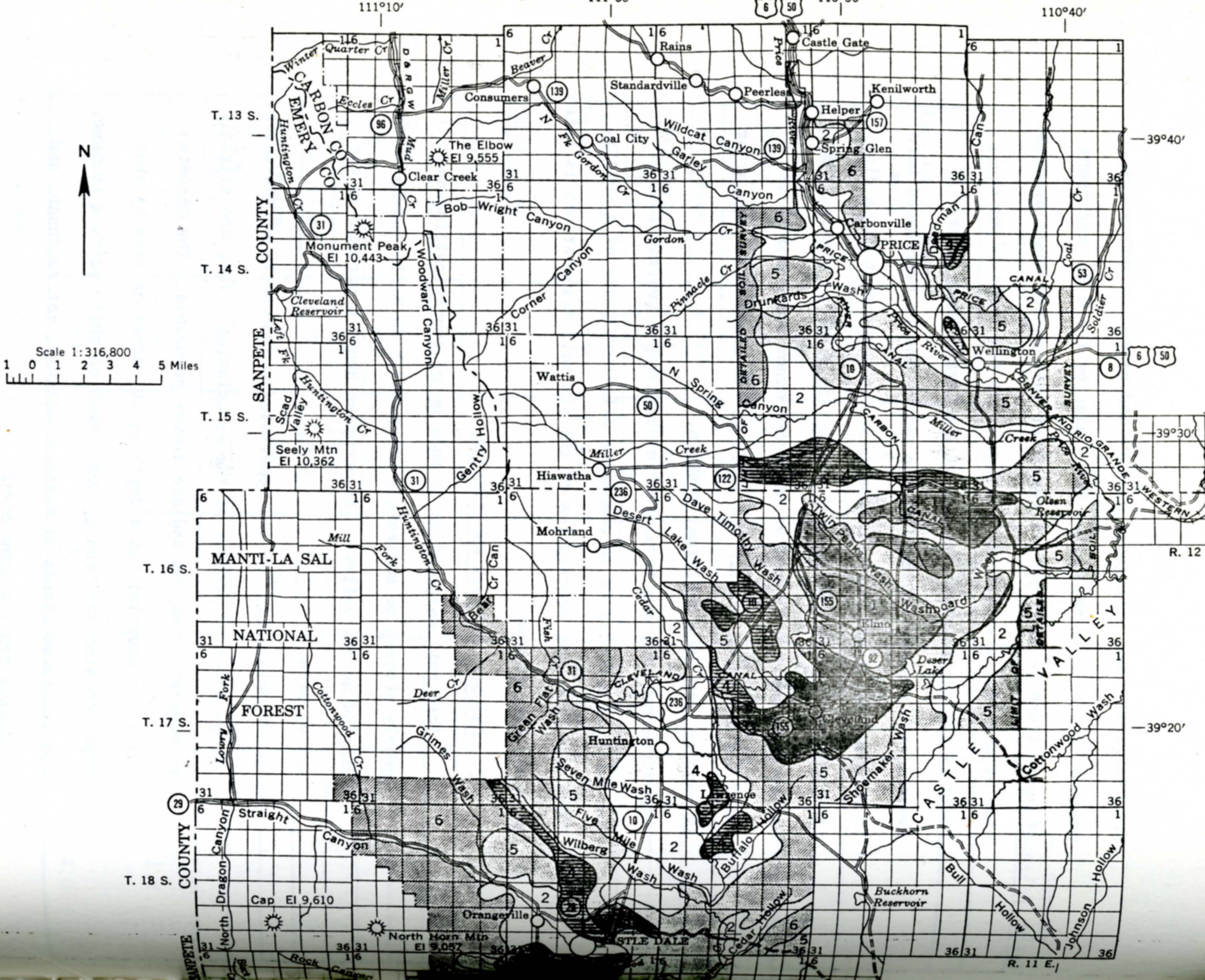
for irrigated crops, irrigated pasture and range. A survey was made on the soils of the Carbon-Emery area by the U.S. Department of Agriculture in 1970 (6). A result of this survey was a description of six soil associations which make up the types of soils found in the agricultural regions of the Carbon-Emery area. A general soil map was included in the survey and is reproduced here in Figure 1.5. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A general soil map is useful in obtaining a general idea of the soils in a county or in comparing different parts of a county. First the following description of the six soil associations is taken from the Soil Survey.

1. Chipeta-Killpack Association

This soil association is made up of gently rolling and gently sloping to moderately steep soils on hills and in intermingled narrow valleys. It occupies about 6 percent of the survey area.

Chipeta soils, on the upper slopes and crests of the hills, occupy about 60 percent of the association. They are slightly to moderately saline and are slowly permeable. The Chipeta soils are underlain at a depth of 20 inches or less by shale that contains salt and gypsum. Much of their surface is bare, but scattered stands of Nuttall saltbush, mat saltbush, and shadscale provide some cover.


111°10′
111°00′
110°50′
110°40′
39°40′
39°30′
39°20′
T. 13 S.
T. 14 S.
T. 15 S.
T. 16 S.
T. 17 S.
T. 18 S.
R. 12 E.
R. 11 E.
N
Scale 1:316,800
1 0 1 2 3 4 5 Miles
CARBON CO
EMERY CO
SANPETE COUNTY
SANPETE COUNTY
MANTI-LA SAL
NATIONAL
FOREST
CASTLE VALLEY
Castle Gate
Rains
Standardville
Peerless
Helper
Kenilworth
Spring Glen
Consumers
Coal City
Clear Creek
The Elbow El 9,555
Monument Peak El 10,443
Carbonville
PRICE
Wellington
Wattis
Hiawatha
Mohrland
Seely Mtn El 10,362
Cleveland Reservoir
Olsen Reservoir
Desert Lake
Elmo
Cleveland
Huntington
Lawrence
Orangeville
CASTLE DALE
Cap El 9,610
North Horn Mtn El 9,057
Buckhorn Reservoir
Winter Quarter Cr
Eccles Cr
Miller Cr
Beaver Cr
Mud Cr
Huntington Cr
Bob Wright Canyon
Gordon Cr
N Fk Gordon Cr
Wildcat Canyon
Garley Canyon
Price River
Corner Canyon
Pinnacle Cr
Woodward Canyon
Gentry Hollow
Left Fk
Scad Valley
Drunkards Wash
N Spring Canyon
Miller Creek
Deadman Can
Coal Cr
Soldier Cr
Dave Timothy Wash
Desert Lake Wash
Twin Peaks Wash
Washboard Wash
Cedar Cr
Mill Fork
Bear Cr Can
Fish Cr
Deer Cr
Cottonwood Cr
Grimes Wash
Green Flat Wash
Seven Mile Wash
Five Mile Wash
Wilberg Wash
Buffalo Hollow
Shoemaker Wash
Cottonwood Wash
Bull Hollow
Johnson Hollow
Cedar Hollow
Lowry Fork
North Dragon Canyon
Straight Canyon
Rock Canyon
D & R G W
DENVER AND RIO GRANDE WESTERN
PRICE CANAL
CARBON CANAL
CLEVELAND CANAL
LIMIT OF DETAILED SOIL SURVEY
6 50
139
157
96
31
53
8
50
10
122
236
155
29

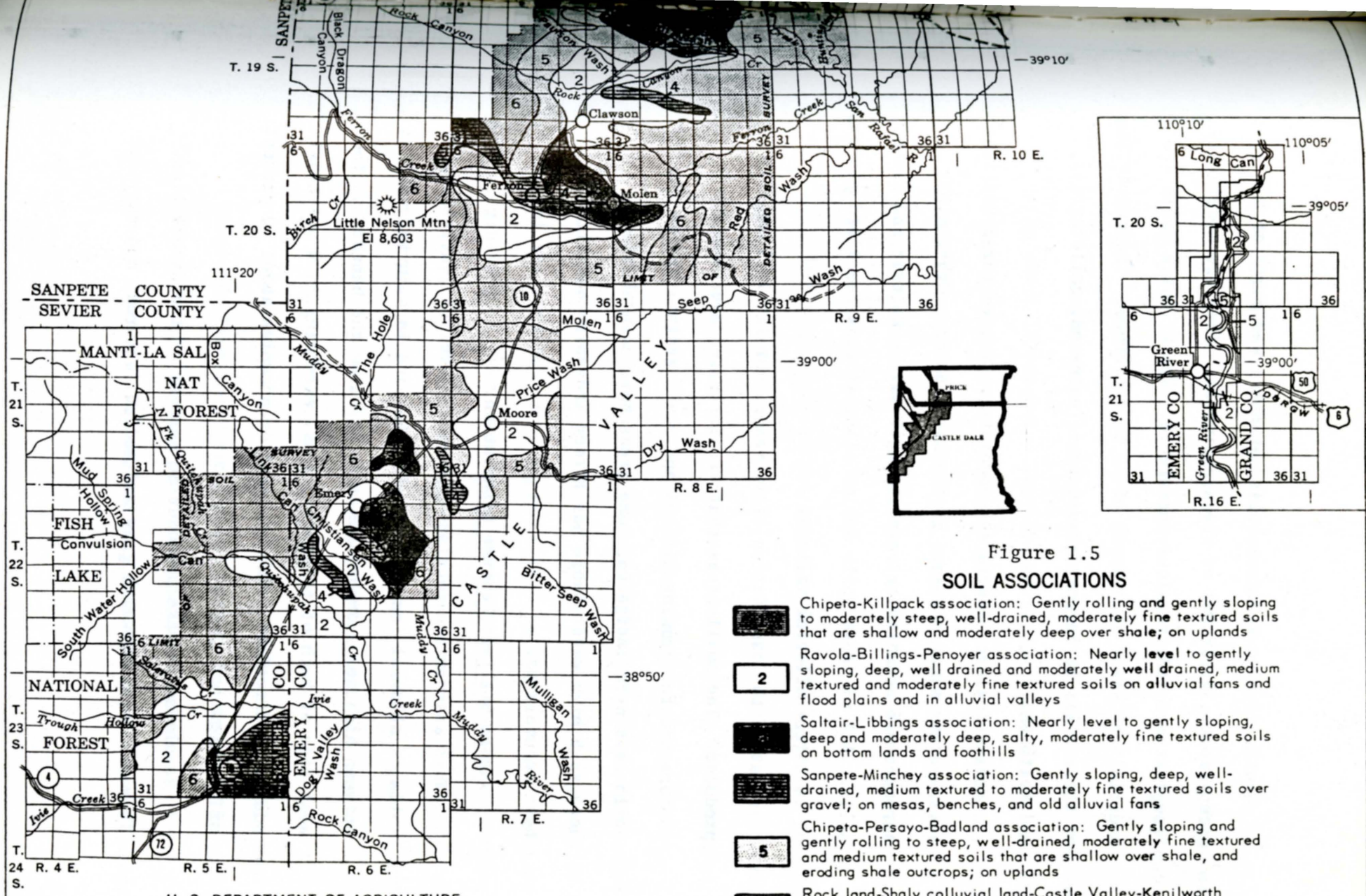


Figure 1.5

SOIL ASSOCIATIONS

- Chipeta-Killpack association: Gently rolling and gently sloping to moderately steep, well-drained, moderately fine textured soils that are shallow and moderately deep over shale; on uplands
- 2 — Ravola-Billings-Penoyer association: Nearly level to gently sloping, deep, well drained and moderately well drained, medium textured and moderately fine textured soils on alluvial fans and flood plains and in alluvial valleys
- Saltair-Libbings association: Nearly level to gently sloping, deep and moderately deep, salty, moderately fine textured soils on bottom lands and foothills
- Sanpete-Minchey association: Gently sloping, deep, well-drained, medium textured to moderately fine textured soils over gravel; on mesas, benches, and old alluvial fans
- 5 — Chipeta-Persayo-Badland association: Gently sloping and gently rolling to steep, well-drained, moderately fine textured and medium textured soils that are shallow over shale, and eroding shale outcrops; on uplands
- 6 — Rock land-Shaly colluvial land-Castle Valley-Kenilworth association: Gently sloping to very steep, shallow to deep, gravelly and stony soils, and rock land; on benches and hills

November 1969

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
CARBON-EMERY AREA, UTAH

NOTE—

This map is intended for general planning. Each delineation may contain soils having ratings different from those shown on the map. Use detailed soil maps for operational planning.

Gently sloping Killpack soils, on the lower parts of hills, occupy about 30 percent of the association. They are moderately fine textured and are slowly permeable. The Killpack soils are underlain by shale at a depth of 20 to 40 inches. The vegetation on these soils is largely shadscale, greasewood, galletagrass, and saltbush.

Medium-textured Ravola and moderately fine textured Billings soils occupy minor acreages in the association. Other minor acreages are occupied by very strongly saline Saltair and Cache soils. All of these soils are on alluvial fans, on flood plains, or in narrow alluvial valleys.

Most of the association is in range, but little forage is produced. The small areas that are irrigated are used for pasture and for growing alfalfa and small grains. Where the soils have been irrigated, some areas have been abandoned because a high water table has formed and salta and alkali have accumulated.

2. Ravola-Billings-Penoyer Association

This association consists of nearly level to gently sloping soils on alluvial fans and flood plains and in alluvial valleys between high mesas or benches. It is below the benches on the west side of much of the survey area, extending in a northeast-southwest direction. The association occupies about 30 percent of the area.

Ravola soils make up about 50 percent of the association. They are light brownish gray and medium textured, and they are

well drained and moderately permeable.

Billings soils, generally on the lower alluvial fans, make up about 20 percent. They are also light brownish gray but are slowly permeable.

Penoyer soils, in the western part of the association, make up about 15 percent. They are on stream flood plains and alluvial fans in the mouths of canyons. Where these soils occur, fruit can be produced to a limited extent because air drainage is better and the hazard of frost damage is less than in most other parts of the survey area.

Minor acreages in the association are occupied by somewhat poorly drained Hunting soils, moderately coarse textured Green River soils, and coarse textured Beebe soils. Small patches of saline-alkali soils occupy other small acreages.

This association has the most potential for production of irrigated crops of any in the survey area. In fact, a major part of the alfalfa, corn, sugar beets, small grains, and fruit originating in the Carbon-Emery survey area is produced on these soils. The soils are moderately low in natural fertility. Where they are properly irrigated, however, response is good to applications of manure and commercial fertilizer.

3. Saltair-Libbings Association

This association occupies bottom lands and foothills near the towns of Cleveland, Castle Dale, Ferron, and Emery. The soils are mainly saline, are poorly drained, and are nearly level or gently sloping. The vegetation is saltgrass, wiregrass, sedges,

and greasewood. Bare areas are common. The association occupies about 6 percent of the survey area.

Saltair soils make up about 65 percent of the association. They are moderately fine textured and have 2 percent salt within 20 inches of the surface. Bare spots are extensive and are more common where the water table is below a depth of 30 inches.

Libbings soils occupy 20 percent of the association and occur on the lower foot slopes of the shale hills that border the bottom lands. They are fine textured, are moderately deep over shale, and have 2 percent salt within 20 inches of the surface. Their profile contains distinct gypsum horizons.

Rafael soils occupy about 12 percent of the association. They are moderately fine textured, and they contain less salt and produce more vegetation than the other soils in the association.

The rest of the association is made up of minor areas of deep, fine-textured, poorly drained, salty soils.

This association is used for pasture, but the vegetation is poor in quality. The wettest areas can be pastured only in winter. Drainage and reclamation are extremely difficult and are not economically feasible.

4. Sanpete-Minchey Association

This association consists mainly of isolated mesas or benches and their steep colluvial side slopes. The mesa tops are 50 to 200 feet or more above the surrounding area. The mesas are remnants of a strongly dissected alluvial fan or plain formed of alluvium that was deposited by glacial melt water. Soils on the mesas formed in this glacial outwash. The vegetation is

mainly galletagrass, bud sage, winterfat, and shadscale. This association occupies about 6 percent of the survey area and lies mainly on the west side of it.

Sanpete soils occupy 57 percent of this association. They are very gravelly or cobbly, moderately coarse textured, and well drained, and they occur on the upper parts of the mesas near the plateaus.

Minchey soils make up 23 percent of the association. They are nearly level, moderately fine textured, and well drained soils that are 20 to 60 inches deep over gravel and cobblestones.

Palisade soils make up about 15 percent of the association. They are medium textured but otherwise are similar to the Minchey soils.

The rest of the association is made up of minor areas of steep Shaly colluvial land on the steep sides of mesas, and of fine-textured, strongly alkaline Harding soils that occupy a bench a few miles northeast of Emery.

Most of this association is used for grazing. Alfalfa, corn, small grains, and pasture crops are grown. These soils need large amounts of phosphorus, especially for legumes. Corn, small grains, and pasture respond to applications of nitrogen.

5. Chipeta-Persayo-Badland Association

This association is made up of gently sloping and gently rolling to steep soils on hills, and of bare areas consisting mainly of eroded shale outcrops. It occupies about 30 percent of the survey area and is mainly on the east and west sides of Castle Valley.

The Chipeta and Persayo soils together make up 80 percent of the association. The Chipeta soils are saline, moderately fine textured, and slowly permeable. They are well drained and are 10 to 20 inches deep over gypsum-bearing shale. The vegetation is a scant cover of mat saltbush and Nuttall saltbush.

The Persayo soils are medium textured and moderately fine textured, and they are moderately permeable. They are also well drained and are typically 10 to 20 inches deep over gypsum-bearing shale. The vegetation is mainly galletagrass and shadscale.

Badland makes up about 13 percent of the association. It consists of the bare areas on eroding shale outcrops.

A minor part of the association is made up of Cedar Mountain soils, Gullied land, and areas of wet alluvial land. The Cedar Mountain are fine-textured, reddish, alkali, gently rolling to steep soils on hills along the eastern edge of the survey area.

This association is used exclusively for grazing. The soils have no potential for cultivation, but they have some potential for irrigated pasture. Runoff washes large amounts of sediment from the areas of Badland and Gullied land.

6. Rock Land-Shaly Colluvial Land-Castle Valley-Kenilworth Association

This association is made up of benches and hills, dissected in places by deep ravines. Sandstone outcrops, stone and boulders are common. The vegetation is mainly juniper, pinon, Mormon-tea, shadscale, pricklypear, squirreltail, and some sagebrush. The association comprises about 22 percent of the survey area and is mainly in the western and southwestern parts.

Rock land and Shaly colluvial land make up about 60 percent

of the association. Rock land mainly consists of very steep to perpendicular sandstone and shale outcrops. Where there is soil material, the surface is more than half covered by cobblestones, other stones and boulders. Small areas are accessible to livestock and wildlife, but most of the area is too steep and rocky for grazing.

Shaly colluvial land contains fewer rock outcrops than Rock land, and the outcrops are mainly shale. Soil material is more abundant, and coarse fragments on the surface are mainly cobblestones. The slopes range from 15 to 40 percent. The only use is spring and fall range.

Castle Valley and Kenilworth soils make up about 40 percent of this association. The Castle Valley soils are medium textured and typically are less than 20 inches deep over sandstone. Sandstone outcrops are common. These soils are used for grazing, and juniper is cut for posts.

The Kenilworth soils are deep, stony, and moderately coarse textured. They are gently sloping to steep and occur on high benches, mainly below the mountains. Grazing is the main use, but in places juniper is cut for fence posts. Some areas have been cleared for seeding, but stones and inadequate amounts of rain interfere with this work.

Minor areas of the Palisade, Penoyer, Minchey, Ravola, and Sanpete soils are also in this association.

The soil survey covered 478,473 acres or about 12.6 percent of the total land area of the two county region. The area covered by the survey comprised nearly all the lands contributing to the agricultural

effort for the study area. Of the 478,473 acres in the survey about 13 percent is presently some type of cropland.

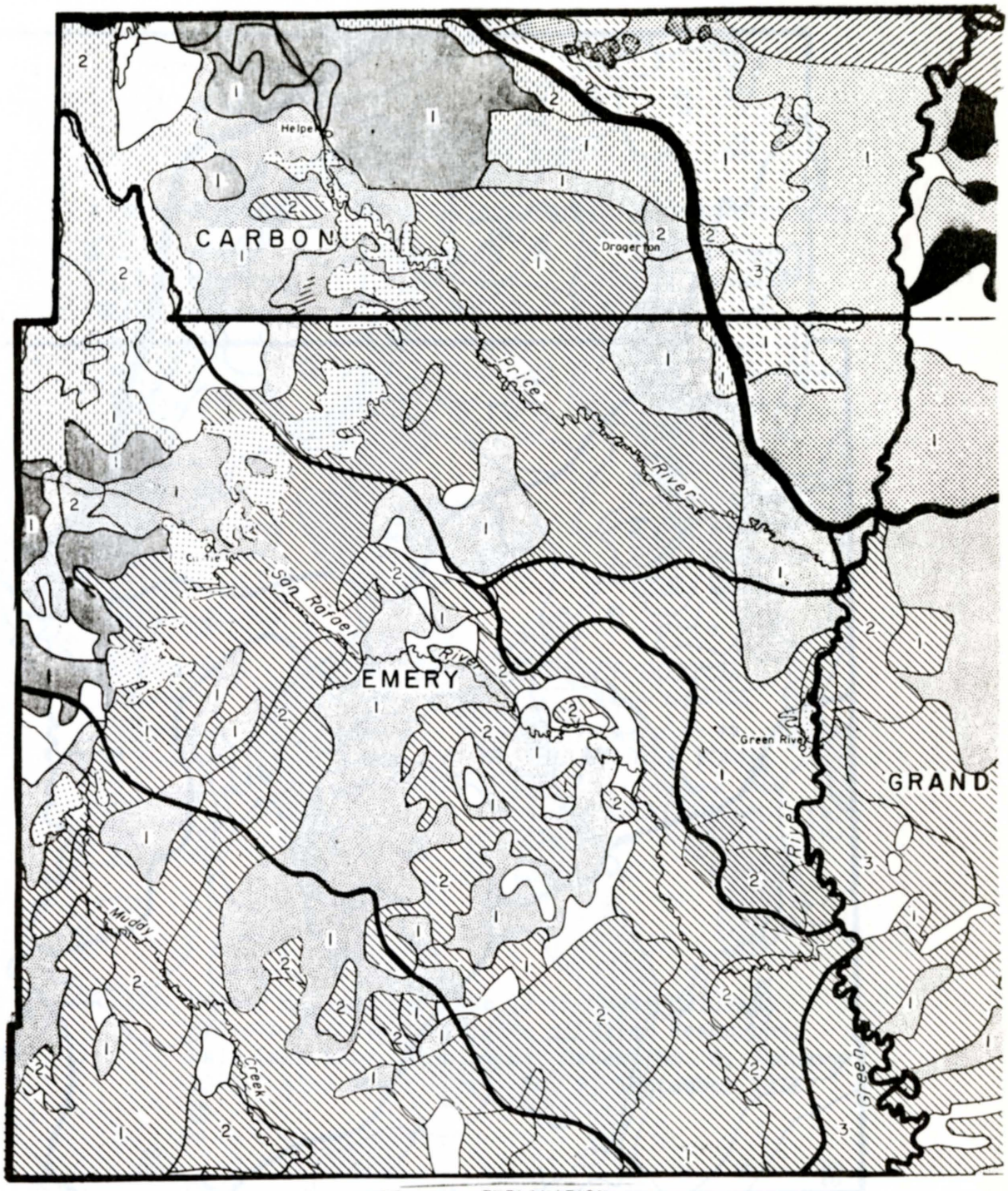
From the descriptions of the soil associations given it can be concluded that approximately 36 percent of the survey area contains soils conducive to agriculture. Of this roughly one-third is presently irrigated cropland with a little non-irrigated cropland. To produce reasonable quantities of crops these soils must be properly irrigated and then they will show good response to applications of fertilizer, which is necessary due to low natural fertility. Even so, about half of the remaining two-thirds of the potentially arable land can only be used as pasture for cattle. Figure 1.15 shows the irrigated and potentially arable land in the Carbon-Emery area.

Range. Figure 1.6 shows the range types found in the Carbon-Emery area. Most of the range is winter range with very little summer range. The only summer range is located in the mountainous areas in the northwest and northeast areas of the region. The best range sites are located in bottom lands and flood plains usually near streams. The greatest potential production of these ranges is 2500 pounds of, air, dry, forage per acre in favorable years. Figure 1.7 shows the location and types of vegetation in the study area.

Mineral Industry. The mineral industry is the lifeblood of Carbon and Emery counties. It is the largest employer for the combined area. In 1973 the employment in mining was 1,670 while employment in government was 1,665 persons (1). The next largest employer was wholesale and retail trade with 1,405 employed. Employment in the mining industry

FIGURE 1.6

RANGE TYPES



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, September 1971.

FIGURE 1.7

VEGETATIVE TYPES

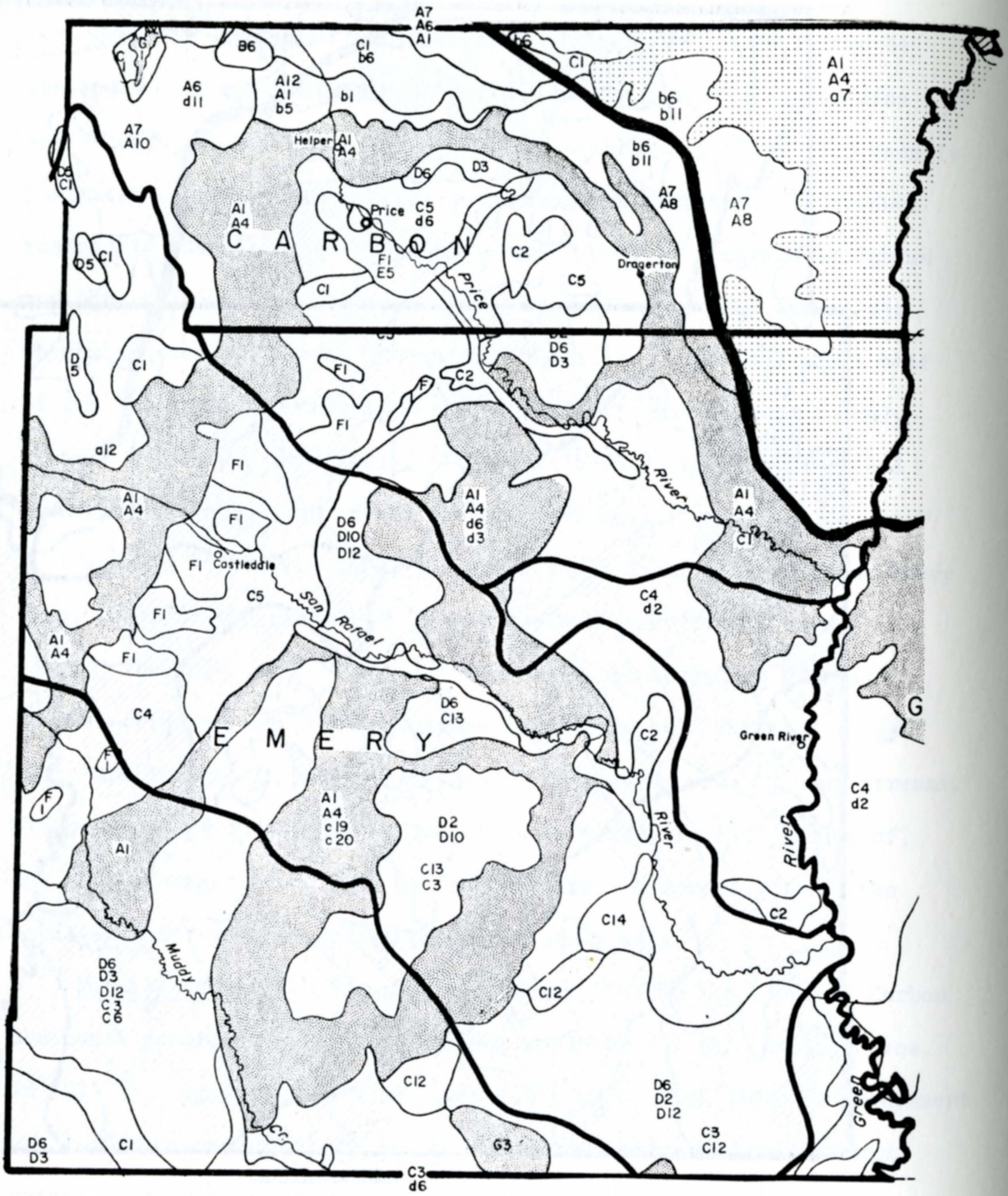
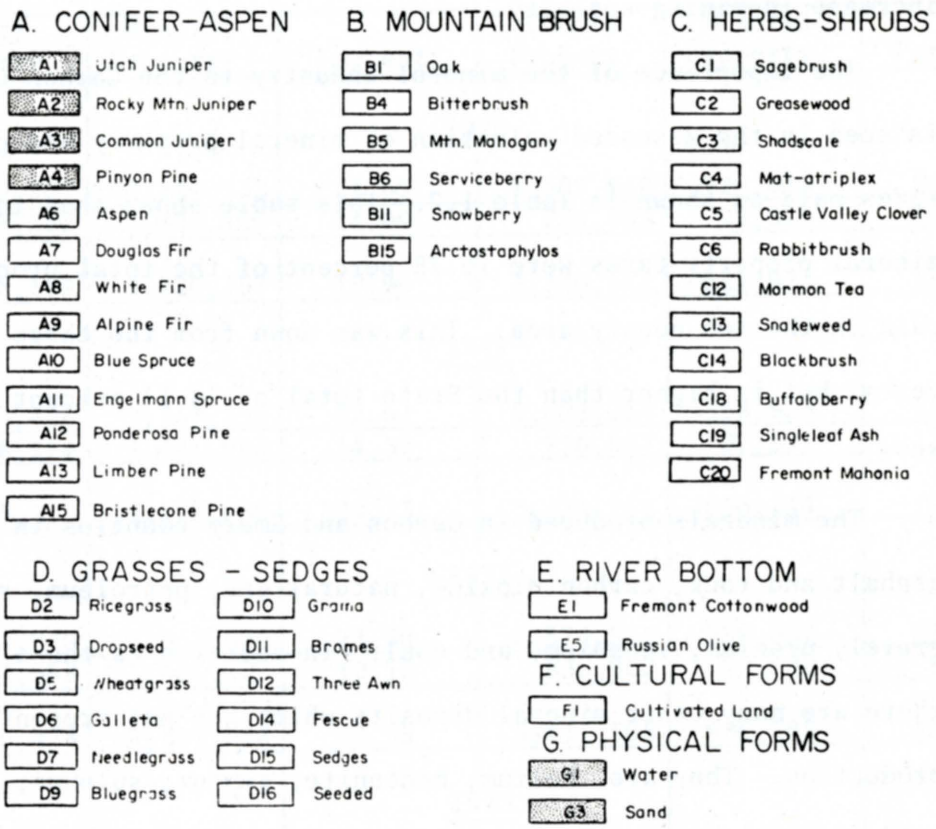


FIGURE 1.7 CON'T



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, September 1971.

was only slightly more than in government, however, employment in other sectors including government which directly or indirectly support the mining industry make it the most important industry in the study area. This will become even more pronounced as the expected increase in population occurs, because this increase is in response to an increase in mining activity.

The importance of the mineral industry to the Carbon-Emery area is seen in the assessed valuation of mineral property and property taxes paid as shown in Table 1.2. This table shows that in 1973 mineral property taxes were 16.78 percent of the total property taxes paid in the two county area. This was down from the three previous years, but is higher than the State total of 14.13 percent for the year 1973.

The minerals produced in Carbon and Emery counties in 1973 were asphalt and rock, carbon dioxide, natural gas, petroleum, sand and gravel, uranium, vanadium, and coal. In addition to those produced there are many other mineral deposits which are not presently under production. They are, helium, bentonite, gypsum, sulphur, copper, gold, lead, manganese, silver, zinc, barite, gypsum, and oil impregnated rock deposits.

Oil and natural gas production in the Carbon-Emery area has not been very significant compared to the State total. Table 1.3 gives

TABLE 1.3

Oil and Gas Production

	Oil - barrels				Gas - MCF*			
	Carbon	Emery	Area Total	Total Utah	Carbon	Emery	Area Total	Total Utah
1970	---	3,937	3,937	23,365,737	904,464	848,793	1,753,257	71,944,927
1971	---	4,655	4,655	23,629,674	544,568	527,689	1,072,257	73,974,275
1972	---	3,453	3,453	26,570,196	486,067	511,483	997,550	74,165,161
1973	---	1,261	1,261	32,676,807	421,533	451,514	873,047	77,011,695
1974	1,272	448	1,720	39,363,032	392,884	406,627	799,511	78,403,361

* MCF equals a thousand cubic feet at 15.02 psia, 60°F.

TABLE 1.2

Mineral Industry Tax Valuation
(dollars)

	ASSESSED VALUATION			PROPERTY TAX		
	County Property	Mineral Property	Percent	County Property	Mineral Property	Percent
			1970			
Carbon	33,639,907	7,284,332	21.65	2,605,848	526,419	20.20
Emery	10,188,282	1,436,425	14.09	734,463	95,515	13.00
Area Total	43,828,189	8,720,757	19.90	3,340,311	621,934	18.62
			1971			
Carbon	34,270,426	7,747,732	22.61	2,698,214	568,923	21.09
Emery	10,068,284	1,441,906	14.32	736,047	97,321	13.22
Area Total	44,338,710	9,189,638	20.73	3,434,261	666,244	19.40
			1972			
Carbon	34,084,070	7,963,033	23.36	2,574,546	558,057	21.67
Emery	13,852,358	1,406,625	10.15	836,962	78,538	9.39
Area Total	47,936,428	9,369,658	19.55	3,411,508	636,595	18.66
			1973			
Carbon	35,106,215	8,101,325	23.08	2,595,612	550,415	21.20
Emery	23,074,771	1,951,987	8.46	1,304,192	104,029	7.98
Area Total	58,180,986	10,053,312	17.28	3,899,804	654,444	16.78

oil and gas production data for the years 1970 through 1974 (7). Oil production was much less than one percent of the state total for the years represented, while natural gas production ranged from 2.4 percent of the state total in 1970 to one percent in 1974. Figure 1.8 shows the locations of the oil and gas fields in the Carbon-Emery area.

Oil-impregnated rock deposits is another source of oil in Carbon and Emery counties. The extent of these deposits are not known exactly but it is estimated that there exists between 4,180 and 4,860 million barrels. The majority of these deposits are in the Sunnyside area (3,500-4,000 million barrels). Figure 1.9 shows the location and names of the various deposits (8).

Uranium production in the study area is confined to Emery County. There are presently six operators mining uranium in Emery County. Table 1.4 lists the mines and their annual production ranges (9).

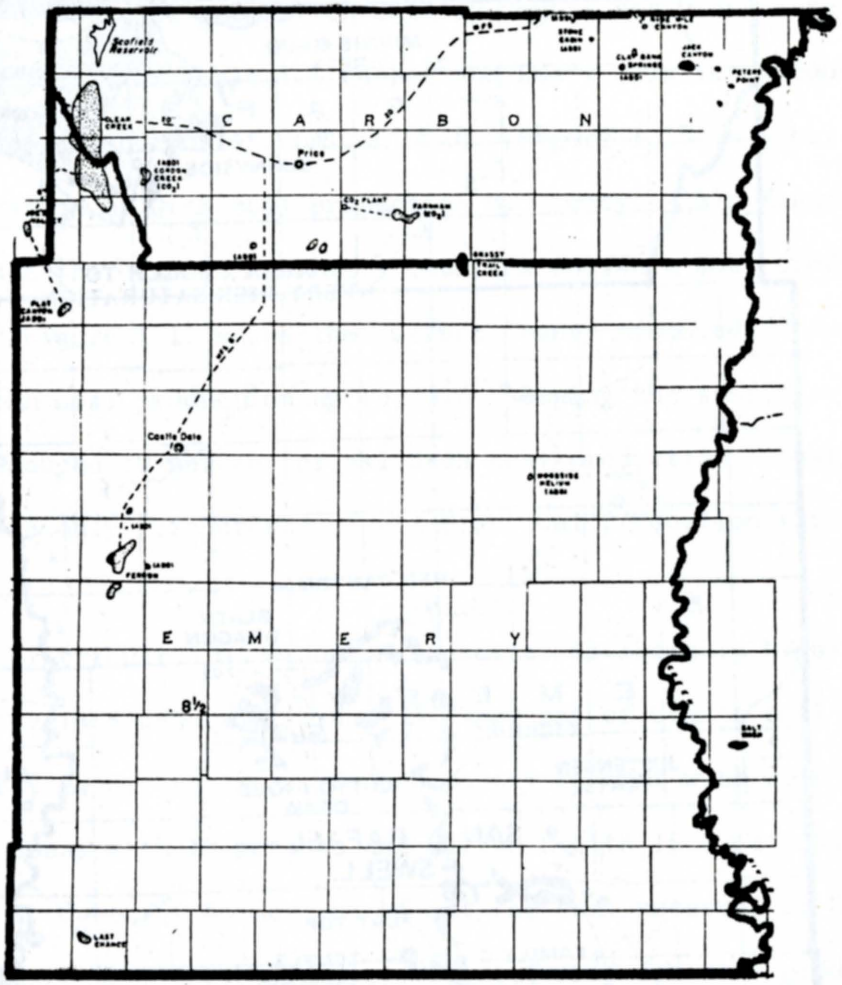
TABLE 1.4
Uranium Mines

1. Darlene #1 and 21 come-to-ite. . . . . 1-100 tons
2. Red #1 and #5, Incline #9. . . . . 1,000-100,000 tons
3. Dexter #7. . . . . 100-1,000 tons
4. Vanadium King Mine . . . . . Data Withheld
5. Incline #10. . . . . 100-1,000 tons
6. Newell Shaft . . . . . Data Withheld

Reserves in Emery County have not been totally defined but are considered sufficient to justify development work. This is based on reports by several companies which have acquired leases in Emery County (10).

FIGURE 1.8

OIL AND GAS FIELDS AND PIPELINES



Explanation

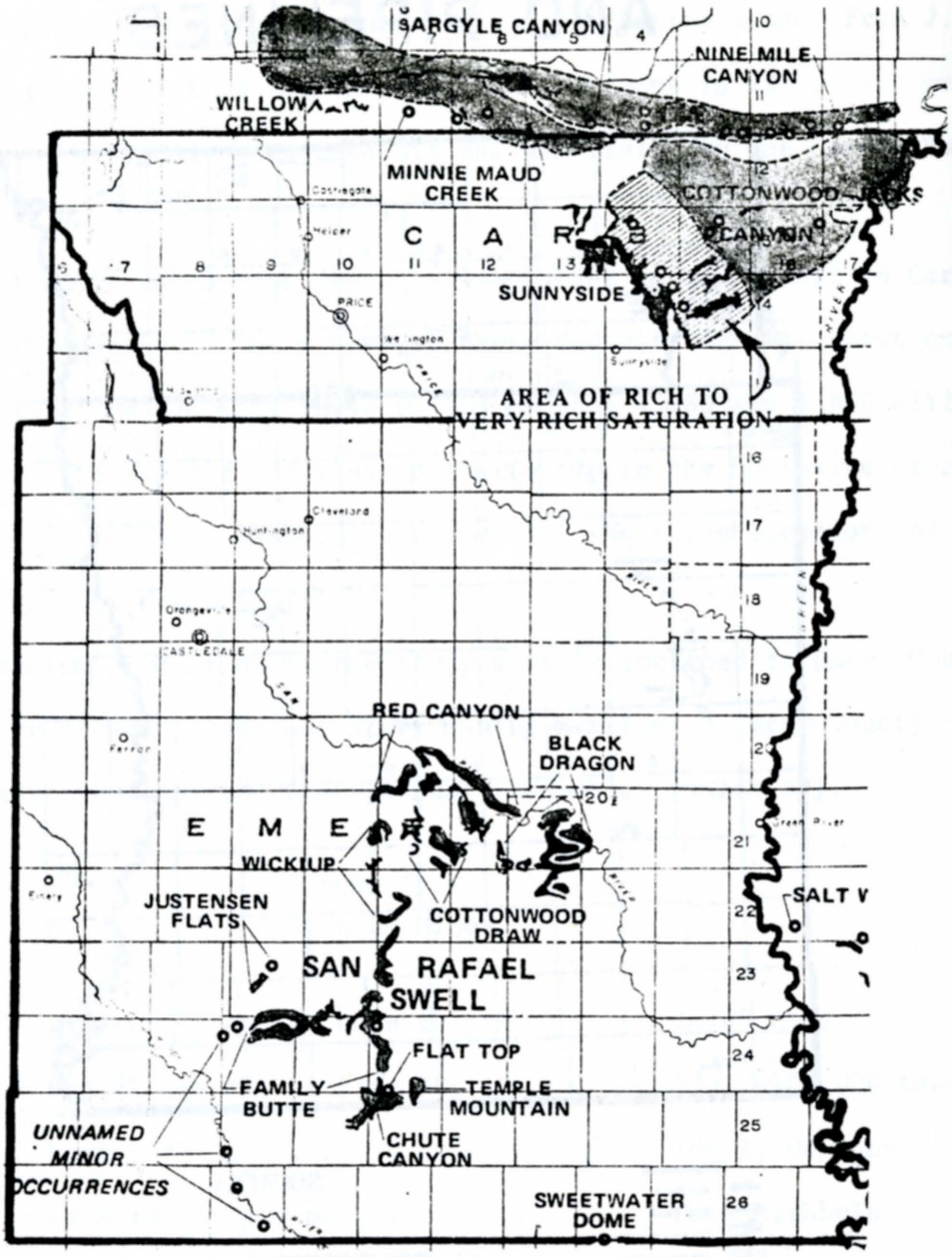
- Oil Field
- Gas Field
- Oil and Gas Field
- (ABD) Abandoned Field
- Oil Pipeline
- Gas Pipeline
- Δ Refinery
- L.R. Loading Rack

SOURCE:

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION ——— OIL AND GAS OPERATIONS

FIGURE 1.9

OIL IMPREGNATED ROCK DEPOSITS



EXPLANATION

DEPOSIT

Areal extent known; extent beneath cover inferred from outcrop or drilling information. Limit of extent beneath cover shown by dashed line where limit can be inferred from outcrop or drilling information. Lower limit is about 500 feet of cover.

DEPOSIT

Concentrated or of small areal extent.

SALT WASH DEPOSIT

Generally similar and grouped together (lines indicate grouping).

SOURCE: Utah Geological and Mineral Survey Map 33.

Coal is by far the most important mineral produced in the Carbon-Emery area. Approximately 97 percent of all the coal produced in Utah is produced in Carbon and Emery counties (1973 data). This percentage will increase as coal production in Carbon and Emery counties increases. Table 1.5 gives coal production data by county for Utah since 1955 (11). As can be seen from Table 1.5 Carbon and Emery counties account for most of the production of coal in Utah. Figure 1.10 is a bar-graph representation of Utah coal production by county. This figure makes it easy to see that Carbon and Emery counties dominate coal production in Utah. Figure 1.11 shows that Carbon County produced 77.7 percent of all Utah coal production up to 1970. During the same time Emery County produced 19 percent of all Utah coal production. Next is Summit County with only 1.5 percent of all Utah coal production through 1970 (12).

The distribution of Utah coal reserves is shown in Figure 1.12. Kane County in Southern Utah has 28.9 percent of Utah's coal reserves, the largest county reserve. Carbon County is next with 20.9 percent followed by Emery with 18 percent and Garfield with 15.2 percent. These four counties account for 83 percent of all the coal reserves of Utah (12). It is evident that they have a promising future for coal production. Figure 1.13 shows the major coal fields in the Carbon-Emery area. This figure shows how extensive the coal deposits of these counties are.

There are presently sixteen coal mines with recent production in Carbon and Emery counties. They are listed in Table 1.6 with their production ranges (10). In addition, the Rigby mine near Huntington, in

TABLE 1.5

Coal Production

($x10^3$ short tons)

	COUNTY								
	Carbon	Emery	Sevier	Summit	Kane	Iron	Garfield	Other*	State Total
1955	4,694	1,492	55	18	2	32	2	1	6,296
1956	4,937	1,480	47	17	2	37	1	--	6,522
1957	5,341	1,408	49	19	1	40	1	--	6,858
1958	3,956	1,266	50	18	1	35	1	--	5,328
1959	3,446	989	47	18	1	42	--	--	4,545
1960	3,698	1,137	49	20	*	*	1	50	4,955
1961	3,916	1,124	47	20	--	52	--	--	5,159
1962	3,105	1,077	49	20	--	46	--	--	4,297
1963	3,493	752	47	18	1	48	--	--	4,360
1964	3,752	848	47	17	2	54	--	--	4,720
1965	3,779	1,101	W	13	W	36	--	63	4,992
1966	3,380	1,170	W	15	2	W	--	68	4,635
1967	2,971	1,113	--	--	2	--	--	88	4,175
1968	3,062	1,167	--	13	2	--	--	73	4,316
1969	3,367	1,200	2	72	4	12	--	--	4,657
1970	3,349	1,292	*	W	--	--	--	92	4,733
1971	3,608	836	158	12	12	--	--	--	4,626
1972	3,044	1,569	184	6	--	--	--	--	4,802
1973	$3,614^p$	$1,697^p$	--	--	--	--	--	--	$5,500^p$
1974	--	--	--	--	--	--	--	--	$5,993^p$

Source: U.S. Bureau of Mines,"Minerals Yearbook," Various Years.

W - Withheld
-- No Production Data
* - Included in other to avoid disclosing individual company data.
p - Preliminary estimates.

FIGURE 1.10

UTAH COAL PRODUCTION BY COUNTY

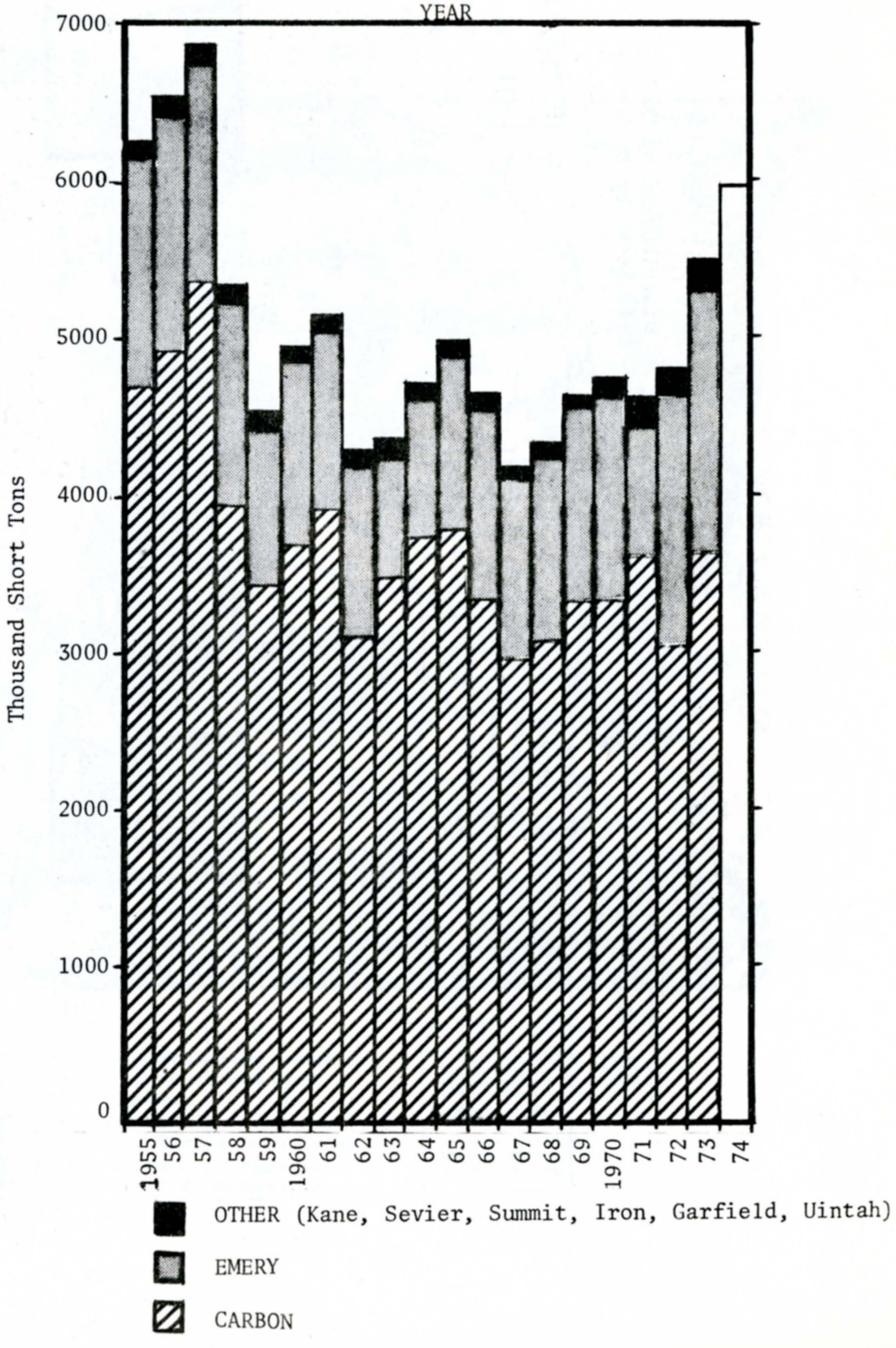


FIGURE 1.11

Utah Coal Production by
County Through 1970

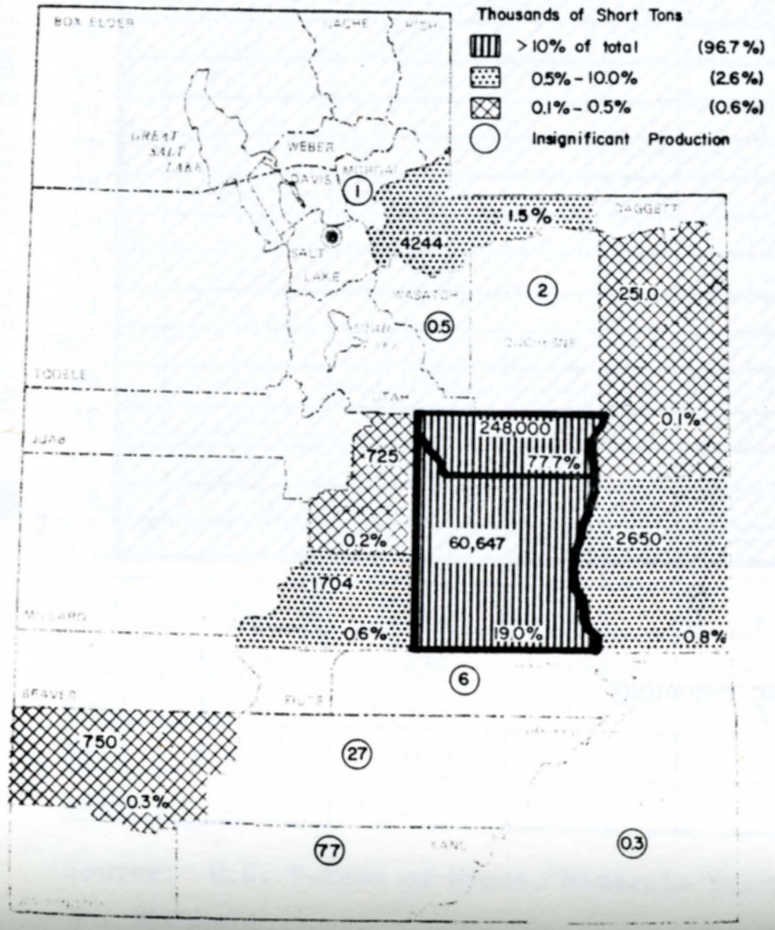
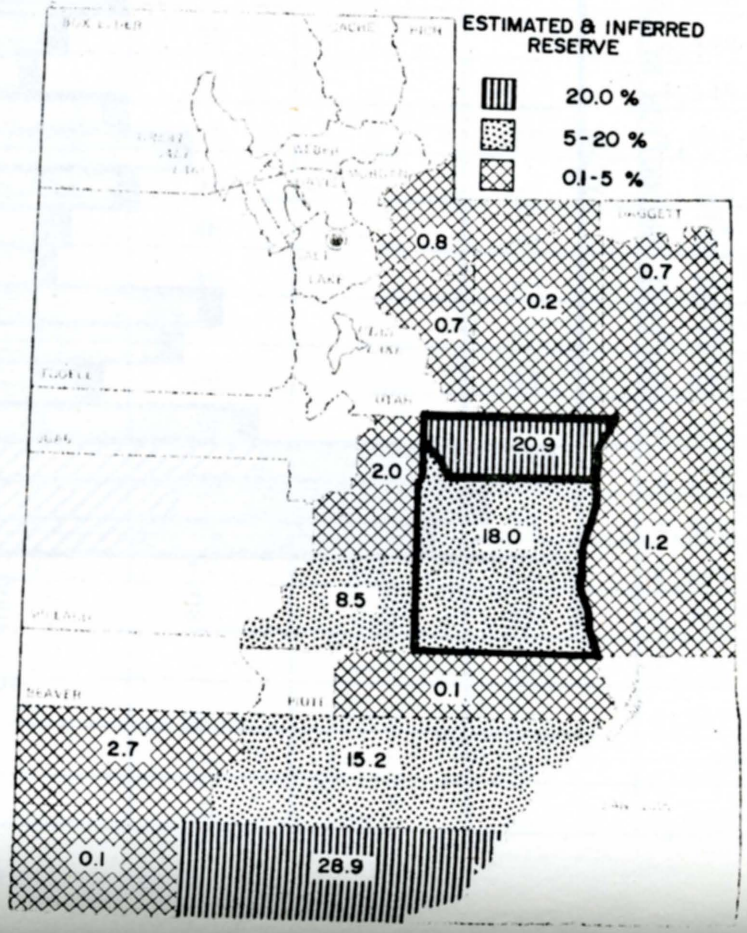


FIGURE 1.12

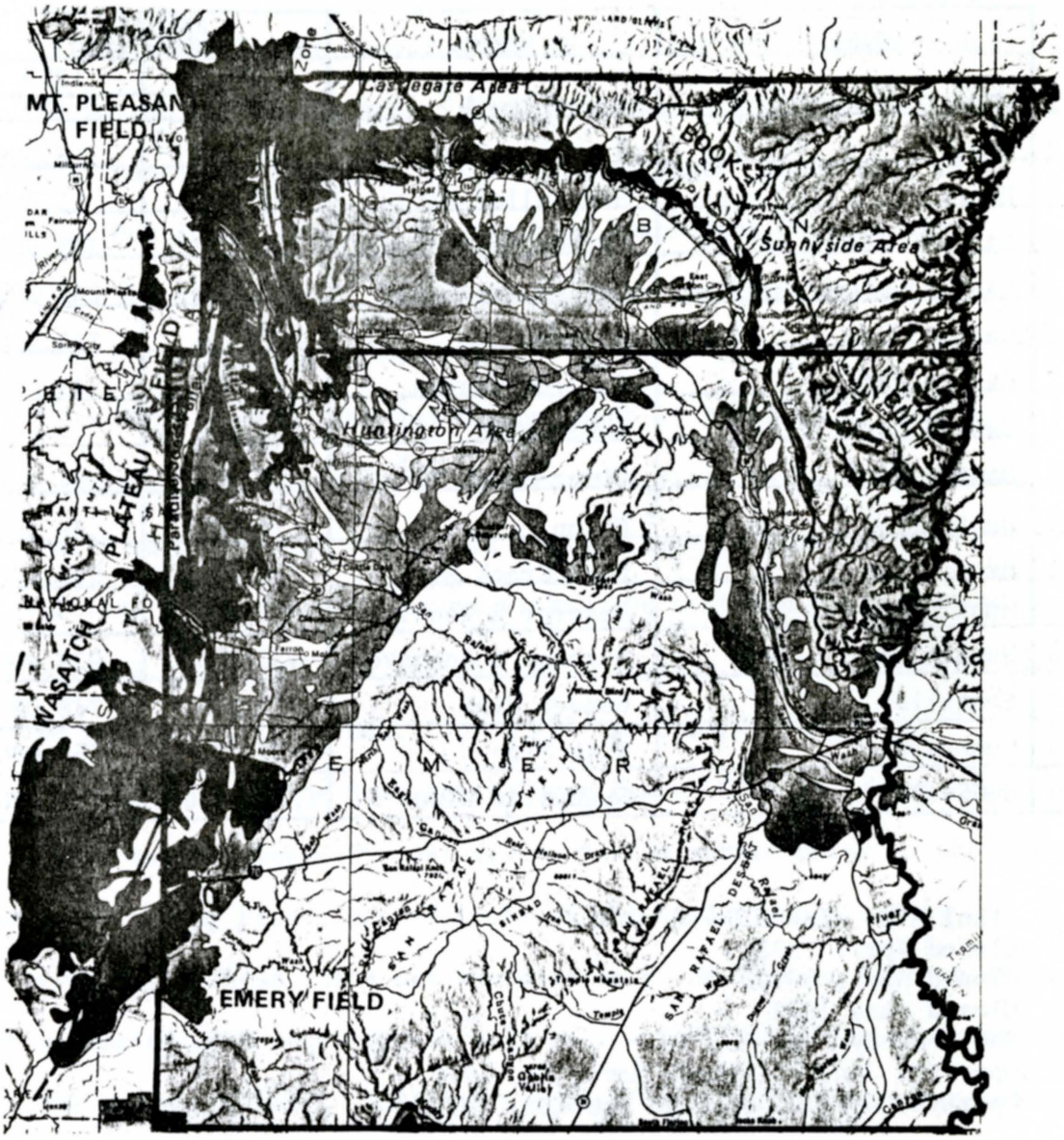
Distribution of Utah
Coal Reserves by County



Source: Doelling, H.H., Central Utah Coal Fields, Utah Geological and Mineral Survey, Monograph Series No. 3, 1972.

FIGURE 1.13

MAJOR COAL FIELDS



Deeply buried Cretaceous strata, probably or possibly coal-bearing, or shallow where information is meager

Cretaceous outcrops with thin coal seams, or inadequately explored or devoid of coal

Cretaceous coal bearing outcrops, coal zone with seams generally thicker than 4 feet

SOURCE DATA

U. S. Dept. of the Interior—Geological Survey topographic maps
U. S. Dept. of the Army—A. M. S. 1:250,000 scale maps
U. S. Dept. of Commerce—Bureau of Public Roads maps

COMPILED IN 1958

BASE MAP WITH HIGHWAYS

EDITION OF 1959 OF THE U.S. GEOLOGICAL SURVEY, MODIFIED 1974 BY THE UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

TABLE 1.6

Coal Mines in Carbon-Emery Area
(Tons)

	FIELD	MINE	ANNUAL PRODUCTION	
			1972	1973
1	Clear Creek	Clear Creek[1]	32,000	--
2	Emery	Browning Mine	124,000	218,000
3	Emery	Sun Valley Mine	21,700	12,000
4	Castle Gate	Carbon Fuel Mine	322,000	395,000
5	Castle Gate	Gordon Creek #2	260,000	266,000
6	Castle Gate	Plateau	290,800	313,000
7	Castle Gate	Soldier Canyon	97,800	47,000
8	Castle Gate	Kenilworth[2]	180,000	--
9	Castle Gate	Clear Creek #5[3]	19,800	--
10	Huntington	Co-op	24,000	35,000
11	Huntington	Deer Creek Mine[5]	330,000	503,000
12	Huntington	Deseret & Beehive[6]	22,500	--
13	Huntington	Deseret & Beehive[7]	420,000	929,000
14	Sunnyside	Geneva Mine	713,000	748,000
15	Sunnyside	King Mine	559,000	568,000
16	Sunnyside	Sunnyside Mines	1,195,000	1,277,000

1 Otani Mine closed June, 1972.
2 Closed April 1972.
3 Closed April 1972.
4 Closed June 1972
5 Now Peabody Coal Co.
6 Operated Jan. 1 through March 31, 1972.
7 Operated April 1 through Dec. 31, 1972.

Source: Stowe, C.H., "Utah's Mineral Activity: An Operational and Economic Review," Utah Geological and Mineral Survey. Bulletin 105, 1974, P. 23.

Emery County, has recently been acquired for modernization. It has the capability of producing 30,000 tons annually.

The coal producing industry in the Carbon-Emery area will more than triple in the next ten years. This is due to two factors.

First there is the construction of electric power generation plants in the two county area. Utah Power and Light Company (UP&L) recently completed the first of four 430 megawatt[1] generating units at their Huntington Power Plant north of Huntington City in Emery County. The second unit[2] is presently under construction and is expected to go on-line in 1977 (13).

The first unit of the Huntington plant is supplied by Peabody Coal Company from a mine two miles from the plant site. This first unit will require about 0.8 to 1.2 million tons of coal per year. If all four units are constructed within the next ten years they will require 3.2 to 4.8 million tons of coal per year. This is nearly equal to the present entire production of the two county area.

In addition to the Huntington Power Plant, UP&L has under construction two 415 megawatt coal-fired steam-electric units of the North Emery Generating Plant located south of the town of Castle Dale in Emery County. These units are expected to go on-line in 1978 or 1979. The estimated coal requirements will be 1.6 to 2.4 million tons annually for the two units (14). Table 1.7 summarizes the coal requirements of these generating stations.

The second factor affecting coal production in Carbon and Emery counties is the contract made between the Indiana & Michigan Electric

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1 - One megawatt equals one million watts or one thousand kilowatts
2 - All units after the first are rated less than 430 mw due to power required to operate air pollution equipment.

TABLE 1.7

Estimated Coal Requirements

	HUNTINGTON		NORTH EMERY	
	First Unit (430-mw)	First and second units (845-mw)	First Unit (415-mw)	First and second units (830-mw)
Coal required at unit rating	170 tons/hour	340 tons/hour	170 tons/hour	340 tons/hour
At average annual capacity factor 0.80	136 tons/hour	272 tons/hour	136 tons/hour	272 tons/hour
Yearly consumption range	800,000 to 1,200,000 tons	1,600,000 to 2,400,000 tons	800,000 to 1,200,000 tons	1,600,000 to 2,400,000 tons

Source: U.P.& L. Environmental Impact Statements, Huntington Canyon, North Emery Generating Stations.

Company and the McCulloch Oil Corporation. This is a 25 year contract to supply more than 140 million tons of Utah coal to this midwestern electric utility. McCulloch Oil's Utah-based coal producing subsidiary, the Braztah Corporation, will produce this coal from mines near the town of Helper in Carbon County. According to the agreement, Braztah is to increase coal shipments as the mine is developed, building up from 800,000 tons the first year to an annual rate of 6.5 million tons in 1982 (15). The initial shipments were already made in late 1973. Braztah Corporation produced 352,000 tons of coal in 1974 and is expected to double that in 1975 (16).

These two factors affecting coal production in the Carbon-Emery area could result in an annual production of from 9.7 to 13.7 million tons of coal. This is over and above the present (1974) coal production figures for these two counties. Within ten years coal production in the Carbon-Emery area could reach the figure of 15 to 19 million tons per year. This is three times the present entire coal production for the state of Utah.

A factor not taken into account in the above discussion is the impact of the proposed Intermountain Power Project (IPP). The IPP proposes to construct four 750MW coal-fired steam electric generating units to begin in 1978 with commercial operation of the first unit scheduled for 1981 (17). Additional units would be completed at approximately one year intervals with the final unit completed about 1984.

Six sites were considered and a primary site was selected near Factory Butte in Wayne County. Coal for this project could be obtained

from either Sevier, Emery, Wayne or Garfield counties or some combination of these counties.

There are two ways in which this project could affect Emery County. The first is if it is decided to obtain the coal from Emery County. This could involve the mining of approximately 9 million tons of coal per year for the entire project by 1984. If only a portion of the projects' coal requirements are to be obtained from Emery County then the 9 million ton figure would be proportionately reduced. At the present time it is not known where the primary coal site will be.

The other way the IPP could affect Emery County is in support of the project. It was proposed that the population base to support IPP would be located in the town of Emery in Emery County. The expected population of this town would be 13,000 to 16,000 people. The present population is approximately 250. Some of the problems this might cause will be discussed in the last section of this study.

Ownership

The majority of the land in Carbon and Emery is under federal jurisdiction. Only 17% is privately owned with 10.1% under state control. Table 1.8 gives the land areas distributed by ownership. The land owned by the federal government can be further subdivided into the various agencies that have been given responsibility for certain tracts of land. The Bureau of Land Management (BLM) is responsible for most of the land within the study area. Table 1.9 gives the acreage controlled by the different agencies (18). Figure 1.14 shows the distribution of land ownership in the study area.

Table 1.8

Land Ownership in Carbon-Emery Counties
(Acres)

	Federal[1]	% Total	State[3]	% Total	Private	% Total	Co. Total[2]
Carbon	461,676	48.8	91,677	9.7	393,177	41.5	946,530
Emery	2,302,263	80.9	289,525	10.2	252,792	8.9	2,844,580
Area Total	2,763,939	72.9	381,202	10.1	645,969	17.0	3,791,110

Sources:

1 "Utah Facts," Bureau of Economic and Business Research, University of Utah 1973, Table A-2, P. VI-10, Revised 12-74.

2 ibid. Table A-1, P. VI-9.

3 Data furnished by Utah State Department of Natural Resources, Land Division, March 12, 1975.

Table 1.9

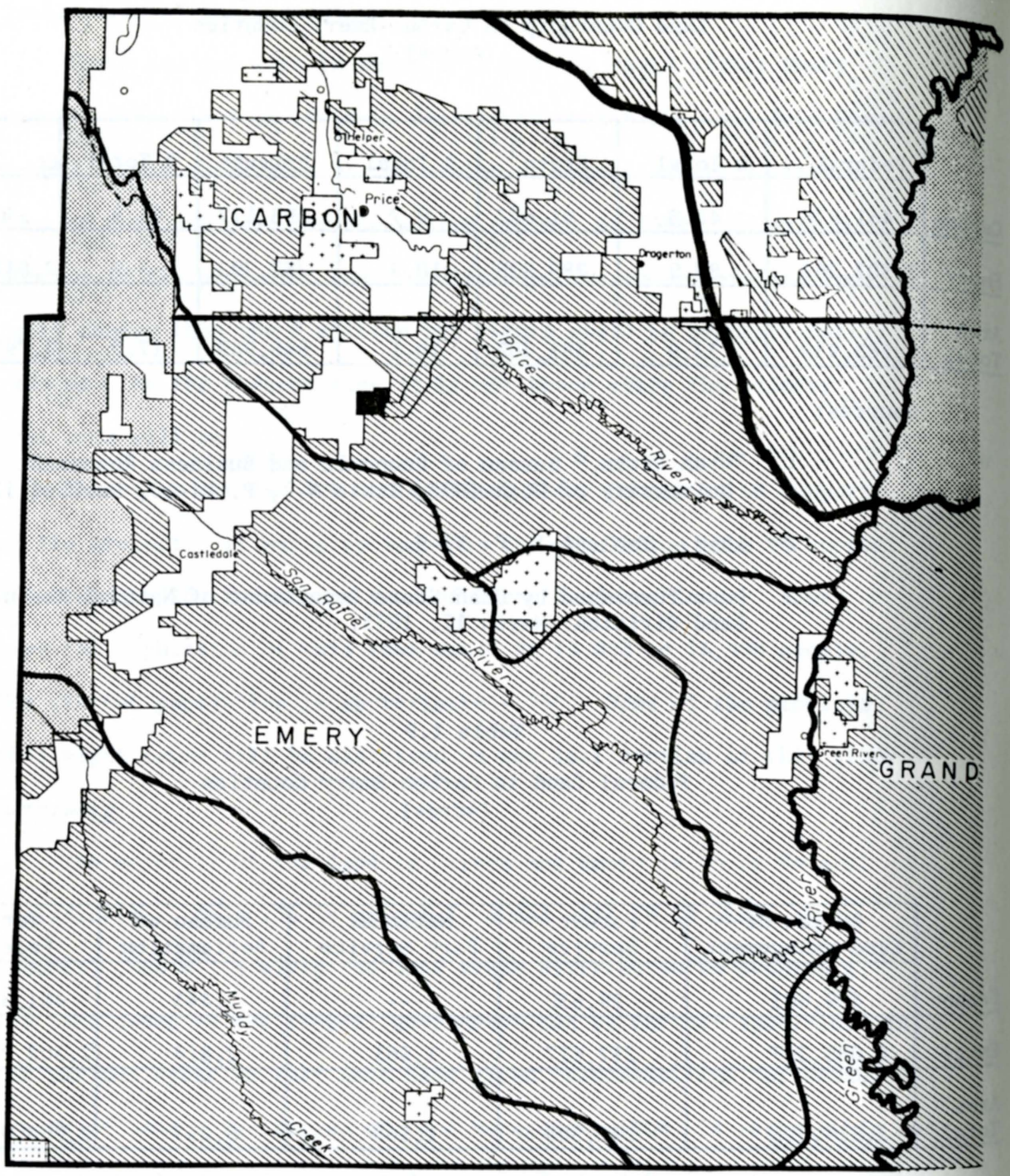
Federal Land in Carbon-Emery Counties
(Acres)

	Bureau of Land Management	Forest Service	National Park Service	Bureau of Reclamation	Total Federal
Carbon	429,601	29,632	---	2,443	461,676
Emery	2,085,207	212,677	1,565	2,814	2,302,263
Area Total	2,514,808	242,309	1,565	5,257	2,763,939

Source: "Utah Facts," Bureau of Economic and Business Research, University of Utah 1973, Table A-2, P. VI-10, Revised 12-74.

FIGURE 1.14

LAND OWNERSHIP



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, September 1971.

Land Use

Land use in the study area is generally associated with the availability of water. Because of this, most of the development has occurred in the river valleys. This is especially true in agriculture where most farms are located close to a source of irrigation water. In Carbon County there are 12,344 acres of irrigated cropland which amounts to 1.3% of the total land area. In Emery County the irrigated cropland covers 38,604 acres of land or 1.4% of the total land mass for this county. Table 1.10 gives a breakdown of land use in the study area (19).

TABLE 1.10

Land Use In Carbon-Emery Counties (Units in Acres)-1969

	Total Land Area	Total Cropland	Irrigated Cropland	Harvested Cropland	Number of Farms	Acreage in Farms	Ave. Acres per Farm	Range*	Forest*
Carbon	946,530	14,692	12,344	9,061	140	382,021	2,729	166,869	277,199
Emery	2,844,580	48,344	38,604	21,978	353	281,798	798	325,791	54,565
Area Total	3,791,110	63,036	50,948	31,039	493	663,819	1,346	492,660	331,764

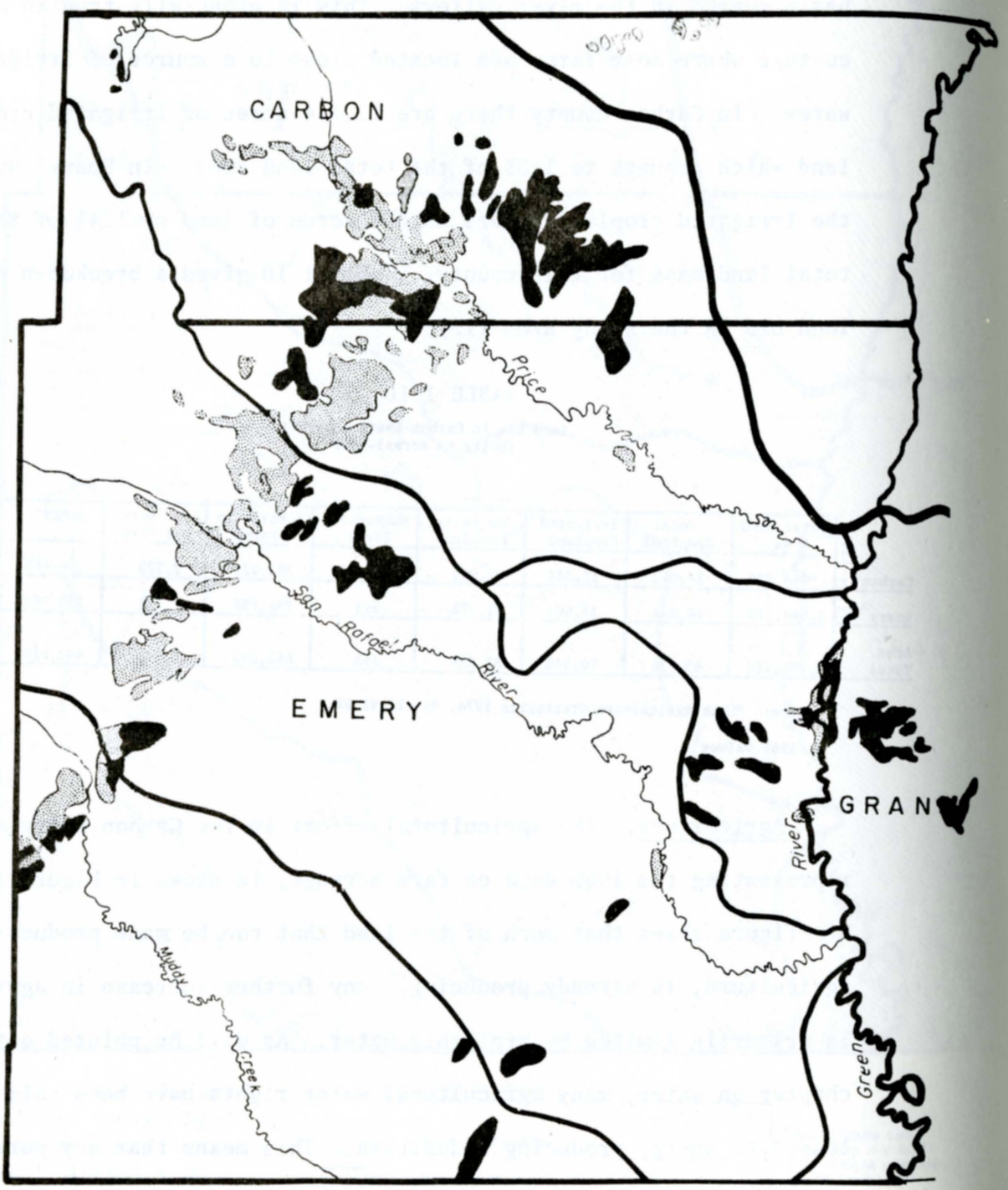
Source: "Utah Agriculture Statistics 1974, Pp. 14,91,92.

*** 1967 values**

Agriculture. The agricultural effort in the Carbon-Emery area, representing the 1969 data on farm acreage, is shown in Figure 1.15. This figure shows that much of the land that can be made productive in agriculture, is already producing. Any further increase in agriculture is primarily limited by available water. As will be pointed out in the chapter on water, many agricultural water rights have been sold or leased to energy producing industries. This means that any potential future increase in agriculture will likely necessitate interbasin transfers of water to the Carbon-Emery area. The most likely result will be

FIGURE 1.15

IRRIGATED AND POTENTIALLY ARABLE LAND



Source: "Water Related Land Use in the West Colorado Hydrologic Area," Division of Water Resources, Salt Lake City, Utah, Staff Report No. 8, January 1972. Also Staff Report No. 7, Sept. 1971

a decreased agricultural effort in the Carbon-Emery area.

The crops produced from the farms in the Carbon-Emery area are; hay, alfalfa, wheat, corn, oats, barley, sugar beets, and potatoes (19). Production of these crops are given in Tables 1.11, 1.12, 1.13, and 1.14. Not shown in the tables are 21 acres of potatoes yielding 2,754 cwt.[1] in Carbon County (1969) and 1 acre of potatoes yielding 140 cwt. in Emery County (1969). A large amount of the alfalfa and grain crops are used by the local livestock producers for feed (5). Table 1.15 gives the percentage of the state totals produced in Carbon and Emery counties for each crop. Except for corn and oats in Emery and sugar beets in Carbon, production in these two counties is small compared to the total produced in Utah.

Fruit production is shown in Table 1.16 for 1969. Pear production was the only fruit produced which was greater than 1% of the state totals. Data for later years are not available. However, a fruit tree survey conducted in 1972 can be compared with a similar survey in 1969 as shown in Table 1.17. This table shows that the total number of apple trees in Carbon and Emery counties nearly tripled in the years 1969 to 1972. However, the increase percentage wise, of the state totals, was from 1.3% to 1.6% The only other fruit tree that showed any sizable increase in numbers was the peach which increased nearly 5 times, and showed an increase percentage wise from .3% to .9% of the state totals. The 1969 acreage of orchards in Carbon County is 11 acres, and in Emery County there are 55 acres. This compares with 11,275 acres of orchards for the entire state.

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1 - cwt. is an abbreviation for the hundred weight, a unit of weight equal to 100 pounds in the United States.

TABLE 1.11

Acreage and Production of Hay and Alfalfa Seed - 1969

	ALL FARMS		FARMS WITH SALES OF $2500 AND OVER			
	All Hay (excluding Sorghum Hay)		Alfalfa and Alfalfa Mixtures for Hay		Alfalfa Seed	
	Acres	Tons	Acres	Tons	Acres	Pounds
Carbon	5,294	14,246	4,167	11,817	6	300
Emery	15,254	41,418	11,490	34,143	200	(*)
Area Total	20,548	55,664	15,657	45,960	206	300

Source: "Utah Agricultural Statistics - 1974," P. 97.

(*) Data withheld to avoid disclosure of information for individual farms.

TABLE 1.12

Acreage and Production of Feed Grains - 1969

	ALL FARMS			FARMS WITH SALES OF $2500 AND OVER			
	FIELD CORN			Oats for Grain		Barley for Grain	
	For Grain		Silage, Fodder or Grazed				
	Acres	Bushels	Acres	Acres	Bushels	Acres	Bushels
Carbon	12	714	694	584	31,300	271	12,775
Emery	326	28,110	1,102	1,785	95,621	551	29,916
Area Total	338	28,824	1,796	2,369	126,921	822	42,691

Source: "Utah Agricultural Statistics - 1974," P. 96.

TABLE 1.13

Acreage and Production of Wheat for Grain - 1969

	ALL FARMS		FARMS WITH SALES OF $2500 AND OVER			
	All Wheat		Winter Wheat		Spring Wheat	
	Acres	Bushels	Acres	Bushels	Acres	Bushels
Carbon	515	23,915	132	6,060	258	11,444
Emery	1,652	72,845	666	32,899	728	30,847
Area Total	2,167	96,760	798	38,959	986	42,291

Source: "Utah Agricultural Statistics - 1974," P. 95.

TABLE 1.14

Acreage and Production of Sugar Beets

CARBON COUNTY

	Farms	Acreage		Production	
		Planted	Harvested	Per Acre	Total
	No.	Acres	Acres	Tons	Tons
1973	6	400	380	13.9	5,300
1972	8	530	490	19.6	9,600
1971	10	990	960	14.6	14,000
1970	14	1,140	1,090	11.2	12,200
1969	16	1,320	1,320	16.2	21,800
		EMERY COUNTY			
Only Year 1970	1	50	40	7.5	300

Source: "Utah Agricultural Statistics - 1974," P. 29.

TABLE 1.15

Carbon-Emery Crop Production-Percentage of State Total
(percent)

	Wheat	Hay	Alfalfa	Corn	Oats	Barley	Sugar Beets	Potatoes
Carbon	.4	.95	1.0	.14	3.7	.19	4.8	.24
Emery	1.3	2.8	2.9	5.5	11.2	.45	---	.01
Area Total	1.7	3.75	3.9	5.64	14.9	.64	4.8	.25

TABLE 1.16

Fruit Production - 1969*

	Apples	Pears	Cherries		Peaches
			Sweet	Tart	
	lbs. / %	lbs. / %	lbs. / %	lbs. / %	lbs. / %
Carbon	2,000/ --	-- / --	-- / --	-- / --	12,000/.13
Emery	73,400/.3	112,800/2.0	400/ --	400/.01	17,400/.2
Area Total	75,400/.3	112,800/2.0	400/ --	400/.01	29,400/.33

Source: "Utah Agricultural Statistics - 1974," Pp. 100-102.

* - Pounds harvested and percentage of State total.

TABLE 1.17

Fruit Tree Survey*

	Apples	Apricots	Cherries		Peaches	Pears	Prunes
			Sweet	Tart			
	No. / %	No. / %	No. / %	No. / %	No. / %	No. / %	No. / %
1972							
Carbon	267/ .1	24/.1	-- / --	-- /--	-- / --	-- /--	-- / --
Emery	6,512/1.6	46/.1	59 /	16 /	2,794/.9	588/.7	17/.1
Area Total	6,779/1.6	70 /.16	59 /	16 /	2,794/.9	588/.7	17/.1
1969							
Carbon	500/.24	-- / --	-- / --	-- /--	112/.1	10/--	NA
Emery	2,194/1.1	-- / --	9/ --	8/	441/.2	405/.5	NA
Area Total	2,694/1.3	-- / --	9/	8/	553/.3	415/.6	NA

Source: "Utah Agricultural Statistics - 1974," Pp. 44, 100-102.

* - Number of trees and percentage of State total.

Livestock and poultry production in Carbon-Emery counties is given in Tables 1.18 and 1.19. Cattle in Carbon County comprised only 1.3% of the state total and Emery County was 3.1% of the state total. Sheep in Carbon County comprised 2.8% of the state total and in Emery County they were 1.9%. Hogs were 1.6% and 3.8% of state totals for Carbon and Emery counties. Poultry in both counties comprised less than 1% of the state totals. In addition, Emery County had 317 hives of bees in 1969 which was 1.6% of the state total.

Livestock raising and dairying have historically been the major forms of agricultural enterprise in the Carbon-Emery area. In 1964, more than 90 percent of the products sold were livestock and livestock products, with more than half of the farms classified as primarily livestock or dairy operations (20). In 1969, approximately 83 percent of the products sold were livestock and livestock products (19). This is most certainly going to change as a result of the transfers of agricultural water rights to the new energy producing industries in the area.

Transportation. The highway transportation system in Carbon and Emery counties is primarily composed of a triangle of highways formed by U.S. 6,50 on the east, State road 10 on the west, and Interstate 70 on the south. In addition, State road 24 connects Interstate 70 with Hanksville in Wayne County, State road 31 connects Huntington in Emery County with Fairview in San Pete County and State road 33 connects the old town of Castle Dale in Carbon County with Duchesne in Duchesne County.

There are also many spur roads leading to small communities and

TABLE 1.18

Livestock in Carbon-Emery Counties - 1969

	ALL FARMS						
	Farms Reporting Cattle	Cattle & Calves	Farms Reporting Sheep	Sheep & Lambs	Farms Reporting Hogs	Hogs & Pigs	Horses & Ponies
Carbon	85	9,384	49	28,874	31	611	500
Emery	295	22,960	118	18,851	95	1,506	733
Area Total	380	32,344	167	47,725	126	2,117	1,233

Source: "Utah Agricultural Statistics - 1974," Pp. 103-105, 107.

TABLE 1.19

Poultry in Carbon-Emery Counties - 1969

	ALL FARMS			FARMS WITH SALES OF $2500 & OVER	
	Chickens 3 Months Old & Older	Broilers & Other Meat Type Chicken Under 3 Months Old		Turkeys	
	Inventory No.	Inventory No.	Sales No.	Inventory No.	Sales No.
Carbon	6,712	20	500	8	--
Emery	2,200	--	---	58	2
Area Total	8,912	20	500	66	2

Source: "Utah Agricultural Statistics - 1974," P. 106.

and other developments. Finally, there exists many miles of improved, graded and ungraded dirt roads. Travel in the southern half of Emery County is almost exclusively limited to dirt roads, with the exceptions of Interstate 70 and State road 24. Figure 1.16 shows the locations of many of these transportation routes in the study area.

Railroad transportation into Carbon and Emery counties is relatively well developed due to the coal industry. A main line of the Denver and Rio Grande railroad cuts diagonally across the two counties entering from the North close to U.S. 6,50, passing through the Price and Helper area and exiting on the east at Green River, Utah.

Air transportation in the region is limited to private, charter, and small commercial flights. The municipal airports that exist in the region are located at Green River, Huntington, and Price.

Recreation Areas. Recreation areas in Carbon and Emery counties consist of several State Parks, National Forests, and a small section of a National Park and many smaller recreation sites. Table 1.20 lists the principal recreation areas. In addition, the many streams and lakes provide fishing and boating opportunities. There are six reservoirs in the Emery-Sanpete county-border area which have been rejuvenated by the Forest Service. These are to be used for recreational fishing only. These are Red Pine 1, Red Pine 2, Academy Mill, Grassy Lake, Pete's Hole and Soup Bowl reservoirs. A popular activity on the Green River is river running in rafts and kayaks. Figure 1.16 also shows the locations of these recreation areas.

The mountains and deserts in the study area are ideally suited

FIGURE 1.16

TRANSPORTATION ROUTES AND RECREATIONAL AREAS

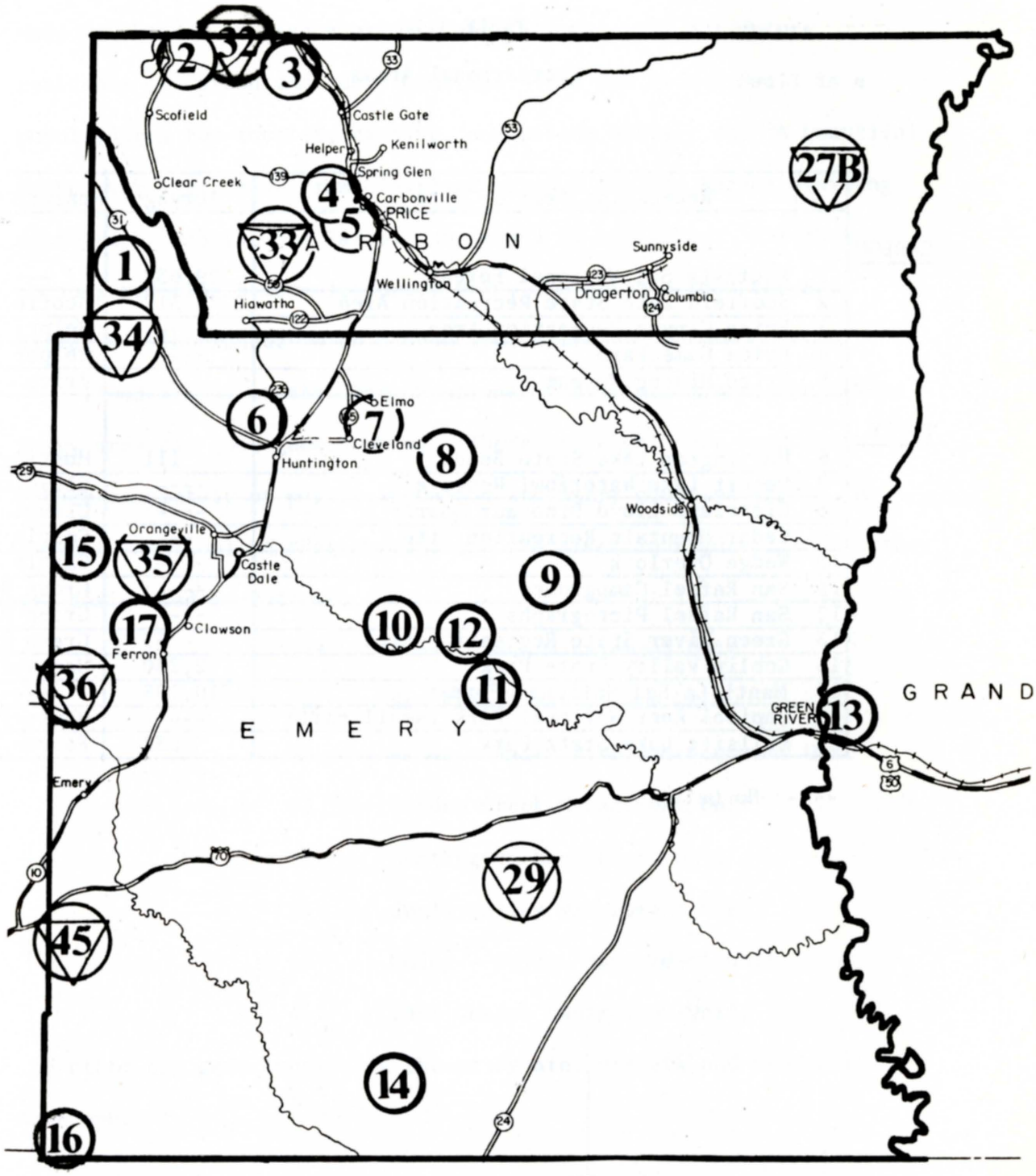

TABLE 1.20

Recreational Areas

		Recreation Area or Site	Acreage	Nearest Town
CARBON				
	1	Manti-La Sal National Forest	29,632	----
	2	Scofield Lake State Recreation Area	312	Scofield
	3	Price Canyon Recreation Area	----	Helper
	4	Price Game Farm	----	Helper
	5	Price Mining Museum	----	Price
EMERY				
	6	Huntington Lake State Beach	111	Huntington
	7	Desert Lake Waterfowl Reserve	----	Cleveland
	8	Cleveland Lloyd Dinosaur Quarry	----	Cleveland
	9	Cedar Mountain Recreation Site	----	Castle Dale
	10	Wedge Overlook	----	Castle Dale
	11	San Rafael Campground	----	Green River
	12	San Rafael Pictographs	----	Green River
	13	Green River State Recreation Area	53	Green River
	14	Goblin Valley State Park	2,240	Hanksville
	15	Manti-La Sal National Forest	210,108	----
	16	Capitol Reef National Park (small part)	----	Hanksville
	17	Millsite Lake State Park	638	Ferron

---- No Data

for many kinds of camping and hiking activities. The Manti-La Sal National Forest is also a primary recreational area for future residents of Carbon and Emery counties. The San Rafael Swell is a popular area for tourist, camping, and hiking activities. A beautiful drive over dirt roads from Cleveland through the San Rafael visiting pictographs and the San Rafael campground is available. For those persons desiring a more leisurely trip, the drive across the San Rafael via Interstate 70 is a beautiful drive.

In addition, to the above mentioned recreation areas, the Carbon-Emery area has good game hunting. There are eight deer herd units either completely or partly in Carbon and Emery counties (21). The general locations of these herd units are given in Figure 1.16 and they are designated as follows:

27B - Range Creek Management Unit

29 - San Rafael Management Unit

32 - Price - White Rivers Management Unit

33 - Gordon Creek Management Unit

34 - Huntington Management Unit

35 - Joe's Valley Management Unit

36 - Muddy - Ferron Management Unit

45 - Last Chance Management Unit

The other big game species in the study area are Elk and Pronghorn Antelope.

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SECTION 2

WATER

Water in Carbon and Emery counties is considered a scarce and valuable resource. Residents and industries within the area depend on seasonally fluxuating snow and rain fed streams for water. The more prominent streams in the Carbon-Emery area are Green River, Price River, Minnie Maud Creek, Nine Mile Creek, Huntington Creek, Cottonwood Creek, Ferron Creek, San Rafael River, and the Muddy Creek. These streams and other lesser streams and creeks make up the four hydrologic divisions having drainage into Carbon and Emery counties. These divisions are Nine Mile Creek Division, Price River Division, San Rafael River Division, Dirty Devil River Division, and a part of lower Green River Division. These divisions are depicted in Figure 2.1 (1).

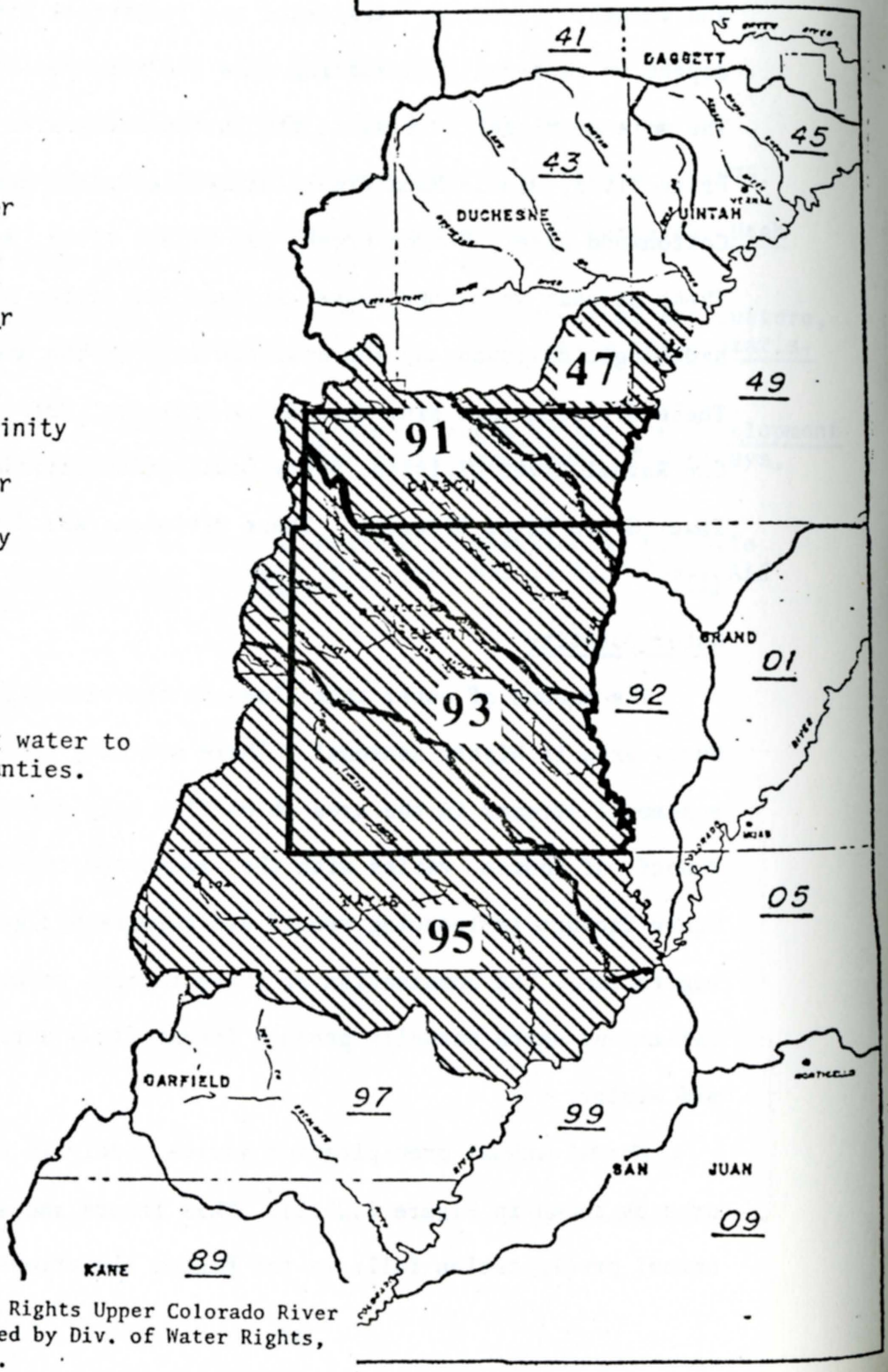
Water Quantity

The amount of water that flows in the rivers in the Carbon-Emery area is highly seasonal. There are many intermittant and ephemeral streams in the area which flow only during runoff periods. Runoff, of course, varies with the amount and type of precipitation. Other factors influencing runoff are topography, geology, soil, and vegetation. The combination of these factors results in seasonal variations which normally produce lowest flows during late summer and mid winter.

Normal annual precipitation varies widely in the Carbon-Emery area as shown in Figure 2.2 (2). This figure shows that most of the annual precipitation falls in the higher elevations.

AREA CODE	DIVISION NAME
41	Green River
43	Duchesne River
45	Ashley Valley
47	Nine Mile Creek
49	SE Uinta Basin
89	Paria River
91	Price River
92	Lower Green River
93	San Rafael River
95	Dirty Devil River
97	Escalante River
99	White Canyon Vicinity
01	NW Colorado River
05	Moab and Vicinity
09	San Juan River

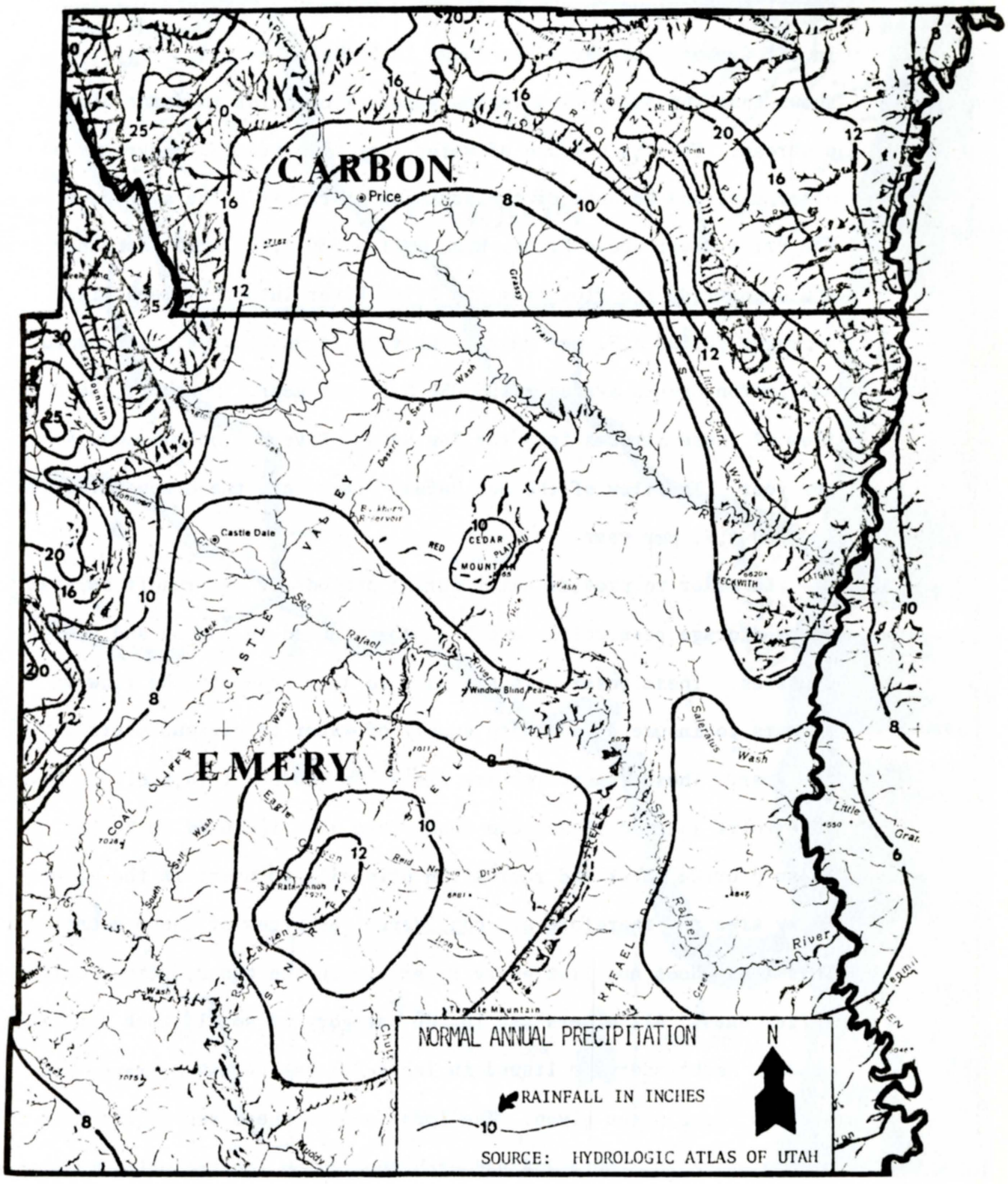
FIGURE 2.1
HYDROLOGIC AREAS
Upper Colorado River Basin
Utah



Basins supplying water to Carbon-Emery Counties.

Source: "Inventory of Water Rights Upper Colorado River Basin Utah," prepared by Div. of Water Rights, Utah, December 1974.

FIGURE 2.2


CARBON
Price
EMERY
Castle Dale
CASTLE VALLEY
CEDAR MOUNTAIN
Window Blind Peak
Saleratus Wash
Little Grass
Rafael River
NORMAL ANNUAL PRECIPITATION
N
RAINFALL IN INCHES
10
SOURCE: HYDROLOGIC ATLAS OF UTAH

Precipitation data is more meaningful when applied to mean annual streamflows in the area. Streamflow for the larger streams in the Carbon-Emery area are shown in Figure 2.3 (2,3). This figure shows that the streamflow varies widely from point to point along a stream. This is because of water that is extracted and returned after use, and because of the addition of runoff. The average flow on the Price River above Price, Utah is 103,530 A.F. (Acre Feet) per year, and downstream the flow from the Price River into the Green River averages 70,590 A.F. per year. The flow in Huntington, Cottonwood, and Ferron Creeks averages 195,050 A.F. per year. However, the combined flow of these streams into the San Rafael River is only 89,050 A.F. per year. The flow of the San Rafeal River into the Green River is 133,200 A.F. per year.

In order to provide water during periods of low runoff several water storage reservoirs have been constructed in Carbon and Emery Counties. These reservoirs are used to help regulate the flow in the streams to insure an adequate supply of water to various users during the year. These reservoirs are listed in Table 2.1 (4,5,6,7). Several reservoirs located in Sanpete County are also included in Table 2.1. These provide water and recreation primarily to users in the Carbon-Emery area and therefore are considered resources of these counties. This table does not list every reservoir in the two counties, only the larger ones. All others are in the category of small stock watering ponds. Each reservoir listed in Table 2.1 has township, range and section coordinates given. The locations of these reservoirs have been plotted in Figure 2.4 and each one can be located using the coordinates given in Table 2.1.

FIGURE 2.3

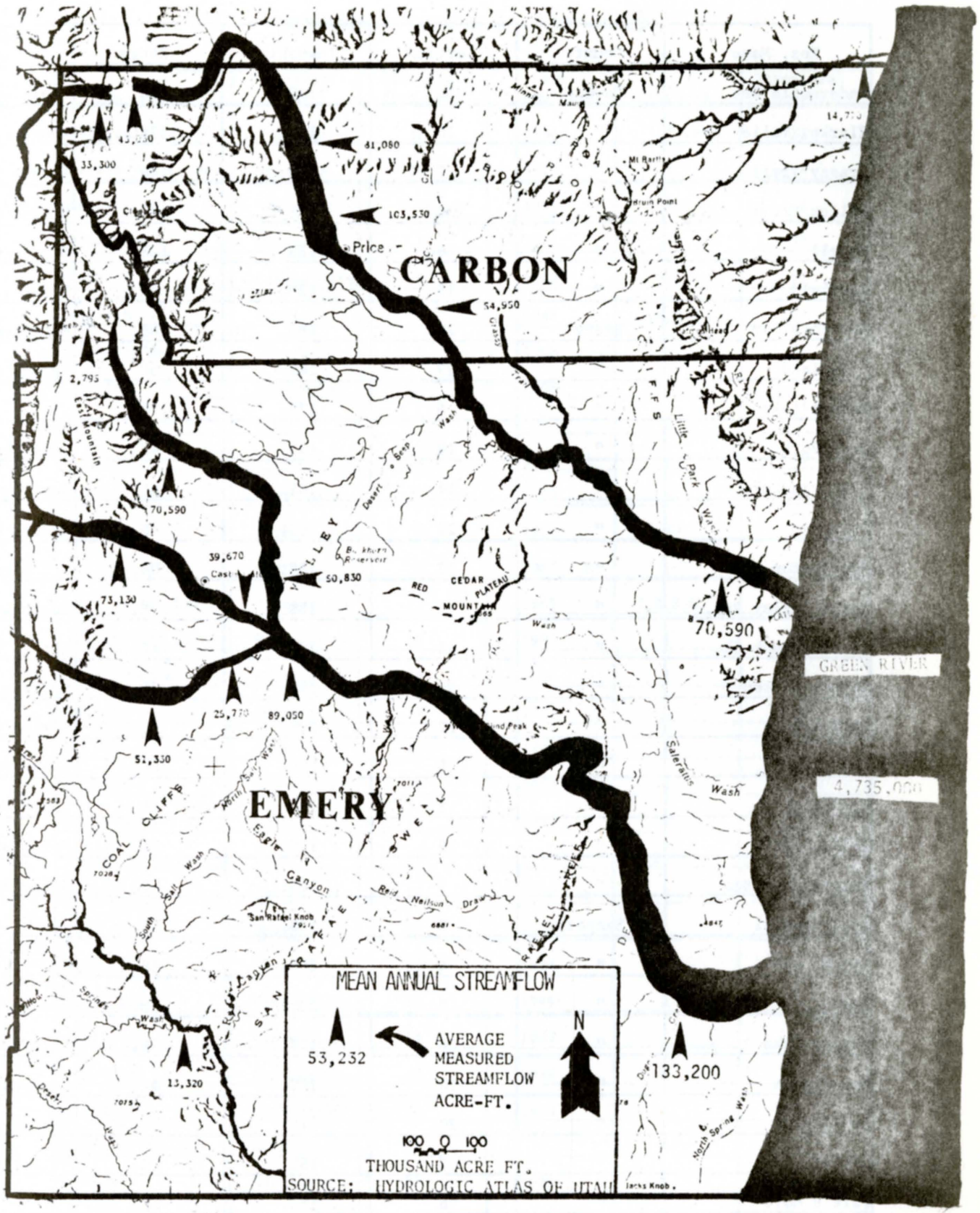

CARBON
EMERY
GREEN RIVER
4,735,000
Price
33,300
61,080
103,530
54,950
2,795
70,590
39,670
50,830
73,130
25,770
89,050
51,330
13,320
70,590
133,200
MEAN ANNUAL STREAMFLOW
53,232
AVERAGE
MEASURED
STREAMFLOW
ACRE-FT.
N
100 0 100
THOUSAND ACRE FT.
SOURCE: HYDROLOGIC ATLAS OF UTAH

TABLE 2.1

RESERVOIRS IN CARBON-EMERY COUNTY AREA ⊙

Res. Name	County	Section	Township	Range	River or Stream
Anderson's Res.	Carbon	36	14S.	11E.	Soldier Ck.
Clarkes Valley Res.	"	10	14S.	12E.	Dugout Ck.
Grassy Trail	"	7	14S.	14E.	Grassy Trail Ck.
Miller Creek	"	30	15S.	9E.	Miller Ck.
Powell	"	6	12S.	12E.	Minnie Maud
Scofield	"	15	12S.	7E.	Price River
Buckhorn Dam	Emery	20	18S.	10E.	Buckhorn Wash
Cleveland	"	27	14S.	6E.	Spring Ck.
Desert Lake	"	3	17S.	10E.	----
Duck Fork	"	10	19S.	4E.	Duck Fork
Electric Lake	"	14	14S.	6E.	Huntington Ck.
Ferron	"	22	19S.	4E.	Indian Ck.
Huntington No.	"	17	17S.	9E.	Off Stream
Joe's Valley Res.	"	5	18S.	6E.	Cottonwood Ck.
Little Brush Ck.	"	14	20S.	4E.	Little Brush Ck.
Little Madsen	"	33	14S.	6E.	Rolfson Ck.
Millsite	"	12	20S.	6E.	Ferron Ck.
Red Pine 1	"	8	16S.	6E.	Lowry Fork
Red Pine 2	"	8	16S.	6E.	Lowry Fork
Willow Lake	"	29	19S.	5E.	Shingleton Ck.
Wrigley Springs	"	7	20S.	6E.	Slide Hollow
Academy Mill	Sanpete	5	18S.	5E.	----
Brush	"	4	20S.	4E.	No. Fork Muddy Ck.
Emery	"	4	20S.	4E.	No. Fork Muddy Ck.
Grassy Lake	"	26	17S.	5E.	Little Ck.
Henningson	"	20	20S.	4E.	Reservoir Ck.
Huntington	"	20	14S.	6E.	Spring Ck.
Miller Flat	"	3	15S.	6E.	Miller Flat Ck.
Pete's Hole	"	6	18S.	5E.	----
Rolfson	"	33	14S.	6E.	Rolfson Ck.
Soup Bowl	"	32	17S.	5E.	----
Spinner	"	2	20S.	4E.	No. Fork Muddy Ck.

TABLE 2.1 CONT.

RESERVOIRS IN CARBON-EMERY COUNTY AREA ⊙

Res. Name	Nearest City	Distance from Res.	Year Completed	Purpose	Structural Height
Anderson's Res.	Woodside	30	1936	I	32
Clarkes Valley Res.	Woodside	26	1917	I	14
Grassy Trail	Dragerton	7	1951	I,N,O	88
Miller Creek	Hiawatha	4	1931	I	30
Powell	Castle Gate	15	1940	I	22
Scofield	Scofield	10	1946	I,R,C,S	125
Buckhorn Dam	Cleveland	8	1968	I,C,O	35
Cleveland	Huntington	25	1908	I,R	40
Desert Lake	Elmo	2	----	O	--
Duck Fork	Ferron	18	1949	R#	38
Electric Lake	Huntington	24	1973	H	204
Ferron	Ferron	23	1916	R#	25
Huntington No.	Huntington	1	1965 E.	I	62
Joe's Valley Res.	Orangeville	12	1965	I,R,S,C	195
Little Brush Ck.	Moore	16	1903	I	36
Little Madsen	Huntington	24	1950	I	24
Millsite	Ferron	3	1971	I,S	122
Red Pine 1	Huntington	18	1908 E.	R	15.5
Red Pine 2	Huntington	18	1908 E.	R	17.5
Willow Lake	Ferron	15	1940	R#	14
Wrigley Springs	Ferron	20	1956	I,R	23
Academy Mill	Orangeville	18	1908 E.	R	13.5
Brush	Moore	13	1926	I	30
Emery	Moore	18	1924	I	18
Grassy Lake	Orangeville	18	1945	R	22
Henningson	Moore	18	1947	I	6
Huntington	Huntington	23	1949	I	42
Miller Flat	Huntington	24	1953	I,R	75
Pete's Hole	Orangeville	19		R	16
Rolfson	Huntington	24	1929	I	36
Soup Bowl	Orangeville	19		R	13
Spinner	Moore	17	1926	I	15

TABLE 2.1 CON'T

RESERVOIRS IN CARBON-EMERY COUNTY AREA ⊙

Res. Name	Hydraulic Height	Max. Storage	Normal Storage	Owner	Remarks
Anderson's Res.	32 E.	229 E.	229	H. Mahleres, S. Siampinos	
Clarkes Valley Res.	8	230 E.	230	John Marakis	
Grassy Trail	84	1,003 E.	1,003	Geneva - Kaiser Steel Co.	O - Industrial
Miller Creek	26	174 E.	174	Price River Irrigation Co.	Drains into Desert Lake
Powell	18	50 E.	37	Sheridan R. Powell	Drains into Green River
Scofield	55	73,600	65,800	Carbon Water Conservancy Dist.	
Buckhorn Dam	28	8,799	2,753	Bureau of Land Management	O-Stock Watering; Drains into San Rafael
Cleveland	32	3,275 E.	3,275	Huntington - Cleveland Irr. Co	
Desert Lake	--	---	---	Utah State Dept. of Interior	O - Waterfowl Reserve
Duck Fork	32	718 E.	718	Division of Wild-life Resources	No Storage Allowed To be rebuilt in 1975.
Electric Lake	194	34,000	34,000 E.	Utah Power & Light Co.	
Ferron	20	1,330	995	Division of Wild-life Resources	Special use permit from U.S. Forest Service
Huntington No.	55	4,850	3,100	Bureau of Reclamation	
Joe's Valley Res.	--	71,600	54,630	Bureau of Reclamation	
Little Brush Ck.	34	175 E.	175	Independent Canal Res. Co.	
Little Madsen	21	58 E.	58	Huntington - Cleveland Irr.Co.	
Millsite	100	18,000	18,000 E.	Ferron Canal - Res. Co.	
Red Pine 1	11.5	---	74	Forest Service	R - Fishing
Red Pine 2	13.5	---	66	Forest Service	R - Fishing
Willow Lake	14 E.	116 E.	116	Division of Wild-life Resources	R - Fishing
Wrigley Springs	18	133 E.	133	Ferron Canal - Res. Co.	
Academy Mill	9.5	---	46	Forest Service	R - Fishing
Brush	30 E.	50 E.	50	Muddy Creek Irr. Co.	
Emery	18 E.	145 E.	145	Muddy Creek Irr. Co.	
Grassy Lake	18	137	131	Forest Service	R - Fishing
Henningson	6 E.	350 E.	350	Muddy Creek Irr. Co.	
Huntington	37	2,900	2,625	Huntington - Cleveland Irr.Co.	
Miller Flat	70	5,561 E.	5,561	Huntington - Cleveland Irr.Co.	
Pete's Hole	12	---	100	Forest Service	R - Fishing
Rolfson	30	900 E.	900	Huntington - Cleveland Irr.Co.	
Soup Bowl	8.5	---	22	Forest Service	R - Fishing
Spinner	15 E.	550 E.	550	Muddy Creek Irr. Co.	

TABLE 2.1 CON'T

RESERVOIRS IN CARBON-EMERY AREA *

(*) Reservoirs in Carbon and Emery Counties and those in Sanpete County which supply water or recreation for residents of Carbon and Emery Counties.

\# Irrigation water rights purchased by the Division of Wildlife Resources, to be stabilized for recreational use.

LEGEND

I - Irrigation

H - Electric Power Production

C - Flood Control

E*- Estimate

R - Recreation

S - Water Supply

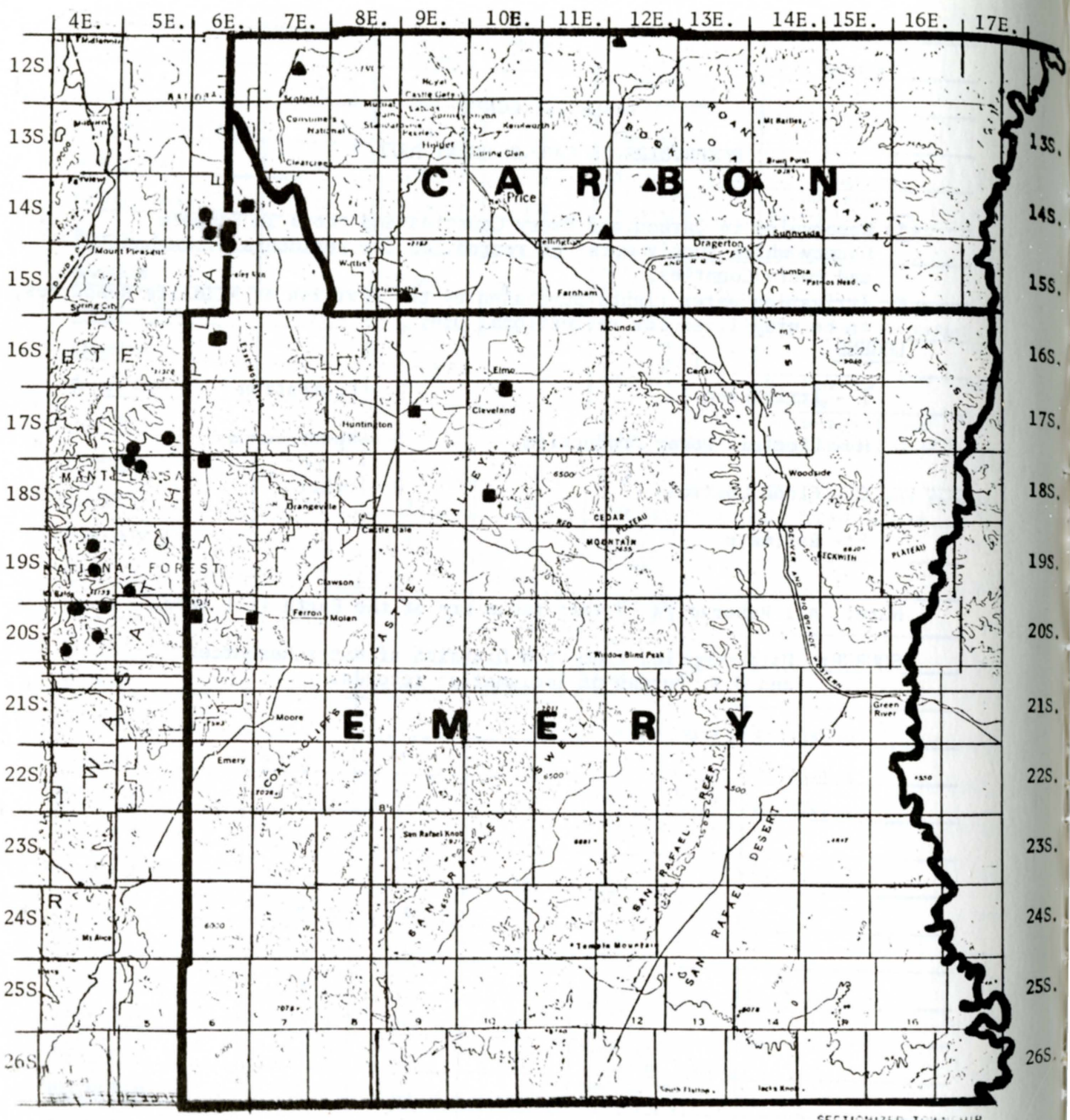
O - Other

Note: All Reservoirs in this table are of the Earth fill type.

SOURCE: Data compiled from Utah Division of Water Resources and U.S. Bureau of Reclamation records.

FIGURE 2.4

RESERVOIRS IN THE CARBON-EMERY AREA



Electric Lake Reservoir is of particular interest since it was constructed by Utah Power & Light Company to supply a continuous, steady amount of water to the recently finished Huntington Power Plant complex, the first large scale energy development in the region. This reservoir represents a large scale water conservation project for the Carbon-Emery area.

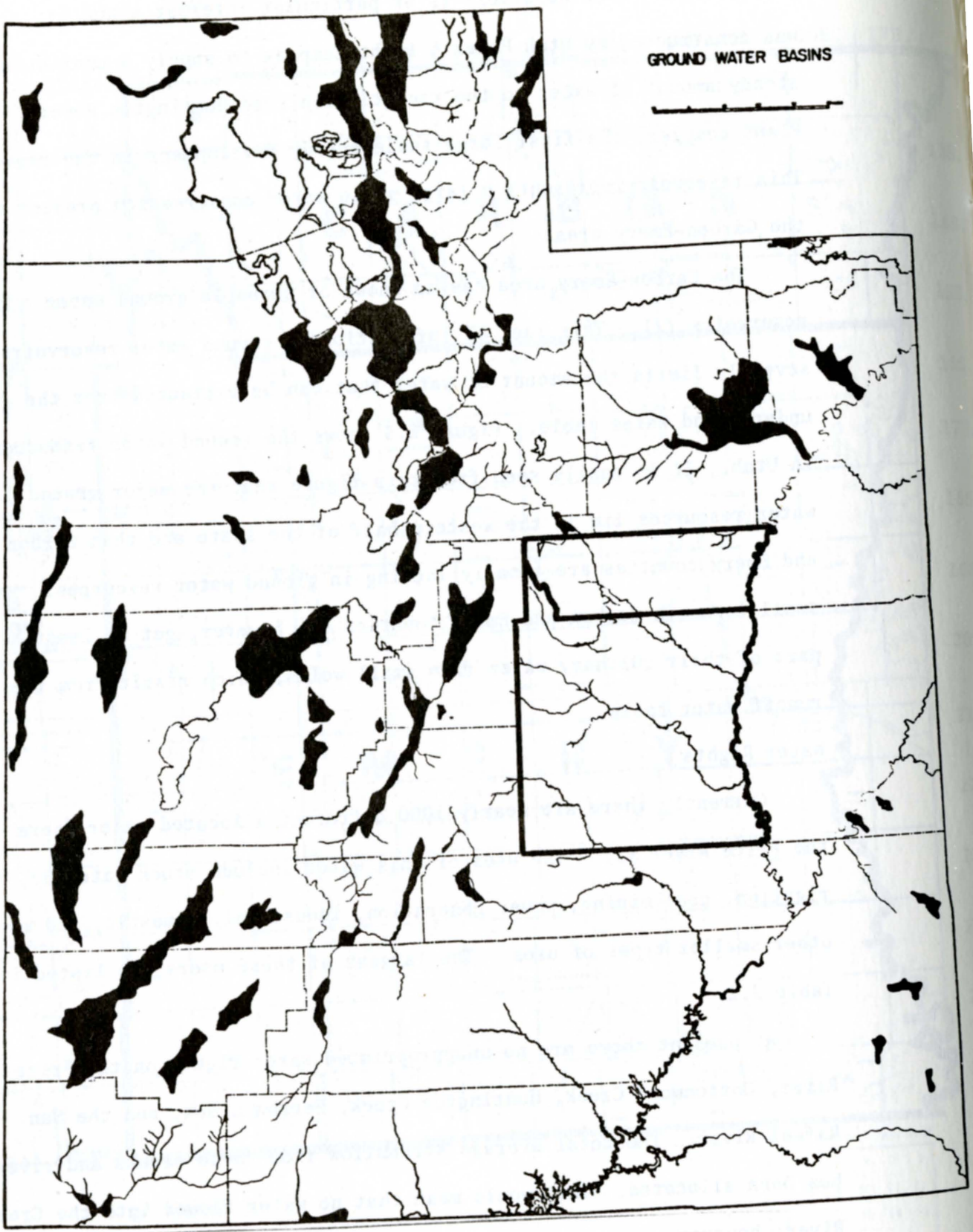
The Carbon-Emery area has no known or probable ground water reservoirs (2). This lack of information on ground water reservoirs severely limits the amount of water that can be extracted from the underground water table. Figure 2.5 shows the ground water resources in Utah. It is easily seen from this figure that the major ground water resources lie in the western half of the state and that Carbon and Emery counties are totally lacking in ground water resources. Many small towns in Carbon and Emery counties do, however, get at least a part of their culinary water from small wells, which result from the runoff water table.

Water Rights

Currently there are nearly 1000 different allocated water users on the Price River (1). The uses of this water include stock watering, irrigation, coal mining, power generation, industrial, domestic, and many other smaller types of uses. The largest of these users are listed in Table 2.2.

At present there are no unappropriated water rights on the Price River, Cottonwood Creek, Huntington Creek, Ferron Creek, and the San Rafael River. The total average streamflow from these creeks and rivers has been allocated. This would mean that no water flowed into the Green River; however, there is a flow into the Green River which is caused by

FIGURE 2.5



SOURCE: "Hydrologic Atlas of Utah," Utah State University, Utah Division of Water Resources, Nov. 1968.

TABLE 2.2

SELECTED WATER RIGHTS IN CARBON-EMERY COUNTIES

River Div.	Source	Quantity C.F.S.	Quantity A.F.	Use	Applicant
Nine Mile Creek Division	Nine Mile Creek	5.0		I,S	T.A. Christensen
	"	10.7		I,S	C. Pace
	Cow Canyon Creek	4.0		I,S	A. Keel
	Minnie Maud Creek	10.0		I,S	Minnie Maud Irr. Co.
Price River Division	Price River	125.0		I,S,D	Carbon Coal Co.
	"	56.3		I	Wellington Canal Co.
	"	50.0		I	Price River Water Users
	"	25.0		S,D	"
	"	32.4		I,S,D	Allred Ditch Co.
	"	37.0		I	"
	"	36.0		I	Spring Glen Canal Co.
	"	37.8		I	Pioneer Canal Co. #1
	"	32.4		I	Pioneer Canal Co. #2
	"	307.0		I,S	Carbon Canal Co.
	"	30.2		I,S,D	Price Water Co.
	Green River	220.0		P	Green River City
	"	35.0		I	Wilson Produce Corp.
	"	60.0		I,D,S	Green River Canal Co.
	"		50,000	S.G.	U.P. & L. Co.
	Fish Creek		17,980	I,In,Mu	Price River Water
				D,C,S	Users
	"		90,000	I	Bureau of Reclamation
San Rafael River Division	Ferron Creek	378.0		I,D,S	Board of Water Res.
	"		15,124	I,D,S,In	"
	Huntington Creek	75.0		I	Bureau of Reclamation
	"	75.0	15,043	I	H.-C. I.C.
	"		60,000	S.G.	U.P. & L. Co.
	Lowry Fork	100.0	20,000	I	Bureau of Reclamation
	Cottonwood Creek	122.82		I	C.C.C.I.C.
	"		117,546	I	Bureau of Reclamation
	Green River	40.0		D,S.G.	Western Development Co.
	S. Straight Hollow	25.0	500	I	Ferron Canal & Res. Co.
	Olsen Canyon	23.0		I,S	Horseshoe Canal Co.
Dirty Devil River Division	Muddy Creek	50.0		I,S	Muddy Creek Irr. Co.
	"	100.0		I	C.C. Moore
	UGW	20.0		Misc.	Kemmerer Coal Co.

1 C.F.S = 722.7 A.F.

C.F.S. - Cubic Feet Per Second
A.F. - Acre Feet Per Year
I - Irrigation
In - Industrial
D - Domestic
C.C.C.I.C. - Cottonwood Creek Con. Irr. Co.
Mu - Municipal
S.G. - Steam Generation
P - Power Hydro
S - Stock Watering
Misc. - Miscellaneous
UGW - Underground Water Claim
H-C.I.C. - Huntington-Cleveland Irr. Co.

SOURCE: "Inventory of Water Rights, Upper Colorado River Basin, Utah," Prepared by Div. of Water Rights, Salt Lake City, Utah Dec. 1974.

two factors. First, there is the agricultural return flow from flood irrigation. Second, it is evident that many water allocations are not being used.

We understand that Utah Power and Light Company has purchased water rights for the Huntington Generating Station and has sufficient water for future needs. For their North Emery Plant, UP&L has leased water rights from farmers and others in the area on a 40 year lease. These water rights will, therefore, revert back to the control of the present owners after 40 years. Meanwhile the farmers in the area can still use the water as long as it is not needed for power generation. This arrangement is very satisfactory for the persons concerned and presents a minimum of conflict between industry and agriculture (consumptive use by power plants indicates conflict) (8).

Water Quality

An analysis of water quality can be divided into two major areas. The first area is chemical pollutants and its associated water quality problems, and the second area is biological pollution and its problems. Before each of these areas is analyzed, several general comments are in order. Streamflow vs. pollution is generally an inverse relationship. As streamflow increases the dillution of the pollutants also increases. This would indicate that during periods of high flow the pollution concentration will decrease and conversely that at low flow the pollution concentration will increase. For this reason, low flow conditions are critical in evaluating water pollution and the effect that future developments will have on water quality.

The state of Utah has established minimum water quality standards that must be met in order for water to fit into several classes. These

classes are:

QUALIFICATION

Class "A" Waters - Domestic water supply without treatment and certain other uses.

Class "B" Waters - Domestic water supply after disinfection and certain other uses.

Class "C" Waters - Domestic water supply after coagulation, sedimentation, filtration, and disinfection, and certain other uses.

Class "D" Waters - Limited irrigation uses and certain other uses.

Class "E" Waters - No beneficial uses.

The standards for each of these classes of water are listed in Table 2.3 below (9). This list does not include all the various standards that should be met. However, these parameters provide a measure of the present water quality. These standards deal with controllable pollution and do not govern natural pollutants. All unlabeled numbers are mg/liter.

TABLE 2.3

WATER QUALITY STANDARDS

Quality Factor	Class A	Class B	Class C	Class D
COLIFORM	1 MPN	50 MPN	5000 MPN	5000 MPN
PH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
BOD	NONE	NONE	< 5	< 25
IRON	0.3	0.3	0.3	0.3
MAGNESIUM	0.5	0.05	0.05	0.05
NITRATE	45	45	45	45
SULFATE	250	250	250	250
TDS	500	500	500	500

Chemical. Chemical pollution in the Carbon-Emery area water varies from very little at the headwaters of the streams to excessive at their mouths. One indicator of this chemical deteoriation is the acceptable level of total dissolved solids (TDS) for irrigation water. Water which will have no detrimental effects upon the crops will have a TDS less than 500 mg. per liter. Sensitive crops can be affected by TDS levels between 500 and 1000 mg. per liter. Between 1000 and 2000 mg. per liter an adverse effect may be noticed unless careful management is practiced. For a TDS level greater than 2000 mg. per liter only certain tolerant plants can be cultivated and then only under a careful management program (10). In the Price River the TDS level just below Scofield Reservoir is 211 mg/liter. As the water from the Price River enters the Green River the TDS concentration is 3154 mg/liter. Similarily the San Rafael River complex has the same TDS pattern. At the headwaters of the Huntington, Cottonwood, and Ferron Creeks the TDS concentrations are 202 mg/liter, 929 mg/liter, and 661 mg/liter respectively. Close to where the San Rafael meets the Green River a TDS concentration of 2125 mg/liter has been observed (11, 12, 13).

A second indicator of chemical pollution is the salinity levels of the water. Present data suggest the largest single man-caused source of salinity is irrigation return flow amounting to about a third of the total salt load. Natural sources as salt wells and springs plus concentration by evaporation account for another third. The remaining salt load is largely contributed by diffuse sources originating in

immense areas of wild land watersheds. The summation of salt inflows from these wide-spread diffuse sources can result in significant mineral concentrations at tributary outlets. For example, the Price River at Woodside, Utah, has an average salt load of 4,000 ppm, yet its drainage has few identifiable point sources (14).

Along with salinity the alkali, or sodium hazard is also a hazard for irrigation water supplies. The sodium hazard is given by the sodium-adsorption-ratio (SAR). This ratio is defined by the equation: (2)

$$SAR = \frac{Na^{+}}{\frac{Ca^{++} + Mg^{++}}{2}}$$

where Na^{+}, Ca^{++}, and Mg^{++} represent the concentrations in milliequivalents per liter of the respective ions. Figure 2.6 gives the criteria for classifying irrigation water supplies according to sodium and salinity hazards. The salinity hazard is measured by the specific conductance, expressed in micromhos per centimeter at 25°C. When the SAR and salinity are known a classification of the irrigation water supply can be made using Figure 2.6. Table 2.4 gives chemical water quality data for the Price River at Woodside. The last two columns give the specific conductance and the SAR. It will be noted that the mean values are 2,600 for specific conductance and 4.8 for the SAR, then according to Figure 2.6 the salinity hazard is very high and the sodium hazard is medium.

Another parameter of chemical pollution is water hardness. Hardness of water is produced by the presence of alkaline earths such as calcium and magnesium. A concentration of 0-60 mg/liter is considered soft, and from 61-120 moderately hard, and 121-180 hard,

FIGURE 2.6

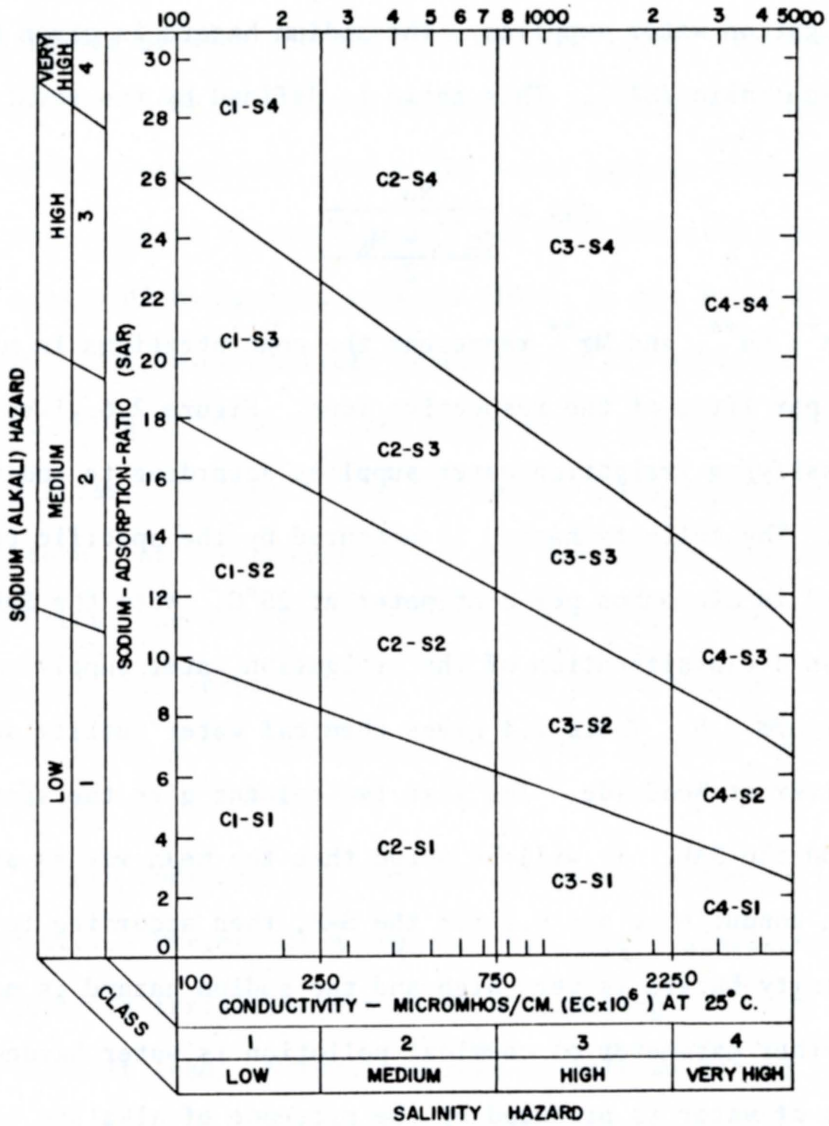


Diagram for the classification of alkali and salinity hazard for irrigation waters. (Taken from U.S. Salinity Laboratory, 1954.)

TABLE 2.4

Chemical Quality of Water at Station
Green River Basin Below the White River

"Price River at Woodside"

Relation between water discharge and chemical quality of water at selected stations in the Green division. (Data are for the water years 1914-57 adjusted to 1957 conditions. Chemical quality data and weighted averages are in parts per million and equivalents per million (italicized), except as indicated.)

Mean Discharge (cfs)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Boron (B)	Dissolved Solids (residue at 180° C) Parts Per Million	Dissolved Solids (residue at 180° C) Tons Per A.F.	Dissolved Solids (residue at 180° C) Tons Per Day	Hardness as $CaCO_3$ Calcium, magnesium	Hardness as $CaCO_3$ Noncarbonate	Percent sodium	Specific conductance (micromhos at 25° C)	Sodium-adsorption ratio
4,310	92	34	62	1.9	267	250	14	0.11	598	0.81	6,960	369	150	27	870	1.4
	4.59	*2.79*	*2.70*	*.05*	*4.38*	*5.20*	*.39*									
2,940	94	38	74	2.6	267	295	16	.12	630	.86	5,000	390	172	29	910	1.6
	4.69	*3.12*	*3.22*	*.07*	*4.38*	*6.14*	*.45*									
2,320	95	40	83	3.1	268	330	17	.12	662	.90	4,150	402	182	31	960	1.8
	4.74	*3.29*	*3.61*	*.08*	*4.40*	*6.86*	*.48*									
1,580	98	47	100	3.9	268	400	18	.12	742	1.01	3,170	438	218	33	1,050	2.1
	4.89	*3.86*	*4.35*	*.10*	*4.40*	*8.32*	*.51*									
1,050	102	54	122	4.7	268	490	21	.13	870	1.18	2,470	476	256	35	1,220	2.4
	5.09	*4.44*	*5.31*	*.12*	*4.40*	*10.19*	*.59*									
665	107	64	155	5.6	270	600	25	.14	1,070	1.46	1,920	530	308	39	1,480	2.9
	5.34	*5.26*	*6.74*	*.14*	*4.43*	*12.48*	*.70*									
348	124	85	224	6.8	272	860	33	.17	1,500	2.04	1,410	659	436	42	1,980	3.8
	6.19	*6.99*	*9.74*	*.17*	*4.46*	*17.89*	*.93*									
149 [1]	160	135	365	8.0	283	1,430	48	.23	2,420	3.29	974	954	722	45	3,000	5.1
	7.89	*11.10*	*15.88*	*.20*	*4.64*	*29.74*	*1.35*									
102	183	165	470	8.5	290	1,800	59	.26	3,000	4.08	826	1,130	896	47	3,650	6.1
	9.13	*13.56*	*20.44*	*.22*	*4.76*	*37.44*	*1.66*									
74	205	190	558	8.8	303	2,100	68	.29	3,530	4.80	705	1,290	1,040	48	4,200	6.8
	10.23	*15.62*	*24.27*	*.23*	*4.97*	*43.68*	*1.92*									
62	217	205	603	9.0	320	2,250	73	.31	3,830	5.21	641	1,380	1,120	48	4,500	7.1
	10.83	*16.85*	*26.23*	*.23*	*5.25*	*46.80*	*2.06*									
52 [2]	230	220	660	9.2	335	2,440	78	.33	4,100	5.58	576	1,480	1,200	49	4,800	7.5
	11.48	*18.08*	*28.71*	*.24*	*5.49*	*50.75*	*2.20*									
44	240	234	710	9.3	345	2,600	83	.35	4,320	5.88	513	1,560	1,280	50	5,000	7.8
	11.98	*19.23*	*30.88*	*.24*	*5.66*	*54.08*	*2.34*									
36	255	250	760	9.4	349	2,780	88	.37	4,580	6.23	445	1,660	1,380	50	5,300	8.1
	12.72	*20.55*	*33.06*	*.24*	*5.72*	*57.82*	*2.48*									
25	280	278	850	9.8	351	3,120	97	.42	4,950	6.73	334	1,840	1,550	50	5,700	8.6
	13.97	*22.85*	*36.98*	*.25*	*5.76*	*64.90*	*2.74*									
11 [3]	325	320	960	10	352	3,600	105	.51	5,380	7.32	160	2,130	1,840	49	6,050	9.1
	16.22	*26.30*	*41.76*	*.26*	*5.77*	*74.88*	*2.96*									
6.8	340	330	970	10	354	3,700	105	.58	5,400	7.34	99	2,200	1,910	49	6,100	9.0
	16.97	*27.13*	*42.20*	*.26*	*5.81*	*76.96*	*2.96*									
5.2	345	330	980	11	355	3,800	106	.61	5,400	7.34	76	2,220	1,930	49	6,100	9.1
	17.22	*27.13*	*42.63*	*.28*	*5.82*	*79.04*	*2.99*									
4.4	350	335	980	11	360	3,800	107	.64	5,400	7.34	64	2,250	1,960	48	6,100	9.0
	17.48	*27.54*	*42.63*	*.28*	*5.90*	*79.04*	*3.02*									
116	151	118	327	6.6	288	1,240	43	.21	2,110	2.87	662	862	626	45	2,600	4.8
	7.53	*9.70*	*14.22*	*.17*	*4.72*	*25.79*	*1.21*									

Data obtained from "Water Resources of Upper Colorado River Basin"
Geological Survey Professional Paper 441, 1965

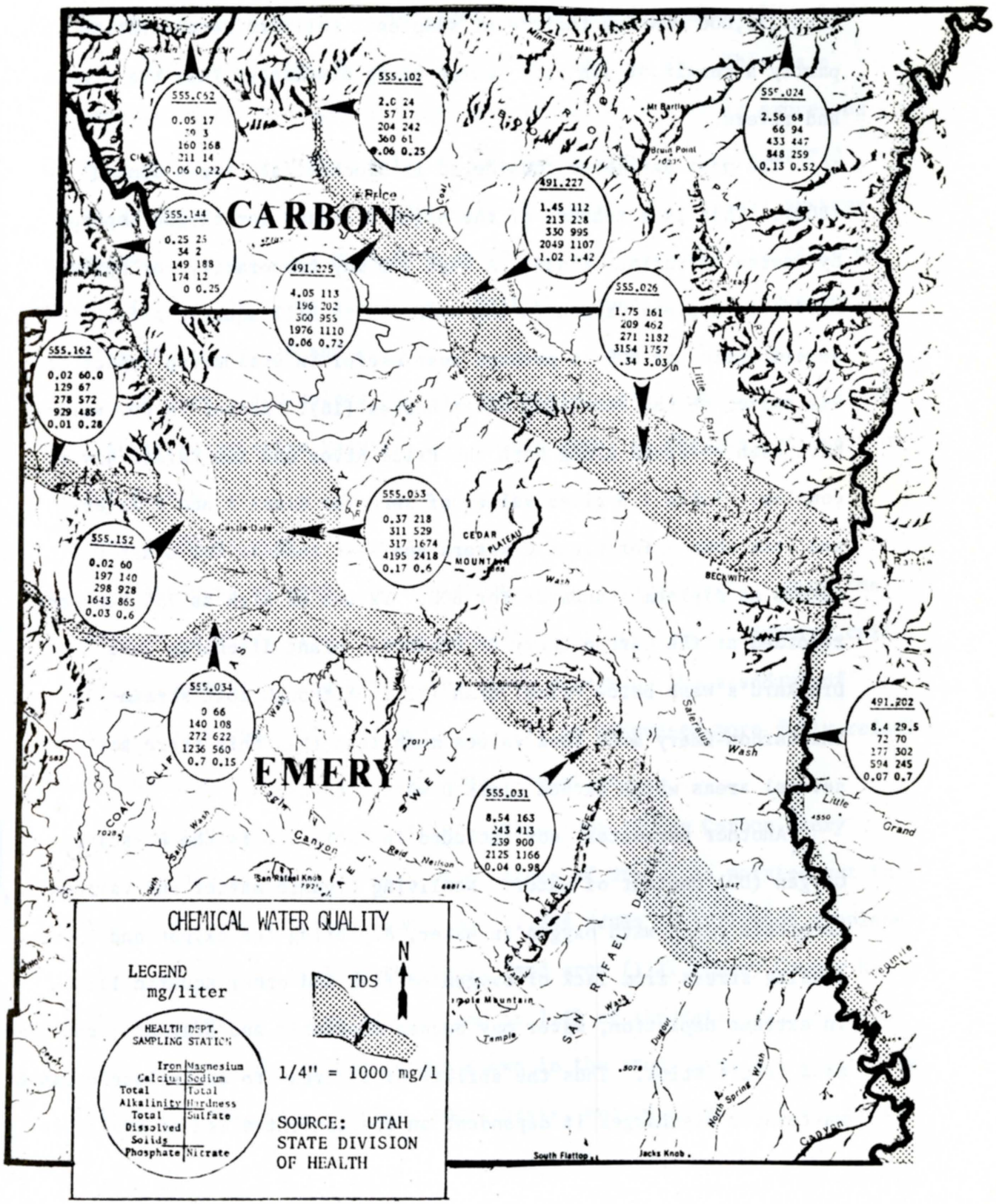
SOURCE: Utah Division of Water Resources, "Hydrologic Inventory of the Price River Study Unit," June, 1975.

and from 180 on is considered very hard (15). All of the streams in the Carbon-Emery area recorded hard to very hard water. Concentrations ranged from 168 to 1674 mg/liter (12, 13).

Figure 2.7 is a graphical representation of TDS concentrations and it also shows other chemical parameters collected at various stations. This data was collected during 1973 and 1974 under the direction of the Utah State Division of Health. Four samples were taken and evaluated at the various stations. The samples were averaged and the numbers found are displayed in Figure 2.7 (12, 13). It is recognized that these numbers may not be accurate at all times since a wide varation often existed between samples. However, for a general overview and for purposes of comparison this data can be considered adequate.

Biological. The most common parameter used in biological evaluation of a water source is coliform count. Coliform count refers to the coliform bacteria including fecal forms which flourish in the guts and feces of warm-blooded animals, including man. The coliform bacteria apparently do not themselves cause disease, but their presence in water suggests that disease-causing organisms (pathogens) may also be present. It is not feasible to identify the exact concentration of coliform bacteria in a water sample. Therefore, a quantity called the most probable number (MPN) is used to interpret test results in terms of results observed. It is reported as MPN per 100 milliliters of sample (MPN/100ml) or simply MPN values. For the Carbon-

FIGURE 2.7


CARBON
EMERY
555.062
0.05 17
20 3
160 168
211 14
0.06 0.22
555.102
2.0 24
57 17
204 242
360 61
0.06 0.25
555.024
2.56 68
66 94
433 447
848 259
0.13 0.52
555.144
0.25 25
34 2
149 188
174 12
0 0.25
491.225
4.05 113
196 202
360 955
1976 1110
0.06 0.72
491.227
1.45 112
213 228
330 995
2049 1107
1.02 1.42
555.026
1.75 161
209 462
271 1182
3154 1757
.34 3.03
555.162
0.02 60.0
129 67
278 572
929 485
0.01 0.28
555.033
0.37 218
311 529
317 1674
4195 2418
0.17 0.6
555.152
0.02 60
197 140
298 928
1643 865
0.03 0.6
555.034
0 66
140 108
272 622
1236 560
0.7 0.15
555.031
8.54 163
243 413
239 900
2125 1166
0.04 0.98
491.202
8.4 29.5
72 70
177 302
594 245
0.07 0.7
CHEMICAL WATER QUALITY
LEGEND
mg/liter
HEALTH DEPT.
SAMPLING STATION
Iron | Magnesium
Calcium | Sodium
Total Alkalinity | Total Hardness
Total Dissolved Solids | Total Sulfate
Phosphate | Nitrate
TDS
N
1/4" = 1000 mg/l
SOURCE: UTAH STATE DIVISION OF HEALTH
Price
Wellington
Castle Dale
CEDAR MOUNTAIN
BECKWITH
Little Park
Saleratus Wash
Little Grand
COAL CLIFF CANYON
SAN RAFAEL DESERT
SAN RAFAEL SWELL
Temple Mountain
South Flattop
Jacks Knob
North Spring Wash
Canyon

Emery area the coliform levels range from less than 3 MPN to more than 230,000 MPN for individual samples. Coliform deterioration is partly a result of sanitary sewage being discharged into the streams and rivers.

The next parameter considered is biochemical oxygen demand (BOD). This is a measure of the organic demand for oxygen imposed by wastes of various kinds. A high BOD may temporarily, or permanently, so deplete oxygen in the water as to kill aquatic life. The determination of BOD is perhaps most useful in evaluating impact of wastewater on the receiving water bodies (16). Excessive BOD values have been observed along both the Price River and San Rafael River complex. Table 2.3 gives values of zero for Class A and B water and less than 5 for Class C waters and less than 25 for Class D waters as minimum standards for BOD. Values as high as 750 BOD were recorded at the Carbon-Emery-By-Products' plant discharge into Drunkard's Wash below Price, Utah (13). Although most streams in the Carbon-Emery area show values much less than this there are several areas which exceed Class D water standards.

Another parameter, not included in Table 2.3 is the Dissolved Oxygen (DO) content of water. Nonliving organic matter and various chemicals react with oxygen in water, depleting the oxygen and causing stress from lack of oxygen on fish and other aquatic life. In extreme depletion, water may become anaerobic and stagnate, and as a result stink. Thus the ability of a stream to assimilate organic wastewater discharges is dependent on the concentration of available

DO. In the Carbon-Emery area DO levels should exceed 5.5 mg/1. DO values recorded in the Carbon-Emery area vary from about 8 to 16.

The last parameter we will consider here is PH. This is a measure of the hydrogen-ion activity in solution. It is expressed on a scale of 0 (highly acid) to 14 (highly basic). A PH of 7.0 is a neutral solution, neither acid nor basic. Biological systems normally do not vary much from neutral. Table 2.3 gives a range of 6.5 to 9.0 for water standards. Most PH values in the Carbon-Emery area are between 8 and 9.

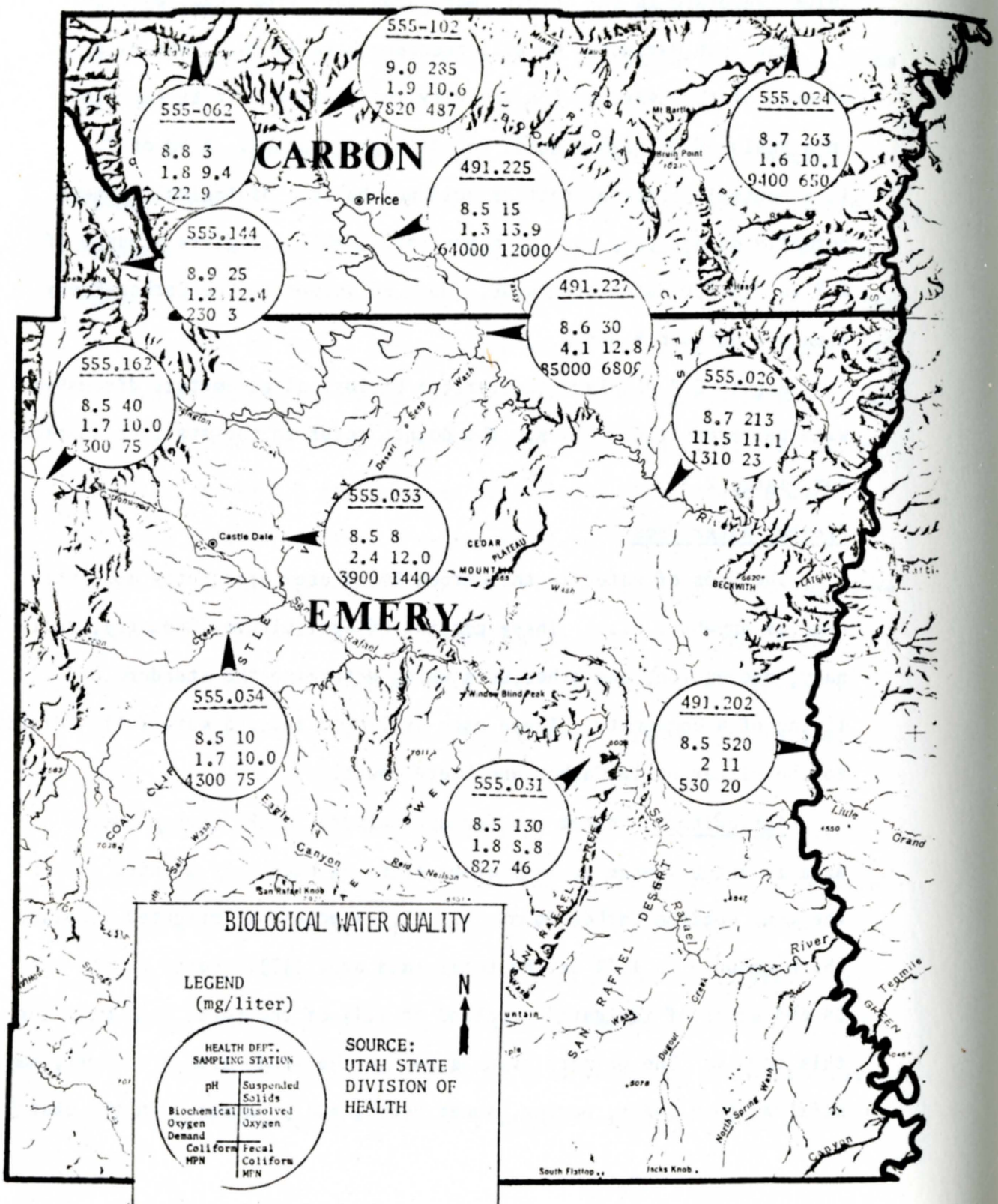
Figure 2.8 displays the various biological parameters discussed with representative values. The points refer to the stations mentioned for Figure 2.7.

Present Water Uses

The uses of water in the Carbon-Emery area are pretty much the same as anywhere else. These consist of agriculture, industry, culinary, recreation, and other uses which determine the standard of living of a community. These uses will be discussed more fully relative to the situation in Carbon and Emery counties.

Agriculture. Water use for agriculture in the Carbon-Emery area is not as large as many other areas of Utah. As pointed out in the Land section Carbon County has 12,344 acres of irrigated cropland which amounts to 1.3% of the total land area (17). Emery County has 38,604 acres of irrigated cropland or 1.4% of the total land mass for this county. The primary crops grown in the study area are wheat, hay, alfalfa, corn, oats, barley, sugar beets, and potatoes. In the past

FIGURE 2.8


555-102
9.0 285
1.9 10.6
7820 487
555-062
8.8 3
1.8 9.4
22 9
CARBON
Price
491.225
8.5 15
1.3 13.9
64000 12000
555.024
8.7 263
1.6 10.1
9400 650
555.144
8.9 25
1.2 12.4
230 3
491.227
8.6 30
4.1 12.8
85000 6805
555.162
8.5 40
1.7 10.0
1300 75
555.026
8.7 213
11.5 11.1
1310 23
555.033
8.5 8
2.4 12.0
3900 1440
Castle Dale
EMERY
555.034
8.5 10
1.7 10.0
1300 75
491.202
8.5 520
2 11
530 20
555.031
8.5 130
1.8 8.8
827 46
BIOLOGICAL WATER QUALITY
LEGEND
(mg/liter)
HEALTH DEPT.
SAMPLING STATION
pH
Suspended Solids
Biochemical Oxygen Demand
Dissolved Oxygen
Coliform MPN
Fecal Coliform MPN
SOURCE:
UTAH STATE
DIVISION OF
HEALTH
N

agriculture has used about 14 times as much water as municipal and industrial users. The mean annual consumptive use by agriculture has been about 112,410 acre feet (18). This figure will drop as the coal-fired power plants U.P.& L. is constructing start to utilize water which has been obtained from agricultural users.

Industry. The industries in the study area that have significant consumptive uses of water are mostly energy related. The largest users are the power companies. Utah Power and Light Company presently diverts water for use in cooling at the Castle Gate and Huntington plants. They have purchased and/or leased water rights for the present and future Huntington generating plant and for the future North Emery generating plant. In Emery County U.P.& L. has acquired water rights through 40 year leases. These water rights were formerly used for irrigation. Each 1,000 megawatts of generating capacity will use approximately 15,000 acre feet of water per year. Within the next ten years there will likely be an increase in generating capacity of more than 2,500 megawatts, in Emery County. All the cooling water has or will be obtained from agricultural users. This will require 35,000 to 40,000 acre feet annually that has previously been used for irrigation. Table 2.5 gives the maximum cooling water use expected at U.P.& L. Huntington (units 1&2) and North Emery (units 1&2) generating stations in Emery County. This table gives data for only two units at each site. A total of 2000 MW capacity is planned at Huntington, but only two units are now operating or under construction.

TABLE 2.5

Maximum Cooling Water Use

	HUNTINGTON				NORTH EMERY			
	First Unit (430-mw)		First and second units (845-mw)		First Unit (415-mw)		First and second units (830-mw)	
	g.p.m.	acre feet/year	g.p.m.	acre feet/year	g.p.m.	acre feet/year	g.p.m.	acre feet/year
Makeup (to tower from Huntington Creek)	4,600	7,500	9,200	15,000	4,600	7,500	9,200	15,000
Evaporation (to atmosphere)	4,100	6,700	8,300	13,000	4,100	6,700	8,200	13,400
Blowdown and Drift (concentrated waste)	470	800	940	1,600	470	800	940	1,600

Above values are calculated at maximum heat loadings:

2060×10^6 Btu/hour/unit
or
180,000 g.p.m. recirculation rate
106.4° F. to 82.5° F. temperature drop

Source: U.P.& L. Environmental Impact Statements, North Emery Vol. I, Second Unit Huntington Canyon.

Culinary. Municipal water systems in the study area are barely adequate for the present population. Table 2.6 gives data on the culinary water supplies of the two county area (19). Carbon County is better off than Emery County but even so five of their systems are listed as "Not Approved" by the State Division of Health. Emery County has two systems listed as "Not Approved", however, Emery has only one system "Provisionally Approved" while Carbon has eight. Neither county has any "Approved" systems at this time.

Recreation. The recreational uses of water in the study area are mainly, boating, fishing, and swimming. Recreational boating is pretty much confined to the larger reservoirs, principally the Scofield Reservoir. River running by raft and kayaks, with the exception of the Green River, represents a small percentage of recreational use in the Carbon-Emery area because of the small size of streams there. Fishing is enjoyed in many streams and reservoirs in the study area. Scofield Reservoir is a favorite spot for many fishermen as is Huntington Lake and Millsite Reservoir. The State Division of Wildlife Resources paid the Ferron Canal and Reservoir Company $100,000 for water rights in Duck Fork, Ferron and Willow Reservoirs. The Division has stabilized Ferron Reservoir as a fishing lake and is now in the process of stabilizing Duck Fork Reservoir as a fishing lake. The U.S. Forest Service Hydrologist has determined that Willow Lake is a slide area and as yet is indeterminable as a recreational area. The Forest Service has rejuvenated six reservoirs in the Emery-Sanpete border area,

TABLE 2.6

CULINARY WATER SUPPLY RATINGS IN CARBON-EMERY COUNTIES
(As of January 1975)

System	Ownership	POPULATION SERVED: Approved	Provisionally Approved	Class Pending	Not Approved	Date Assigned	Number of Connections	Ave. use gal. per conn. per day ④
CARBON CO.								
Aspen View (subdivision)	Private				50	12-6-74		
Carbonville	Private			100			49	
Clear Creek	Private		85				45	
East Carbon City ①	Public				1905			700
Helper	Public		2200				760	800
Hiawatha	Private		175				75	
Kenilworth	Private		425				103	
Price ②	Public		7000				2306	600
Scofield	Public		100				60	
Scofield Mt. Home (subdiv.)	Private				50	12-6-74		
So. Price Water Co.	Private				100		111	
Spring Glen	Private		545				190	
Sunnyside	Private				500			
Wellington	Public		1050				497	
County Total								
Total	14,285		11,580	100	2605			
No. Systems	14		8	1	5			

TABLE 2.6 CON'T

CULINARY WATER SUPPLY RATINGS IN CARBON-EMERY COUNTIES
(As of January 1975)

System	Ownership	POPULATION SERVED: Approved	Provisionally Approved	Class Pending	Not Approved	Date Assigned	Number of Connections	Ave. use gal. per conn. per day ④
EMERY CO.								
Castle Dale	Public			617		11-27-73	175	5-600
Clawson	Private				80		25	
Emery	Public			345			75	557
Ferron	Public		700				250	
Green River	Public			1275			365	
Huntington	Public				890	8-15-73	45	500
N. Emery Water Users ③	Public			1000				800
Orangeville	Public			550			180	
County Total								
Total	5457		700	3787	970			
No. Systems	8		1	5	2			

① Previously Columbia & Dragerton.
② Price City system serves Wellington, Old Highway Water Co., So. Price Water Co., Westside Water Users, Carbonville Water Co., Haycock Land Water Co., Spring Glen Water Co., Emery Star Route Water Co., East Carbonville Water Co., Kenilworth Water Co., and 200 individual homes.
③ Serves Cleveland, Elmo, and Lawrence.
④ Division of Environmental Health estimates.

SOURCE: "Public Water System Ratings," County Listings, January 1, 1975, Bureau of Water Quality, State of Utah, Dept. of Social Services, Division of Health, Pp. 4,8.

which were formerly irrigation reservoirs, to be used for recreational fishing only. These are Red Pine 1, Red Pine 2, Academy Mill, Grassy Lake, Pete's Hole, and Soup Bowl Reservoir. In addition, Desert Lake is a waterfowl management area.

Wastewater Treatment. The wastewater treatment facilities for both domestic and industrial purposes are shown in Table 2.7 and 2.8. The data in Table 2.7 indicate, that with the exceptions of the Price City area and Green River City, that the wastewater facilities in the Carbon-Emery area are inadequate. This inadequacy further complicates the water resource situation by lowering the quality of the available water. This resource contamination in effect removes water from the total available culinary supply.

In the industrial section four of the twelve wastewater facilities are either adequate or undetermined at this time. All others are inadequate to meet wastewater discharge standards.

TABLE 2.7

DOMESTIC WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

SYSTEM	Est. Pop. Served	DATE BEGAN Sewer System	DATE BEGAN Treatment Plant	Ave. Daily Flow MGD	DESIGNED FOR Mean Flow MGD	DESIGNED FOR P.E. (1000's)	TREATMENT FACILITIES
CARBON COUNTY (1)	(2)	(3)		(4)	(5)		(6)
Clear Creek	35	1941/---		0.003 E.	-- / --		CS
E. Carbon City							
Columbia	235	1940/1940		0.024 E.	0.075/0.75		CI
Dragerton	1,614	1940/1942		0.21 E.	0.45/2.7		*SH-(CM-DM)-FT2H-EG-BO
Helper	2,439*	1922/---		0.27	---/---		CS
Hiawatha	170	1929/ND		0.017	---/---		CS-POND *
Kenilworth	464	ND/---		0.05 E.	---/---		CS
Price	7,770	1910/---		0.83	---/---		--
Price River WID	12,121*	1971/1971		1.3	1.8/24.1		GH-SC-CM-FT2H-CM-EG-DFHMR-BOAU
Spring Glen	624	1971/---		0.052 E.	---/---		--
Sunnyside	600	1940/1953		0.06 E.	0.3/3.0		AP-GW-CI-FT1H-CM BOS-FS-ECG
Wellington	1084	1951/---		0.091	---/---		--
EMERY COUNTY							
Castle Dale	661	1928/---		0.07	---/---		NONE
Green River	1700	1936/1965		0.17	0.16/1.6		SC-GH-CM-FT1H-EG CM-DCMR-BOAU
Huntington	1325	1937/1960		0.13	---/---		LO*
Ferron	800	1939/1974		0.1	0.1/0.96		LO
Orangeville	600	ND/---		0.06 E.	---/---		NONE*

TABLE 2.7 CON'T

DOMESTIC WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

SYSTEM	DOWNSTREAM USE/ Pollution Abatement Needs	DISCHARGED TO	P.E. (BOD) Untreat. Waste / Dischgd. Waste	REMARKS
CARBON COUNTY	(7)	(8)	(9)	(10)
Clear Creek	ABCDFHJ/0	Clear Creek	31/31	Septic tanks and drain fields.
E. Carbon City				
Columbia	CD/0	Dry ditch to Price River	235/235	Inadequate *No secondary settling or Chlorine contact facilities
Dragerton	CD/2	Irrigation	1614/833	
Helper	BCD/7	Price River WID	--/--	*See App.
Hiawatha	BCD/0	Miller Creek to Price River*	170/59 E.	*Major portion of waste water flow dischgd. to slurry ponds
Kenilworth	BCD/0	Price River	464 E./464 E.	----
Price	CD/0	Price River WID*	--/--	*See App.
Price River WID	CH/7	Price River	12121/1721	*See App. cannot meet 1977 standards.
Spring Glen	--/--	Price River WID*		*See App.
Sunnyside	-/7	Whitmore Canyon	600/38	
Wellington	--/--	Price River WID*		
EMERY COUNTY				
Castle Dale	CD/0	Cottonwood Creek	661/661	Only a collection system
Green River	CDFHJ/7	Green River	1700/320	Generally satisfactory, but cannot meet 1977 standards
Huntington	CE/0	Lagoon eff. to Irr. ditch Raw W.W. dischgd. to H.C.	1417**/1417	*New lagoon built, not in use **Includes 92 P.E. ind. waste
Ferron	CD/7	NONE	930*/0	Lagoons and collection systems under construction * Includes 130 P.E. slaughter house wastes.
Orangeville	CD/0	Cottonwood Creek	600/600	*Applied for grant to construct facilities 1974 presently, raw sewage is dischgd. to Cottonwood Ck

TABLE 2.7 CON'T

DOMESTIC WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

*App. Price River Water Improvement District - Treatment Plant

Municipalities	No. Connections	Est. Pop. Served	Est. Flow MGD
Castle Gate, Helper	864	2,643	0.287
Price	2,590	7,770	0.83
Wellington	271	1,084	0.091
Spring Glen & Unicorp. Areas	156	624	0.052
TOTALS	3,881	12,121	1.27

NOTES:

BOD - Biochemical Oxygen Demand
ND - Data Not Available
WID - Water Improvement District
E. - Estimate
P.E. - Population Equivalent, in thousands, as measured by BOD, for which the treatment facilities were designed.
MGD - Million Gallons Per Day

KEY TO SYMBOLS - COLUMN (6)

AP - Aeration, plain, without sludge return.
BO - Open sludge beds.
BOAU - Sludge beds, open, asphalt surfaced, underdrains provided.
BOS - Open sludge beds, sand surfaced.
CI - Two story Imhoff settling tanks.
CM - Mechanically equipped settling tanks.
CS - Septic tanks .
DCMR - Digester, separate sludge, with fixed cover, stirring mechanism, heated.
DFHMR - Digester, separate sludge, with floating cover, gas used in heating, stirring mechanism, heated.
DM - Digester, separate sludge with stirring mechanism.
ECG - Chlorination with contact tank by chlorine gas.
EG - Chlorination by chlorine gas.
FS - Intermittent sand filters.
FT1H - High capacity, single stage filters.
FT2H - High capacity, two stage filters.
GH - Grit chambers without continuous removal mechanism.
GW - Grit chambers, separate grit.
LO - Oxidation lagoons or ponds.
SC - Screens, comminutor (screenings ground in sewage stream)
SH - Screens, bar rack (1/2" to 2" openings) hand cleaned.

KEY TO SYMBOLS - COLUMN (7)

Number to left of slash - Existing water uses downstream from the point of waste discharge.
A - Source of domestic water supply.
B - Source of industrial water supply.
C - Livestock water supply.
D - Irrigation water supply.
E - Commercial fishing.
F - Game fishing.
H - Wildlife.
J - Other recreation.

KEY TO SYMBOLS - COLUMN (7)

Number to right of slash - Needs of a facility according to the Utah Water Pollution Control Board standards.
0 - New treatment facilities needed.
2 - Addition of other treatment methods to existing facilities needed.
7 - No project needed.

SOURCE: Adapted from; "Domestic Wastewater Facilities in Utah," 1975 update to 1971 inventory. State of Utah, Dept. of Social Services, Division of Health, S.L.C., Utah.

TABLE 2.8

INDUSTRIAL WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

LINE NO.	INDUSTRY	TYPE OF INDUSTRY	LOCATION	ESTIMATED BOD PRODUCED LBS/OPERATING			WASTE TREATMENT FACILITIES	
				Day	Month	Year		
				Sanitary/Process	Sanitary/Process	Sanitary/Process	Sanitary	Process
	CARBON COUNTY (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Carbon-Emery By-Products	Animal By-Products	Price	1/10	19/14,351	220/166,430	CS-IS	CS-IS
2	Jeanselmes Mkt. & Slaughter House	Slaughter House	Price	1/143	7/1,859	80/22,310	NONE	NONE
3	Mariani Air Products	Misc. Dry Ice	Wellington	1/7	11/152	100/1,460	CS	KC-P
4	North American Coal Corp.	Misc. H20 Treat	Castle Gate	0/0	3/0	40/0	NONE	NONE
5	Plateau Mining Co.	Mining Coal	Price	6/0	180/0	2,190/0	CS-IS	LE-Recycle
	U.S. Fuel Co.	Coal Washing	Hiawatha	16/0	356/0	4,260/0	CS	LP
	Utah Power & Light Co.	Misc. Elect. Power	Castle Gate	5/57	150/1,710	1,830/20,810	CS-IS	P
	Wellington Coal Cleaning Plant	Coal Washing	Wellington	4/0	69/0	840/0	CS-IS	LPE
	EMERY COUNTY							
	Justice Meat Co. (a)	Slaughter House	Huntington	0/393	9/477	100/5,720	CS-IS	NONE
10	Kilpack Locker Plant	Slaughter House	Ferron	0/245	2/518	30/6,240	NONE	NONE
11	Miller & Curtis Packing Co.	Slaughter House	Castle Dale	0/48	10/1,248	120/14,980	NONE	NONE
12	Peabody Coal Co.	Mining Coal	Huntington	8/0	228/0	2,740/0	KC	LP

TABLE 2.8 CON'T

INDUSTRIAL WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

LINE NO.	ESTIMATED BOD DISCHARGES LBS/OPERATING			WASTE WATER DISCHARGE				DOWNSTREAM USE/ Pollution Abatement Needs	REMARKS
	Day	Month	Year			VOLUME GALS./OPERATING			
						Day	Month		
	Sanitary/Process	Sanitary/Process	Sanitary/Process	To Sanitary	To Process	Sanitary/Process	Sanitary/Process		
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
1	1/0	17/14,351	190/166,450	Price River Underground	Price River Underground	140/1,000	3,330/23,800	BCDH/O	Cannot Meet 1977 Standards
2	0/143	0/1,859	0/22,310	Price RWID Sewer	Price RWID Sewer	20/4,900	260/63,700	CD/7	
3	0/7	2/152	20/1,460	Price River	Price River	180/77,000	3,910/1,670,900	BCDH/X	Reviewed from CDE Appln. 7-6-71
4	0/0	3/0	40/0	None	Price River	0/80,000	0/2,400,000	CDH/O	COE Appln. 7-15-71
5	0/0	0/0	0/0	Underground	Pond	600/1,000	18,000/30,000	-/7	
6	0/0	0/0	0/0	Miller Ck.	Pond	16,300/70,700	353,710/1,534,190	CD/O	Reviewed 10-27-67
7	0/57	0/1,710	0/20,810	---	Price River	500/140,000	15,000/4,200,00	DFHI/2	
8	0/0	0/0	0/0	Underground	Pond&Recirc.	800/316,000	13,840/5,480,640	-/7	Reviewed 10-26-67
9	0/393	0/477	0/5,720	Underground	Huntington Ck. & Irr.	40/3,100	870/108,000	DFH/O	Will connect To Huntington Sewer When Available
10	0/245	0/518	0/6,240	Ferron Sewer	Ferron Sewer	0/2,300	0/24,840	-/O	
11	0/48	10/1,248	120/14,980	Irrigation	Irrigation*	80/1,420	2,080/36,920	-/O	*Blood To Irrigation
12	0/0	0/0	0/0	Chem. Toilets	Ponds	0/200,000	0/6,000,000	-/1	COE Appln. 6-3-74

TABLE 2.8 CON'T.

INDUSTRIAL WASTEWATER FACILITIES IN CARBON-EMERY COUNTIES

EXPLANATION OF TABULATIONS

NOTES: [a] Also known as Castle Valley Meat Co.
BOD - Biochemical Oxygen Demand

COLUMNS (4) (5) (6) - NUMBER TO LEFT OF SLASH - The estimated quantity of BOD produced from sanitary wastes in pounds per operating day, per month, and per year (based on 0.1 lb. per employee per operating day).
NUMBER TO RIGHT OF SLASH - The estimated quantity of BOD produced from process sources in pounds per operating day, month, and year.

COLUMNS (7) (8) - KEY TO SYMBOLS

CS - Septic tank.
IS - Subsurface wastewater application to land.
KC - Chemicals used.
LE - Evaporation lagoons (non-overflowing).
LP - Lagoons for settling of wastewater.
LPE - Evaporation lagoons for settling of wastewater (non-overflowing).
P - Ponds

COLUMNS (9) (10) (11) - NUMBER TO LEFT OF SLASH - Pounds of BOD discharged from the plant in sanitary waste per operating day, month, and year.
NUMBER TO RIGHT OF SLASH - Pounds of BOD discharged from the plant in process waste per operating day, month, and year.

COLUMNS (12) (13) - Indicates the ultimate disposition of the waste following its discharge from the plant.

COLUMNS (14) (15) - Gives the estimated volume of waste discharged in gallons per operating day and month. Sanitary wastes have been estimated at 10 gallons per person per day.

COLUMN (16) - NUMBER TO LEFT OF SLASH - Existing water uses downstream from the point of waste discharge.

B - Source of industrial water supply.
C - Livestock water supply.
D - Irrigation water supply.
F - Game fishing.
H - Wildlife.
I - Bathing.

NUMBER TO RIGHT OF SLASH -

X - Treatment needs presently undetermined.
0 - New treatment facilities needed.
1 - Enlargement of existing facilities needed.
2 - Addition of other treatment methods to existing facilities needed.
7 - No project needed.

SOURCE: Adapted from; "Industrial Wastewater Facilities in Utah," 1975 update to 1973 inventory. State of Utah, Dept. of Social Services, Division of Health, S.L.C., Utah.

SECTION 2

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3. U.S. Geological Survey, Water Resources Data for Utah, Part 1. Surface Water Records, 1973.

4. Division of Water Rights, Utah State Inventory of Dams-1974, Salt Lake City, Utah.

5. Bureau of Reclamation, Reclamation Project Data, Salt Lake City, Utah, P. 701-705.

6. Bureau of Reclamation, Emery County Project, Definite Plan Report, Salt Lake City, Utah, Sept. 1961.

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SECTION 2

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17. Utah Agricultural Statistics - 1974.

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SECTION 3

AIR

There are many factors which can affect the air quality of a region. These include the historical meteorology of the region, its industry, and its population. In the Carbon-Emery area air quality has been good in the past, but the area is now undergoing large-scale industrial and demographic expansion which will affect future air quality.

Climate

Many factors contributing to the climate of the Carbon-Emery area have been discussed in the Land and Water section of this study. In this section only those factors contributing to air quality are discussed. The data available on air in the Carbon-Emery area has been obtained from the Utah State Division of Health Air Conservation Program, the Utah Engineering Experiment Station, and Environmental Impact Statements for Utah Power & Light Company's generating plants in Emery County. There are other agencies and organizations which are presently conducting air quality studies, but their results are not yet available.

Prevailing winds in the Carbon-Emery area are generally light to moderate in all seasons of the year. As a rule, the strongest winds blow in the spring from the South and last for several days at a time. Extremely strong winds are rare and usually occur with local thunderstorms or storm fronts. Surface winds are influenced strongly by the topography of an area, therefore, it is difficult to generalize over a large area.

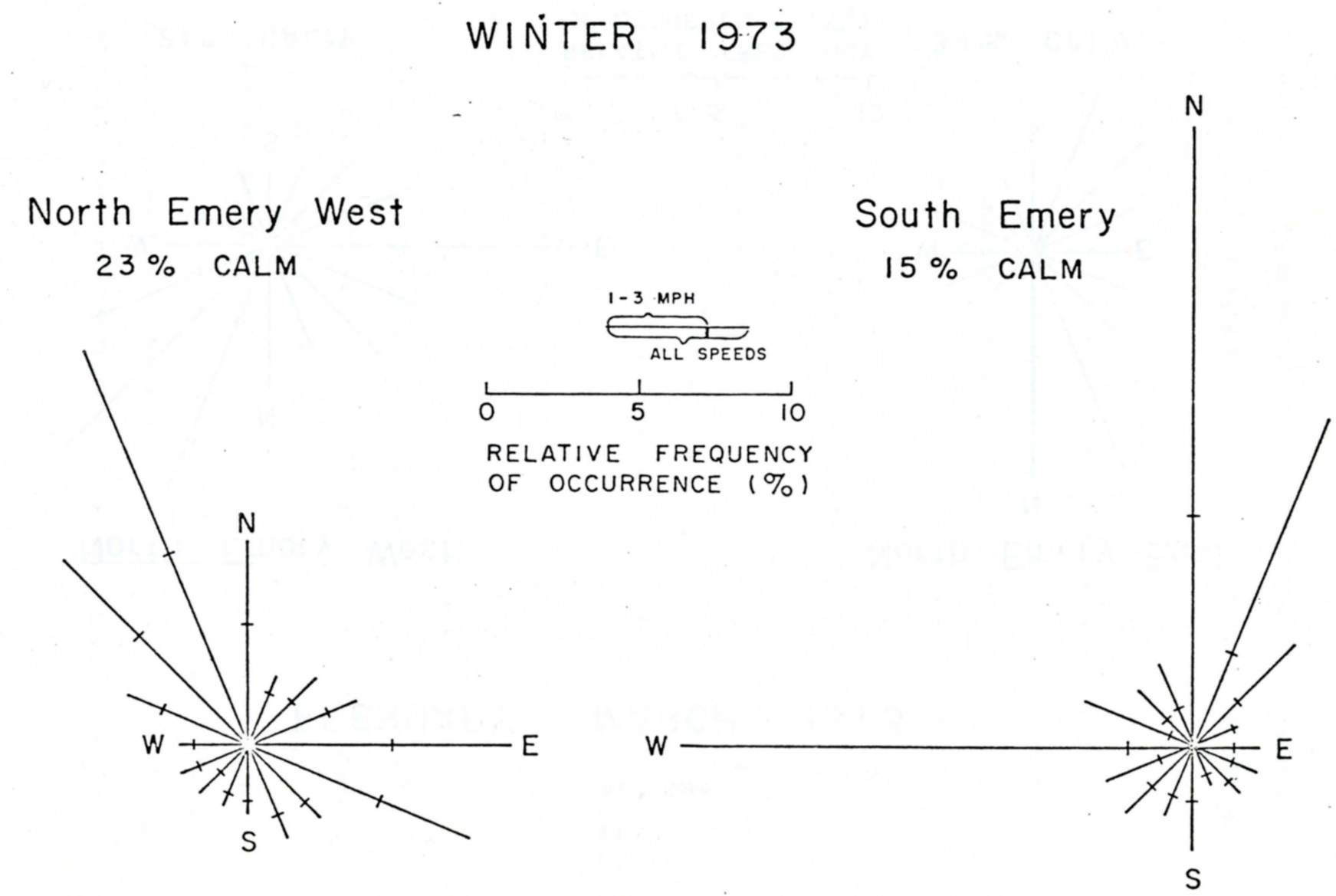
Wind direction data are available for specific sites such as the Castle Valley area of Emery County where UP&L is building a power plant. Figures 3.1 and 3.2 show wind direction roses for four sites in Castle Valley (1). North Emery West includes the area around the towns of Ferron, Castle Dale, Orangeville, Hiawatha, Wattis and points north and west of these towns. North Emery East includes the area around the towns of Huntington, Cleveland, Wellington (Carbon Co.) and points north and east of these towns. South Emery includes areas around the towns of Moore, Emery and areas south and east of these towns. All of these areas show a predominate wind direction from either the Northwest or Northeast and at the South Emery site, moderate to strong westerly winds also occured frequently.

Potential for air pollution depends largely upon the mixing height, i.e., the height in the atmosphere through which effluents can be mixed by turbulent diffusion, and upon the average wind speed in this mixing layer. In the Castle Valley area of Emery County the mixing height is restricted in the mornings to about 100 feet with a wind speed below 10 mph. In the afternoons the mixing height rises typically to over 8000 feet with wind speeds up to 12 mph. Diffusion conditions would be poorest on fall and winter mornings when mixing heights and wind speeds are lowest (1).

The air-mass stability of the Castle Valley area is detectably more stable than in Huntington Canyon to the north. Less than 10 percent of observed inversions were at a height which would result in fumigation or severe limited mixing conditions. During the winter months

FIGURE 3.1

Wind Rose

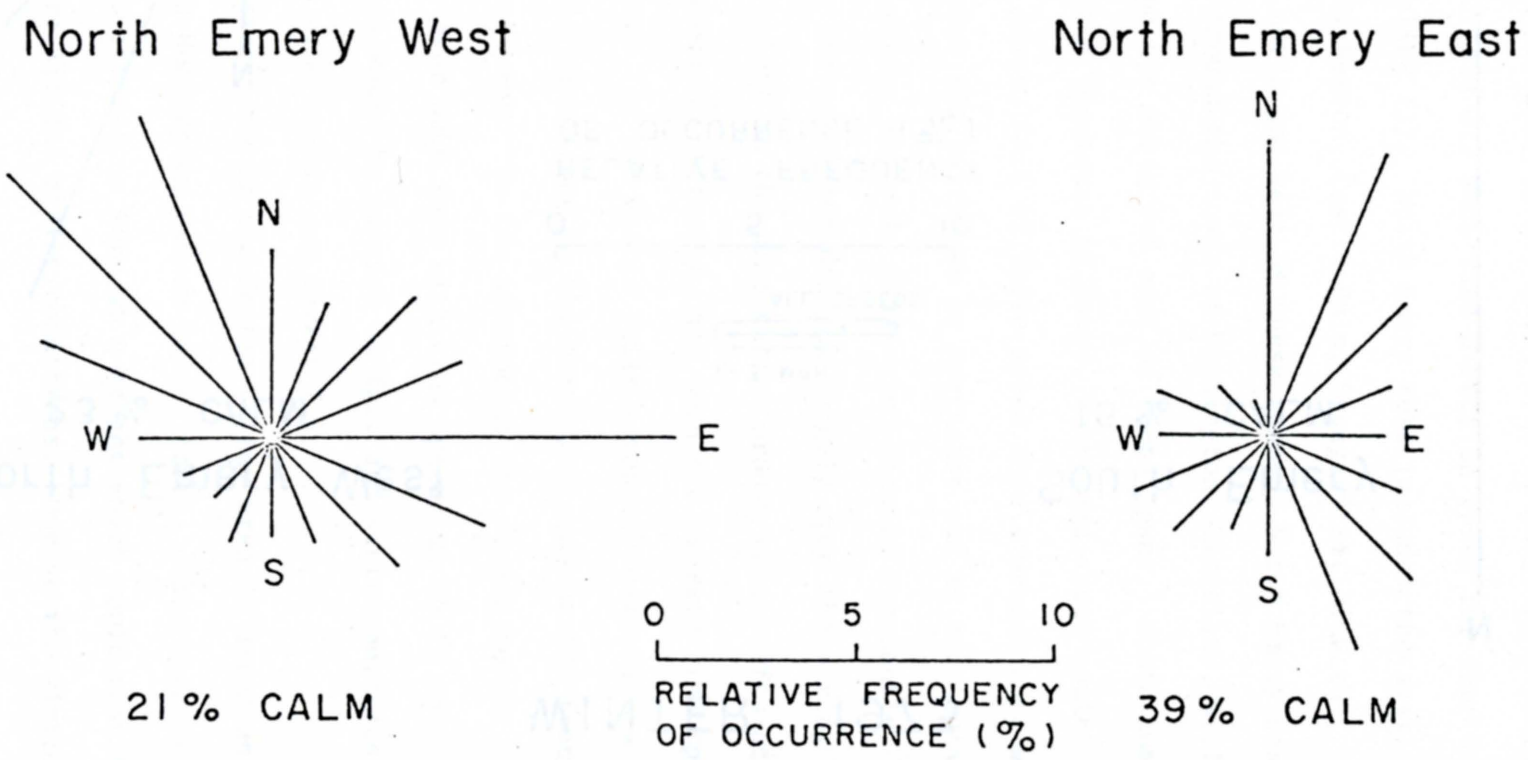


Source: Utah Power and Light Company, "North Emery Generating Station Applicant's Environmental Analysis," Vol. I. Revised Dec. 1973, P. 30

FIGURE 3.2

Wind Rose

FEBRUARY - MARCH 1973



Source: Utah Power and Light Company, "North Emery Generating Station Applicant's Environmental Analysis," Vol. I, Revised Dec. 1973, P. 37

the Castle Valley is characterized by light wind with very stable air mass during the morning and moderately stable air masses during the afternoon.

Air Quality

Air pollution in Carbon and Emery counties has been minimal in the past due to the low population and absence of large industry in the region. However, with the increase in coal mining and construction of new coal-fired steam-electric generating plants air quality will probably deteriorate somewhat.

Air pollution data are expressed in units of concentration (ppm or $\mu g/m^3$) or in terms of total emissions expressed in tons. The two sets of units are not directly related. If the rate of emission is known along with the concentration then total emissions, in tons, can be calculated. However, if only total emissions, in tons, is known it cannot be related back to units of concentration. This is due to dispersion factors unique to each emission site and time of emission. For example an industrial plant emits 100 tons of air pollutants in a given year. This is compared to another plant which emitted 200 tons for the same year. One conclusion is that the second plant is a "worse" pollutor than the first. However, maybe the first plant only emitted pollutants during a two month period while the second emitted pollutants continuously during the year. In this case the first plant actually is emitting pollutants at a rate three times greater than the second plant. Given that the two hypothetical plants emitted their pollutants over the same time period

of one year, then the same conclusion as above could be made. This however, could also be in error. Maybe the first plant was located in an area with severe inversion conditions and the second in an open area without inversions. Then the concentration of pollutants in the ambient air around the first plant would likely be higher than around the second plant. So, once again total emission data would lead to incorrect conclusions regarding the two plants.

This example is only intended to point out the confusion which could result from using total emission data. It is useful when comparing with other total emission data, but should not be compared with "concentration" data.

The Utah State Division of Health adopted a Code of Air Conservation Regulations on January 24, 1972. This code gives ambient air standards based on Federal Ambient Air Standards.[1] Included in the ambient air standards are standards for particulates, sulfur oxides, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen oxides. Table 3.1 summarizes the Ambient Air Standards for these pollutants. Federal primary and secondary ambient air quality standards are defined as: (2)

> Primary ambient air quality standards are those which, in the judgement of the Administrator, based on the air quality criteria and allowing an adequate margin of safety, are requisite to protect the public health.

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1. 40CFR50; 36FR22384, November 25, 1971; as amended by 38FR25678, September 14, 1973; 40FR7042, February 18, 1975.

TABLE 3.1

AMBIENT AIR STANDARDS

POLLUTANT	AVERAGING PERIOD	STANDARDS Primary	Secondary	REMARKS
SO_2	Annual	0.03 ppm ($80\ \mu g/M^3$)	None	Arithmetic mean
	24 hours	0.14 ppm ($365\ \mu g/M^3$)	None	Not to be exceeded more than once per year
	3 hours	None	0.5 ppm ($1300\ \mu g/M^3$)	Not to be exceeded more than once per year
PARTICULATE	Annual	$75\ \mu g/M^3$	$60\ \mu g/M^3$	Geometric mean
	24 hours	$260\ \mu g/M^3$	$150\ \mu g/M^3$	Not to be exceeded more than once per year
CO	8-hour	9 ppm ($10,000\ \mu g/M^3$)	Same as Primary	Not to be exceeded more than once per year
	1-hour	35 ppm ($40,000\ \mu g/M^3$)	Same as Primary	Not to be exceeded more than once per year
PHOTOCHEMICAL OXIDANTS	1-hour	0.08 ppm ($160\ \mu g/M^3$)	Same as Primary	Measured as Ozone. Corrected for NO_x and SO_2. Not to be exceeded more than once per year
HYDROCARBONS	3-hour	0.24 ppm ($160\ \mu g/M^3$)	Same as Primary	Corrected for Methane. Not to be exceeded more than once per year
NO_2	Annual	0.05 ppm ($100\ \mu g/M^3$)	Same as Primary	Arithmetic mean

TABLE 3.1 CONT.

AMBIENT AIR STANDARDS

ppm = parts per million

$\mu g/M^3$ = microgram per cubic meter

ppm = $(\mu g/M^3)$ (3.82×10^{-4})

Source: Utah State Division of Health
Bureau of Air Quality, February 28, 1975

Secondary ambient air quality standards are those which, in the judgement of the Administrator, based on the air quality criteria, are requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air.

Each state is required by Section 110 of the Clean Air Act to adopt and submit to the Administrator, EPA, a plan which provides for the implementation, maintenance, and enforcement of such national ambient air standards within 9 months or no later than January 30, 1972. The state of Utah adopted the Utah Implementation Plan on January 20, 1972, to abide by this act.

A copy of the Air Conservation regulations which constitute the legal basis for control of air pollution sources in the state of Utah is included in the Appendix. It should be noted that the Utah Air Conservation Committee and the State Board of Health do not necessarily agree with most of the specific limits selected for ambient standards by the Federal government. Nevertheless, Federal ambient and new source standards apply throughout the nation and are legally enforceable in Utah.

Industrial standards have been set at 100 ppm for workers exposed 8 hours per day 5 days per week.[1] These represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day, without adverse effect. In Los Angeles, Cal-

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1 - Adopted at the 25th Annual Meeting of the American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, May 6, 7, 1963.

ifornia, 100 ppm for 1 hour is considered safe but approaches levels where city air pollution alerts are issued.[2]

Air quality data for the Carbon-Emery area has been collected by the Utah Engineering Experiment Station, University of Utah, for the Applicant's Environmental Analysis for UP&L power plants in Emery County. Table 3.2 gives the monthly suspended particulate concentration data at Huntington City and Huntington Canyon in Emery County. This data was collected over a three year period, 1970-72, at seven different sites. The 24-hour high and low values for each site were included to show the wide variation observed in these actual measurements. (3).

The particulate concentrations from Table 3.2 are compared with the Federal primary and secondary standards in Table 3.3. This comparison shows that for a total of 2,027 measurements, 22 exceeded the primary standard and 77 exceed the secondary standard.

Table 3.4 shows the particulate concentrations, from Tables 3.2 and 3.3, by type of particulate as determined from scanning electron microscope examination. It is clear that the largest contributor to total suspended particulates is soil dust. It accounts for 97 percent of the total suspended particulates in the samples taken during 1970-72. Fly ash had the next largest concentration which was 2 percent of the total followed by soot with one percent. Particules less than 2 microns (1 micron = .001 millimeter) in diameter

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2 - Arthur C. Stern, "Air Pollution," Vol 3, P. 682.

TABLE 3.2

MONTHLY SUSPENDED PARTICULATE CONCENTRATION AT HUNTINGTON AND HUNTINGTON CANYON FOR 1970, 1971 AND 1972 (GEOMETRIC MEAN CONCENTRATION $\mu g/m^3$)*

	STATIONS						
	Huntington				Huntington Canyon		
Month-Year	Rowley	Litster	Mac-Arthur	School Roof	Bear Creek Canyon	Harrison	Cedar Mountain
Aug. 1970	68				11	22	
Sept.	81				16	23	
Oct.	64				6	14	
Nov.	65				9	19	
Dec.	47	44			16	22	
Average	65	44			12	20	
24-hr. High	215	69			25	510	
24-hr. Low	16	16			1	3	
Jan. 1971	94	101					
Feb.	72	67	63				
March	109	61	72				
April	109	71	102				
May	65	44	62				
June	82	59	65				
July	92	69	72		20		84
Aug.	77	67	55		11		
Sept.	79	65			16		
Oct.	58	60			6		
Nov.	63	67	53		9		
Dec.	30	41	45	58	16		
Average	78	64	65	58	13		84
24-hr. High	990	439	472	107	417		1016
24-hr. Low	4	3	17	33	3		10
Jan. 1972	70	71	76	79	14		
Feb.	51	71		68	16		
March	74	39		71	17		
April		65		55	20		
May		68		63	28		
June		58		50	15	20	
July				53			
Aug.				50	18		
Sept.				44	15		
Average	65	62	76	60	18	20	
24-hr. High	199	174	131	187	139	56	
24-Hr. Low	30	12	42	26	6	8	

*** Values corrected to standard conditions.**

Source: Ursenbach, Wayne O., Utah Engineering Experiment Station, University of Utah, "Hearings on Proposed Regulations to Prevent Significant Deterioration," Environmental Protection Agency, Denver, Colorado, Sept. 5-6, 1973.

TABLE 3.3

SUMMARY OF MAXIMUM 24-HOUR PARTICULATE CONCENTRATIONS

HUNTINGTON CANYON

Location	Year	Number of Samples	Number in excess of Federal Primary (260 ug/m^3)	Number in excess of Federal Seconds (150 ug/m^3)
Huntington Canyon (Bear Creek)	1970	95	0	0
	1971	104	2	2
	1972	130	0	0
Huntington Canyon (Harrison)	1970	137	1	3
	1971	15	0	0
	1972	16	0	0
Huntington (Rowley)	1970	141	0	4
	1971	347	8	27
	1972	80	0	8
Huntington (Litster)	1970	30	0	0
	1971	329	3	13
	1972	146	0	1
Huntington (School Roof)	1971	24	0	0
	1972	213	0	5
Huntington (McArthur)	1971	203	5	11
	1972	7	0	0
Huntington (Cedar Mountain)	1971	10	3	3
TOTAL		2,027	22	77

Source: Ursenbach, Wayne O., Utah Engineering Experiment Station, University of Utah, "Hearings on Proposed Regulations to Prevent Significant Deterioration," Environmental Protection Agency, Denver, Colorado, Sept. 5-6, 1973.

TABLE 3.4

PARTICULATE CONCENTRATIONS (ug/m^3) IN THE VICINITY OF HUNTINGTON CANYON, UTAH

1970 - 1972

	Huntington	Bear Creek
Total Suspended Particulates		
Fly Ash	1.34	0.34
Soil Dust	63.79	14.41
Sulfate Type	0.21	0.18
Soot	0.68	0.08
Total	66.0	15.0
Suspended Particulates less than 2.0 microns diameter		
Fly Ash	0.16	0.05
Soil Dust	3.19	1.30
Sulfate Type	0.06	0.06
Soot	0.53	0.07
Total	3.94	1.48

Source: Ursenbach, Wayne O., Utah Engineering Experiment Station, University of Utah, "Hearings on Proposed Regulations to Prevent Significant Deterioration," Environmental Protection Agency, Denver, Colorado, Sept. 5-6, 1973.

had a small contribution to the total. The source of the fly ash was undetermined as the measurements were taken before the Huntington power plant was completed.

Sulfur dioxide concentrations are shown in Table 3.5 and nitrogen oxides in Table 3.6. It is evident from Table 3.5 that the concentrations of sulfur dioxide was very low at all sampling sites. It was concluded by the Utah Engineering Experiment Station that "until better methods are available the background can only be stated as below .005 ppm or 13$\mu g/m^3$."

Nitrogen oxides were measured to be well below the Federal primary and secondary standards. The highest readings were for summer months "indicating that decay of organic matter and possibly mobile sources may be important sources of NO_x in the area" (1).

Data on other sources of air pollution is not presently available in concentration units. The Utah State Division of Health has published data on total emissions by source (4). Table 3.7 and Figure 3.3 show total emission for Carbon County in 1972.

Transportation accounts for 44% of all air pollution in Carbon County. The majority of this is from private vehicles such as the family car. This pollution is primarily carbon monoxide and hydrocarbons.

The other major source of air pollution in this county is electrical power generation which accounts for 46% of the county's air pollution. The source of this pollution is the Utah Power and Light generating station near Price (Castle Gate Station). Sulfur oxides and particulates are the pollution forms this source generates.

TABLE 3.5

SULFUR DIOXIDE (SO_2) CONCENTRATIONS (PPM) IN THE HUNTINGTON AREA 1971-72

Date	HUNTINGTON		HUNTINGTON CANYON			
	Rowley	Litster	Bear Creek	Harrison	Cleveland	Cedar Mountain
December 1970						
14-15		.0072				
16-17	<.005					
November 1971						
2-3	<.005					
3-5	<.005					
5-6			<.005			
5-8	<.005					
6-9			<.005			
8-10	<.005					<.005
9-12			<.005			
10-13						<.005
11-13	<.005					
December 1971						
13-15	<.005	<.005				
15-16	<.005	<.005				
20-22	<.005	<.005	<.005			
22-23	<.005	<.005	<.005			
22-24						
June 1972						
5-7		<.005	<.005	<.005		
6-8	<.005				<.005	
7-9		<.005	<.005	<.005		
12-16	<.005	<.005		<.005	<.005	
13-16			<.005			
20-24		<.005			<.005	
27-30					<.005	

Source: Ursenbach, Wayne O., Utah Engineering Experiment Station, University of Utah, "Hearings on Proposed Regulations to Prevent Significant Deterioration," Environmental Protection Agency, Denver, Colorado Sept. 5-6, 1973.

TABLE 3.6

NITROGEN OXIDE (NO_2, NO_2+NO) CONCENTRATIONS (ppm) IN THE HUNTINGTON AREA
1971-72

	HUNTINGTON				HUNTINGTON CANYON							
	Rowley		Litster		Bear Creek		Harrison		Cleveland		Cedar Mountai	
Date	NO_2	NO_x	NO_2	NO_x	NO_2	NO_x	NO_2	NO_x	NO_2	NO_x	NO_2	NO_x
Nov. 1971												
2-3	.0088											
3-5	.0041											
4-6					.0009	.0012						
5-8	.0052	.0059										
6-9					.0009	.0013						
8-10	.0064	.0073									.0009	.0009
9-12					.0012	.0012						
11-13	.0095	.0116									.0016	.0017
Average	.0068	.0084			.0010	.0012					.0012	.0013
Dec. 1971												
13-15	.0077	.0104	.0141	.0200	.0017	.0022						
15-17	.0116	.0144	.0137	-	-	.0012						
17-19					.0014	.0016						
20-22	.0102	.0122	.0063	.0158								
22-23	.0121	.0126	.0145	.0153								
Average	.0104	.0124	.0121	.0170	.0016	.0017						
June 1972												
5-7			.0300	.0360	.0120	.0133	.0188	.0250				
6-8	.0236	.0330							.0142	.0200		
7-9			.0197	.0246	.0059	.0071	.0140	.0158				
12-14				.0044	.0050	.0057	.0037	.0069	.0054			
14-16	.0052	.0070		.0086	.0060		.0060		.0074	.0083		
20-22			.0165	.0201	.0062	.0083	.0140	.0222	.0090	.0090		
22-24			.0251	.0288		.0075	.0164	.0196	.0128	.0171		
26-28			.0180	.0236	.0057	.0080	.0156	.0180	.0120	.0133		
28-30			.0165	.0207	.0054	.0068	.0160	.0214	.0090	.0121		
Average	.0144	.0200	.0210	.0208	.0066	.0081	.0131	.0164	.0100	.0116		

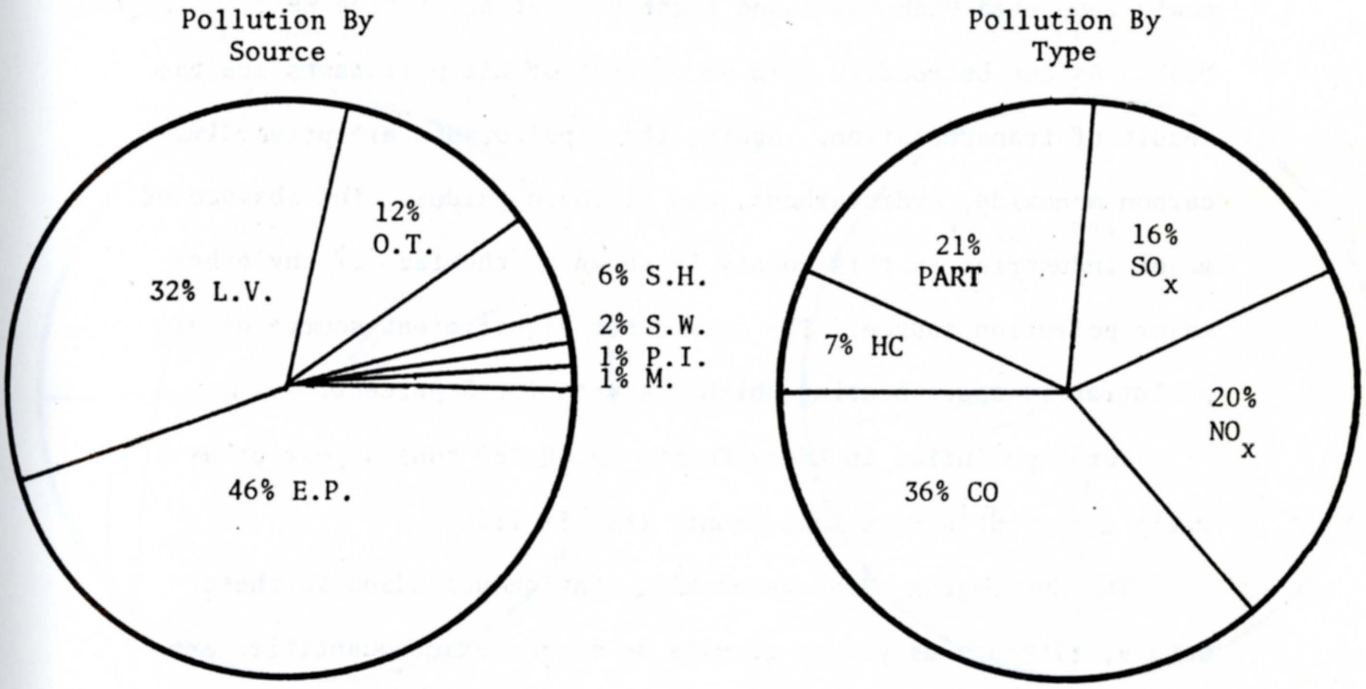
Source: Utah Engineering Experiment Station, Air Pollution Investigations in the vicinity of the Huntington Canyon Power Plant, Progress Report, Sept. 1972, Utah Power & Light Co., North Emery Generating Station Applicant's Environmental Analysis. Vol. I. Revised Dec. 1973.

TABLE 3.7

COUNTY	SOURCE CATEGORY	Particulate	SO_x	CO	HC	NO_x	Other	Total
CARBON	Light Vehicles	40	20	6,420	1,120	710	60	8,370
	Other Transportation	130	310	1,390	500	820	30	3,180
	Process Industries	180	30	10	--	120	--	340
	Solid Waste	70	--	320	100	10	--	500
	Space Heat	260	310	980	10	60	10	1,630
	Electric Power Generation	4,780	3,670	190	60	3,480	--	12,180
	Miscellaneous	40	--	130	190	--	--	360
	County Total	5,500	4,340	9,440	1,980	5,200	100	26,560

TONS OF POLLUTANTS
(1972)

FIGURE 3.3



L.V. - Light Vehicles
O.T. - Other Trans.
P.I. - Process Industry
S.W. - Solid Waste

S.H. - Space Heat
E.P. - Elec. Power
M. - Miscellaneous

CARBON COUNTY AIR POLLUTION

Source: Utah State Division of Health

The only other major pollution source in Carbon County is space heating. This pollution is from the heating of homes and businesses during the winter months and air conditioning during summer. This source of pollution accounts for only 6% of the total pollution and appears mainly as carbon monoxide, sulfur oxides, and particulates.

Total pollution in Carbon County amounts to only 26,560 tons per year. The ratio of this pollution to the pollution in Salt Lake County is 1:20. The ratio of Carbon County to Utah County is 1:5.

Total emissions in Emery County are shown in Table 3.8 and Figure 3.4. It should be mentioned that these values do not include the newly completed Utah Power and Light generating station near Huntington, Utah. As can be readily seen 93 percent of all pollutants are the result of transportation. Again, these pollutants are primarily carbon monoxide, hydrocarbons, and nitrogen oxides. The absence of major industries in this county is shown by the lack of any other major pollution source. The only other significient source of air pollution is space heating which accounts for 5 percent.

Total pollution in Emery County is 10,180 tons a year or as a ratio compared to Salt Lake County this is 1:50.

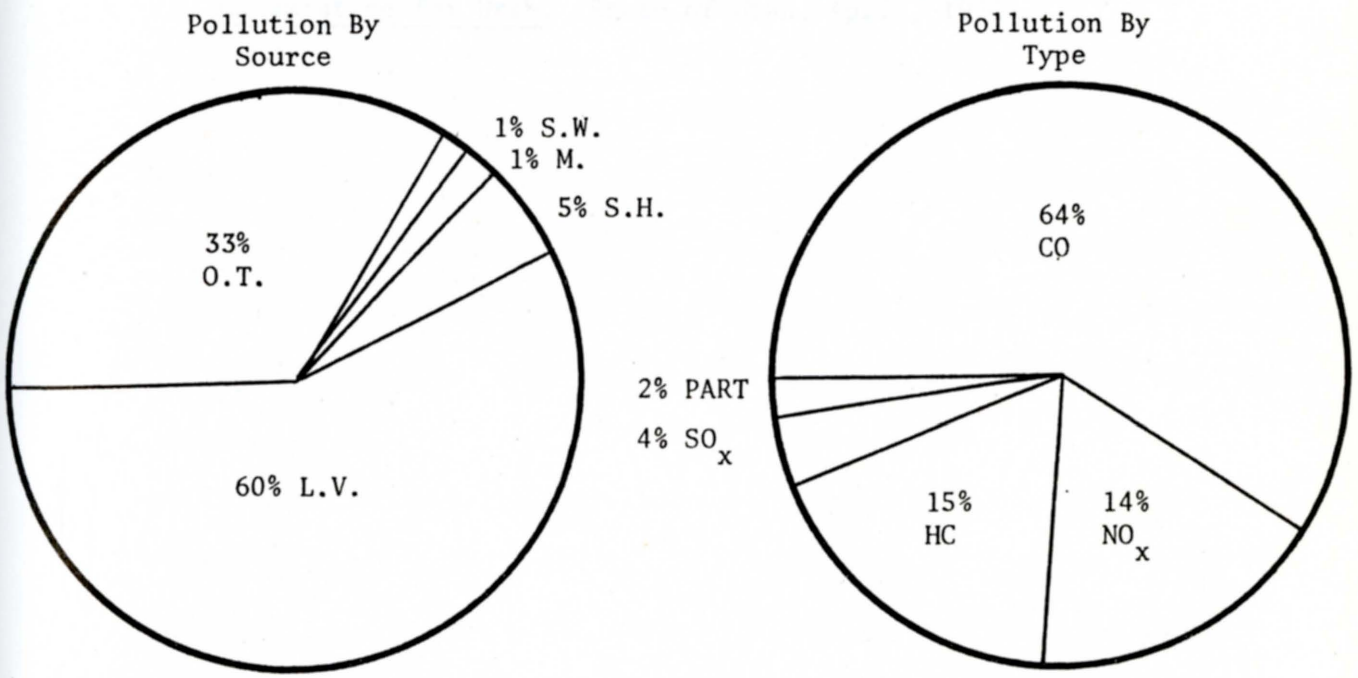
The Huntington, Utah generating station has added to these totals, although as yet no results as to the exact quantities are available.

TABLE 3.8

COUNTY	SOURCE CATEGORY	Particulate	SO_x	CO	HC	NO_x	Other	Total
EMERY	Light Vehicles	30	20	4,590	850	520	40	6,100
	Other Transportation	140	340	1,640	450	780	40	3,390
	Process Industries	10	--	--	--	--	--	10
	Solid Waste	10	--	90	30	--	--	130
	Space Heat	60	80	220	50	30	10	450
	Electric Power Generation	--	--	--	--	--	--	--
	Miscellaneous	--	--	---	100	--	--	100
	County Total	250	440	6,540	1,480	1,380	90	10,180

TONS OF POLLUTANTS
(1972)

FIGURE 3.4



L.V. - Light Vehicles
O.T. - Other Trans.
P.I. - Process Industry
S.W. - Solid Waste

S.H. - Space Heat
E.P. - Elec. Power
M. - Miscellaneous

EMERY COUNTY AIR POLLUTION

Source: Utah State Division of Health

SECTION 3

REFERENCES

1. Utah Power and Light Company. North Emery Generating Station Applicant's Environmental Analysis. Volume I, Revised Dec., 1973.

2. Federal Register, Environmental Protection Agency, National Primary and Secondary Ambient Air Quality Standards, Vol. 36, No. 84, Friday, April 30, 1971.

3. Ursenbach, Wayne O., Utah Engineering Experiment Station, Hearings on Proposed Regulations to Prevent Significant Deterioration, Environmental Protection Agency, September 5-6, 1973, Denver, Colorado.

4. Division of Health. A Summary of Air Pollution Source Emission Calculation for Utah. State of Utah, April, 1974.

SECTION 4

CONFLICTS-IN-USE: LAND, WATER, AIR

The first sections of this study were basically inventories of the land, water, and air resources in the Carbon-Emery area. This section takes a look at the possible and probable conflicts in the use of these resources as they pertain to the development of the electric utility and coal industry in the Carbon-Emery area.

In the Land Section of this study it was stated that 15 to 19 million tons of coal will likely be mined annually in the Carbon-Emery area within the next ten years. These figures could be as high as 24 to 28 million tons annually if the IPP decides to obtain all its coal from Emery County. This large requirement for coal will also put a large requirement on other available resources of the area. Since the increase in coal production is almost totally for the production of electricity it is the impacts of electric power production which will dominate.

What kind of conflict-in-use of resources can we expect when the above development takes place? The hardest felt and most difficult to deal with are the social-cultural impacts that can be expected. These impacts affect, and are also affected by, the utilization of the environment and natural resources of the area. This results in conflicting uses for the same resources. Perhaps the most serious affects will be felt in the demand for the available water.

Water

In the Water Section of this study an inventory of water sources and uses was given. Little can be done, presently, to increase the available water supply except to reestablish the priority of uses for this water. Of the primary users (municipal, industry, and agriculture) the municipal users are first in importance. First we will look at the ways in which the municipal water supply is to be affected by the energy development.

The present culinary water supplies in the Carbon-Emery area are barely adequate or inadequate. Table 2.5 in the Water Section lists the culinary water supply ratings in the Carbon-Emery area. None are presently "Approved" by the State Division of Health, seven are "Not Approved" and nine are "Provisionally Approved."

At this time there is no good quality culinary water, i.e., without treatment, available for an expanding population in the Carbon-Emery area. If treatment plants are constructed, water will be available provided that the water rights can be secured. The relative high prices recently paid for water rights by new industry in the area will naturally drive up the selling price of any other available water rights. The towns, especially in Emery County, may not have a large enough tax base to outbid large corporations for the available water rights. If water rights cannot be secured through the open market, a city may condemn the water rights needed to provide culinary water for the expanding population. This process of "Eminent Domain" could be exercised by any city or town. The owner of the condemned water rights would receive just compensation at the fair market value.

Some work has already been done towards alleviating the culinary water rpoblem. The Price River Water Improvement District had consultants (Templeton, Linke and Alsup) study the water systems in the Price-Helper area of Carbon County to determine both present and future adequacy of the existing system (2).

It was concluded, from the above mentioned study, that the municipal water system was basically adequate for the present population, but needed to be increased to meet the expanding demand. Within the Price City service area, approximately one-third of the connections served rely completely upon a "surplus" or interruptable supply of culinary water. In addition, most of the the existing water distribution systems do not meet State Division of Health standards for maximum run.

Another area of concern is fire protection facilities. Presently, the fire protection facilities are generally poor throughout the Price River Water Improvement District (PRWID). This has two important consequences. First, a hazard to life and property exists which could be improved upon. Second, the area has a high fire insurance classification. An improved water distribution system and installation of fire hydrants would help to improve the ratings. Improvement of even one classification can create about a ten percent reduction in fire insurance premiums (2).

For the PRWID area water is available from the Scofield Reservoir for future expansion of the culinary supply. However, the PRWID would first have to construct a water purification plant with a capacity of 3 million gallons per day with the capability for expansion.

The situation in other areas of Carbon and Emery counties is not

so good. As stated above the towns in Emery County do not have a large enough tax base to purchase water rights or to build water treatment plants. Some form of financing must become available so that the necessary treatment plants are constructed before the need becomes critical.

The only conclusion to be drawn from the available data on water in the Carbon-Emery area is that there simply is not enough to go around. The present culinary systems are barely adequate to meet present average daily demands and cannot meet present peak demand loads. They, therefore, will not be able to supply culinary water for the expected population growth in the area unless some present uses of water are curtailed. The most likely candidate for tradeoff is agriculture.

As stated in the Land section it appears as if most of the possible arable lands in the Carbon-Emery areas are already under cultivation. When the limited sources of water for irrigation are considered then the present agricultural effort can be termed a near maximum effort. For any increase in agriculture to occur there must first be made available new sources of water. The possible source of this "new" water could be from an interbasin transfer. This, however, would be a costly project and it has already been pointed out that the tax base in the Carbon-Emery area is not large enough to supply the necessary funds.

The effects that a decreased agricultural effort in the Carbon-Emery area would have on the state would probably be minimal. This conclusion follows from the data reported for agricultural production

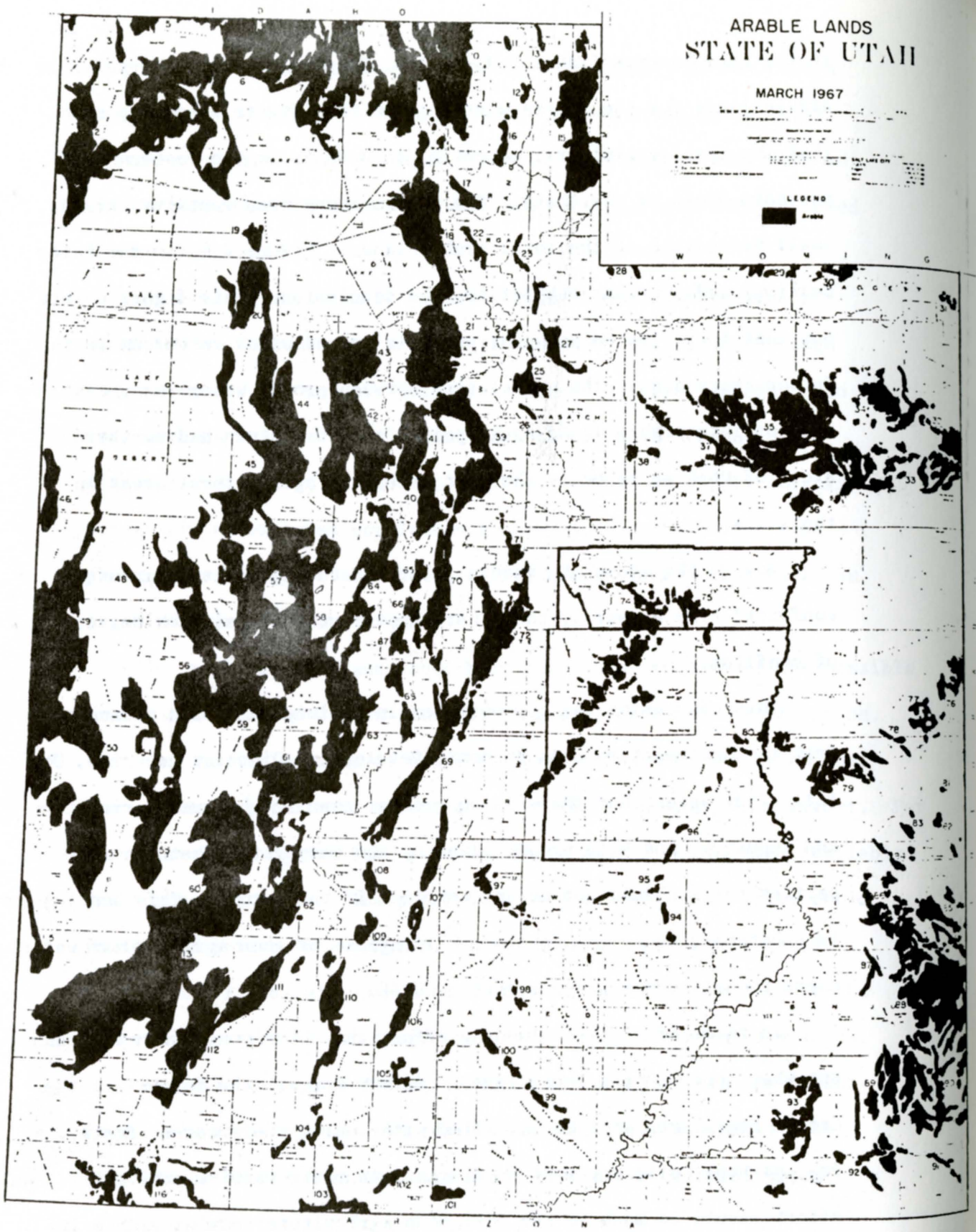
in the Land Section (Table 1.9). Also, Figure 4.1 shows the possible arable lands for the entire state. From this figure it can be seen that the real agricultural potential in Utah is in the western and northern areas of the state. The Carbon-Emery area contains only a small percentage of the total arable lands. Figure 2.5 (in the Water Section) adds further support to this conclusion. This figure points out that there are no known or probable ground water resources in the Carbon-Emery area. The correlation between ground water resources and possible arable lands again points to the western and northern areas of Utah as probably the best potential agricultural areas in the state.

How do the above statements relate to the agriculture-industry conflict? The answer is that there appears to be a minimum degree of conflict.

This conclusion was corroborated in an interview with planners from the Southeastern Utah Economic Development District in Price, Utah (3). They agree that there is no present conflict between agriculture and industry, and with proper planning and cooperation between affected parties there should not be any conflict in the future. This conclusion is substantiated by the apparent willingness of some agricultural water users to sell their water rights to UP&L.

In terms of a state planning effort the above conclusion is tenable. But what about on the local level. Surely not all the farmers in the Carbon-Emery area will be satisfied with losing their water rights. A few, perhaps, will not want to discontinue their farming activities. An effort should be made to see that some agriculture remains viable in the area.

FIGURE 4.1



SOURCE: Adapted From, "Arable Land Resources of Utah,"

Utah Resources Series 42, Feb. 1968

Along with the problem of water quantity there are serious water quality problems in the Carbon-Emery area. These water quality problems are from two sources, man made pollution and natural pollution. The Water Quality Management Plan for the Utah portion of the Colorado River Complex identified several areas concerning water quality. Figure 4.2 shows some of these areas of concern. This figure represents areas found in four sampling periods to have excessive levels of pollutants. These are areas which should be cleaned up before any expansion of domestic water needs takes place.

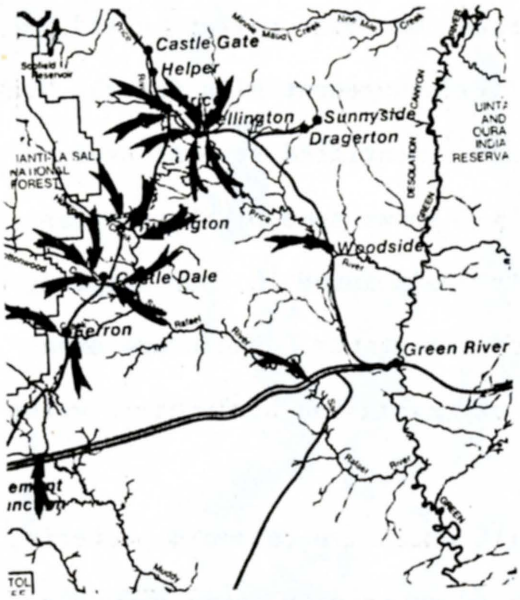
In particular, those areas with excessive coliform bacteria, high BOD and low DO should be cleaned up as soon as is possible. These result from man made pollution which points up the need for better wastewater treatment facilities in the study area. Most of the towns in Emery County have little or no wastewater treatment facilities. Those that do are either in poor repair or there are no trained personnel to operate them. At any rate before the population expansion takes place it will be necessary to upgrade the treatment facilities to handle the expected increased loads.

Effluent standards for waste discharges have been established by the Utah Water Pollution Control Committee and the Utah State Board of Health. These standards are listed in Table 4.1 and they indicate the effluent quality which must be attained by 1977 and 1980. Current municipal sewage treatment facilities are evaluated by the 1977 standards.

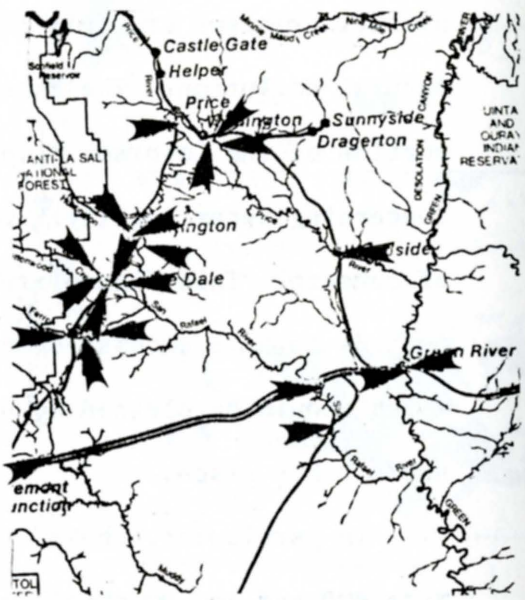
FIGURE 4.2

Problem Areas

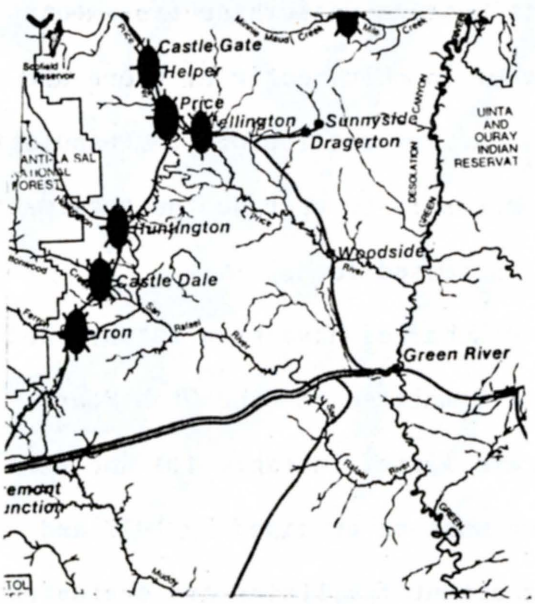
STATIONS REPORTING EXCESSIVE HARDNESS



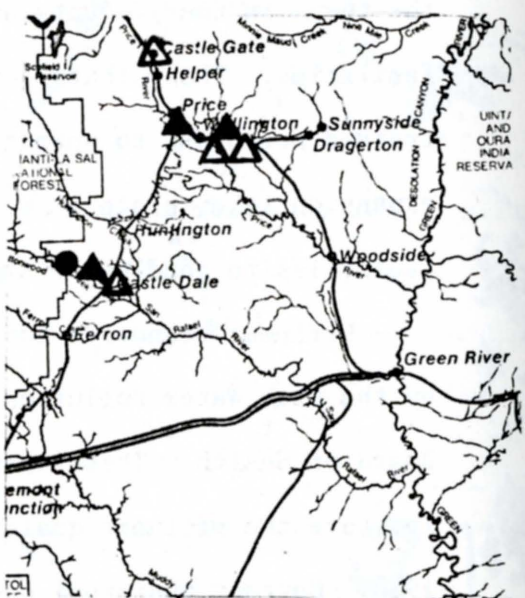
STATIONS REPORTING EXCESSIVE TOTAL DISSOLVED SOLIDS



STATIONS REPORTING EXCESSIVE COLIFORM BACTERIA



STATIONS REPORTING EXCESSIVE BOD AND DO



SOURCE: "Waste Load Allocation for Colorado River Complex Water Quality Management Plan," by Nelson, Haley, Patterson and Quirk, Coon, King and Knowlton Valley Engineering, April 1974, Figs. 3,4,6,9.

TABLE 4.1

Effluent Standards for 1977 and 1980
(Municipal and Industrial)

June 30, 1977 standards

1. BOD (5 day 20°c) shall not exceed 25mg/1.
2. Suspended solids shall not exceed 25mg/1.
3. Total coliforms shall not exceed 2,000 per 100ml and fecal coliforms shall not exceed 200 per 100ml.

June 30, 1980 standards

1. BOD (5 day 20°c) shall not exceed 10mg/1.
2. Suspended solids shall not exceed 10mg/1.
3. Total coliforms shall not exceed 200 per 100ml and fecal coliforms shall not exceed 20 per 100ml.

The other pollution sources in Figure 4.2 are partly man made and partly natural pollution. The streams in the Carbon-Emery area all have high salinity and total dissolved solids due to natural conditions. This situation is, however, compounded by current agricultural and industrial practices. Agricultural return flow adds to the salinity and total dissolved solids in the streams. This, of course, also affects water hardness. Perhaps if agriculture in the Carbon-Emery area is curtailed somewhat this source of pollution will decrease significantly. This would be especially true if the remaining farmers were encouraged to use the best irrigation techniques.

Industrial effluents are monitored by the State Division of Health and the EPA. A permit system has been implemented to control industrial discharges. Industrial effluent standards are the same as for municipal systems as indicated in Table 4.1 except that industrial dischargers are not required to remove any pollutants which they had

not added before returning the diverted flow back to the stream (4).

Personnel from the U.S. Forest Service have expressed some concern about the apparently little understood problem of in-stream water needs (5). This problem addresses the question of what is required by a stream to maintain the conditions necessary for it to be a "living" stream. A specific example is the conditions in the Huntington Creek which result from Electric Lake and the withdrawals of water by the Huntington generating station.

The Huntington generating station was designed to not return any water back into Huntington Creek after it is used for cooling. The possible problems resulting from this practice concern the periodic drying up, or nearly so, of Huntington Creek due to diversion of its water to the power plant. It is not known just how much water is necessary in a stream to maintain the conditions needed for aquatic life. This problem along with those stated above can result in a conflict-in-use for the available water.

Land

The significant conflicts in this area are those affecting agriculture and land use patterns. This includes recreation activities and transportation routes.

Agriculture. In 1973 employment in agriculture was about 4 percent of the total employment in the Carbon-Emery area. During 1969 the value of all farm products was 13.6 percent of total gross taxable sales. Data for 1973 are not available, but due to the increase in farm acreage it would be expected to be proportionately higher.

The total market value of agricultural products from Carbon and

Emery counties, for 1969, was 2.1 percent of the state totals. Eighty-three percent of the total agricultural products in the Carbon-Emery area for 1969 consisted of livestock, poultry and there associated products. The crops produced were primarily used as feed for livestock.

Curtailment of agriculture in the Carbon-Emery area could be done without affecting the livestock portion, with two exceptions. First, irrigated pastures would still be necessary and second feed would have to be obtained from outside the area. This would result in higher prices for the stockmen. They likely would not bear the increased cost for long and many would quit the business (3).

Unless new sources of water can be found it is highly probable that agriculture will be curtailed. Many farmers have already sold or leased their water rights to UP&L but some will probably choose to try and continue farming.

All the impacts resulting from curtailment of agriculture are not known. Emery County will be affected more than Carbon County because agriculture represents 8.5 percent of the work force there compared to 1.9 percent in Carbon County. If these workers become part of the work force for the new developments then there will not be serious problems with unemployment of agricultural workers.

Recreation. The new population will put a burden on existing recreational areas and sites. Existing recreation areas will be able to handle much of the population influx but new ones will undoubtedly have to be constructed. This would be especially true of parks within the cities and towns.

It is likely that the deer herds will suffer somewhat due to increased pressure for utilization of the same forest areas that will be used by the new population. The Manti-La Sal national forest will see increased use for recreational purposes. This will increase usage of the forests and streams contained within them. There are a few places for these deer herds to move to and as a result they may be reduced in numbers.

Fishing and boating activities will also increase in the area. There are several reservoirs and many small streams that have been popular fishing and boating spots in the past and will surely see an increase in activity. This increased use will potentially contribute to the degradation of the available water supply.

Transportation. The major transportation routes in the area are in good condition. It is expected that heavy traffic will exist in places that have not been subject to it before. The real area of concern here concerns the unpaved roads. The entire central region of Emery County is contained in the San Rafael Swell. There are several recreation areas and sites within the San Rafael Swell that are only accessible over grated or ungrated dirt roads. These areas will be subject to much increased traffic in the future. Serious degradation of the environment could result from over use of these access routes unless they are improved to handle the increased load.

Other Conflicts. The archeological value of the Carbon-Emery area was mentioned only briefly in the Land Section, however, a few words are necessary.

Vandalism and collecting of artifacts has already damaged or destroyed much that was of some archeological value. Indian pic-

tographs in the San Rafael area have been disgracefully defaced by ignorant and/or malicious persons. Archeological artifacts belong to everyone. They represent the culture of the past and should be open for all to see and learn about. The need for educating people as to the value of these artifacts in imperative, before they cease to exist.

Coal mining requires a great deal of timber to be used as shoring in mines and for railroad ties. It is estimated that for each one million tons of coal mined, one million board feet of timber is used, for shoring and railroad ties (5). Most of this timber is imported to Utah but it could be cut from our own forests. This is something that should be looked into because of the potential it has for eliminating waste in forest management, and for stimulating the lumbering industry in the area.

Air

Air quality in the Carbon-Emery area will suffer somewhat from the expected increased emissions from the new power plants. Tables 4.2 and 4.3 list the estimated stack emissions of the Huntington Units 1 and 2 and the North Emery Units 1 and 2.

This data should be interpreted carefully as was indicated in the Air Section of this study. These emissions, it is expected, will not exceed the federal primary and secondary standards. Only careful monitoring, which is already being conducted, will determine if these emission levels are within the limits specified.

TABLE 4.2

Huntington

Estimated Stack Emissions (430-mw)
First Unit (Unit No. 2)

Major Constituents	Coal from Hiawatha Seam p.p.m. by vol.	Coal from Hiawatha Seam Tons/Day	Coal from Blind Canyon Seam p.p.m. by vol.	Coal from Blind Canyon Seam Tons/Day
CO_2	136,101	10,187	134,062	9,948
H_2O	67,250	2,060	69,154	2,085
N_2	754,636	35,944	754,953	36,107
O_2	41,146	2,239	41,073	2,209
SO_x (calculated as SO_2)	417	44.8	308	32.9
NO_x (calculated as NO_2)	450	36.0	450	35.3
Ash (with 99.5 percent efficient electrostatic precipitator)		1.4		.9

Estimated Stack Emission First and Second Units
(At 845-mw)

Major Constituents	Coal from Hiawatha Seam (Tons/Day)	Coal from Blind Canyon Seam (Tons/Day)
CO_2	20,374	19,896
H_2O	4,120	4,170
N_2	71,888	72,214
O_2	4,478	4,418
SO_x *(Calculated as SO_2)	53.8	46.7
No_x **	68.0	66.7
Ash (with 99.5 percent efficient electrostatic precipitator)	2.8	1.8

* Assuming 80 percent reduction in SO_2 from the second unit. No reduction of SO_2 from the first unit.

** Based on boiler manufacturers NO_x guarantee for the first unit.

Source: "Draft Environment Statement," Second Unit Huntington Canyon Generating Station, May 1, 1974.

TABLE 4.3

ESTIMATED STACK EMISSIONS (830 MW)

NORTH EMERY

Major Constituents	Coal From Hiawatha Seam			Coal From Blind Canyon Seam		
	ppm by Vol.	tons per day		ppm by Vol.	tons per day	
		415 MW	830 MW		415 MW	830 MW
CO_2	136,101	10,187	20,374	134,062	9,948	19,896
H_2O	67,250	2,060	4,120	69,154	2,085	4,170
N_2	754,636	35,944	71,888	754,953	36,107	72,214
O_2	41,146	2,239	4,478	41,073	2,209	4,418
SO_x (as SO_2) *	83	9.0	18.0	62	6.6	13.2
NO_x (as NO_2)	450	36.0	72.0	450	35.3	70.6
Ash (with 99.5% efficient electrostatic precipitator)		1.4	2.8		0.9	1.8

* With 80% removal

Source: "U.P.& L. North Emery Generating Station Applicant's Environmental Analysis," Volume I, Revised Dec. 1973.

Summary

To summarize, the following points can be made.

1. Energy development in the Carbon-Emery area is centered around coal and electric power production. These activities will require large amounts of water primarily for cooling in the power plants.

2. Water for these energy developments has previously been used for agriculture. This requires a reallocation of water rights which will necessitate some curtailment of agriculture. The full impact of this curtailment is not yet known.

3. This large scale development will require a much larger population base than presently exists. As a result domestic water supplies must be expanded to adequately serve the expanded population.

4. Water treatment plants will have to be constructed because there are no sources of good, i.e., without treatment, quality culinary water available.

5. Wastewater treatment plants will have to be upgraded and new ones built to handle the increased load due to the increased population.

6. Wastewater treatment plant operators will have to be trained and hired for the new and existing facilities. Also items 4, 5, and 6 will have to be initiated before the new population arrives on the scene.

7. This requires a source of funding because tax revenue and local bonding power in the study area are grossly inadequate to finance these projects before the new population arrives.[1]

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1 - Turner, Evan, "Economic and Demographic Impact of Energy Related Development in Carbon and Emery Counties, Utah," March 1975, P. 105.

8. In-stream water needs are not entirely understood. More research needs to be done to fully understand these needs.

9. Recreational areas will have to be expanded and improved to handle increased use by the local population.

10. Hunting and fishing activities will increase putting a further burden on existing water resources.

11. Dirt roads in the area will see increased usage and will require more upkeep than in the past.

12. An education program should be conducted to acquaint the new population with the value and preservation needs of archeological sites and artifacts.

13. The potential for using local timber for use in coal mines needs to be studied.

14. Air quality is not expected to be a major problem, but power plant emissions and other industrial air emissions will have to be monitored to ensure this.

SECTION 4

REFERENCES

1. Templeton, Linke, & Alsup, Preliminary Engineering Report Culinary Water, Price River Water Improvement District, Rev. December 1974.

2. Interview with Chris P. Jouflas, Planner, Southeastern Utah Economic Development District, Price, Utah, Jan. 24, 1975.

3. Utah Water Pollution Control Committee and the Utah State Board of Health. Public Hearing In the Matter of Extending the Dates for Compliance with Water Quality Standards and of Establishing Interim Effluent Standards for Waste Discharges. Official Transcript, May 10, 1974.

4. Interview with Jim Butler and others, U.S. Forest Service office in Price, Utah, March 6, 1975.

APPENDIX

10/29/74

STATE OF UTAH
DEPARTMENT OF SOCIAL SERVICES
DIVISION OF HEALTH

AIR CONSERVATION REGULATIONS

CERTIFIED OFFICIAL COPY
UTAH STATE BOARD OF HEALTH

BY _____
Lyman J. Olsen, Secretary

UTAH STATE DIVISION OF HEALTH
AIR CONSERVATION REGULATIONS

Table of Contents

UTAH STATE DIVISION OF HEALTH

AIR CONSERVATION REGULATIONS

FOREWORD

The Air Conservation Act and these Air Conservation Regulations constitute the legal bases for control of air pollution sources in the State of Utah. These Regulations have been adopted by the Utah Air Conservation Committee and the Utah State Board of Health under authority of Section 26-24-5 and 26-15-5, Utah Code Annotated, 1953, as amended.

These Regulations apply and will be enforced throughout the State of Utah, whether adopted by local governments or not. They are recommended for adoption in local jurisdictions where environmental specialists are available to cooperate in implementing Regulation requirements.

These Regulations are designed to facilitate addition of new sections as they are adopted. It is recognized that rapid growth of technical and scientific knowledge coupled with knowledge acquired by experience will necessitate revision of these Regulations from time to time.

Federal ambient and new source standards apply throughout the Nation and are legally enforceable in Utah. Therefore, a summary of the Federal standards* are included in Appendix A for convenience of reference.

The Committee and Board have interpreted their duties, as assigned by Legislative Act, in the following language:

"..... (1) to determine the kinds and concentrations of pollutants in the air, (2) to control the release of air pollutants to achieve a quality of air that is not harmful to man, animals, or vegetation, or which creates property damage, (3) to control man-caused air contamination which aggravates the visibility problem to which Utah is periodically subjected due to natural meteorological phenomena, (4) whenever economically feasible, to reduce or eliminate the production of pollutants which are a nuisance though not harmful to man, animals or vegetation, (5) to establish an alert system enforcing curtailment of activities of major pollution sources that are not amenable to permanent control."

The Committee has adopted the following air quality monitoring policy:

Determining ambient air pollutant concentrations is, at best, a complex

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* The Utah Air Conservation Committee and the State Board of Health do not necessarily agree with most of the specific limits selected for ambient standards by the Federal Government. (Reference March 17, 1971 letter from the Executive Secretary, Utah Air Conservation Committee to Mr. William D. Ruckelshause, Administrator, Environmental Protection Agency.)

operation if meaningful and useful data are to be obtained. In mountainous terrain, characteristic of most of Utah, the difficulties are particularly severe because micrometeorological variables are superimposed upon the macrometeorological situation and frequently predominate. Under these circumstances a valid monitoring program for the State must be developed on at least one unchanging base-line for reference, consisting of a network of permanently located stations at strategic sites. On this premise, it is concluded that the State monitoring system shall include an appropriate number of permanent stations capable of continuously monitoring all of the pollutants of interest, augumented with semi-permanent stations of a number and capability to assess air quality in any location deemed necessary.

UTAH STATE DIVISION OF HEALTH

AIR CONSERVATION REGULATIONS

PART I
DEFINITIONS AND GENERAL REQUIREMENTS

1.1.1 Air contaminant means any particulate matter or any gas, vapor, suspended solid or any combination thereof, excluding steam and water vapors. (Section 26-24-2 (1) UCA, 1953, as amended)

1.1.2 Air contaminant source means any and all sources of emission of air contaminants whether privately or publicly owned or operated. (Section 26-24-2 (2) UCA, 1953, as amended)

1.1.3 Air Pollution means the presence in the ambient air of one or more air contaminants in such quantities and duration and under conditions and circumstances, as is or tends to be injurious to human health or welfare, animal or plant life or property or would unreasonably interfere with the enjoyment of life or use of property, as determined by the standards, rules and regulations adopted by the Air Conservation Committee. (Section 26-24-2 (3) UCA, 1953, as amended)

1.1.4 Ambient air means the surrounding or outside air. (Section 26-24-2 (4) UCA, 1953, as amended)

1.1.5 Appropriate authority means the governing body of any city, town or county.

1.1.6 Atmosphere means the air that envelops or surrounds the earth and includes all spaces outside of building, stacks or exterior ducts.

1.1.7 Authorized local authority means a city, county, city-county, or district health department; a city, county, or combination fire department; or other local agency duly designated by appropriate authority, with approval of the State Division of Health, as the agency to issue permits for open burning and perform other appropriate functions under regulations of the State Division of Health and other lawfully adopted ordinances, codes or regulations not in conflict therewith.

1.1.8 Board means the Utah State Board of Health.

1.1.9 BTU means British Thermal Unit, the quantity of heat necessary to raise the temperature of one pound of water one degree Fahrenheit.

1.1.10 Clearing index means a number indicating the predicted rate of clearance of ground level pollutants from a given area. This number is calculated by the National Weather Service, from daily measurements of temperature lapse rates and wind speeds and directions from ground level to 10,000 feet. (See appendix for further details)

1.1.11 Committee means Utah Air Conservation Committee.*

1.1.12 Director means the Director of the Utah State Division of Health.*

1.1.13 Division means Utah State Divsion of Health.*

1.1.14 Executive Secretary means the executive secretary of the Committee. (Section 26-24-2 (11) UCA, 1953, as amended)

1.1.15 Emission means the act of discharging, into the atmosphere, an air contaminant or an effluent which contains or may contain an air contaminant; or the effluent so discharged into the atmosphere.

1.1.16 Existing installation means a plant, process, process equipment, or a device, construction of which began prior to the effective date of any regulation having application to it.

1.1.17 Facility means machinery, equipment, structures or any part or accessories thereof, installed or acquired for the primary purpose of controlling or disposing of air pollution. It does not include an air conditioner, fan or other similar device for the comfort of personnel.

1.1.18 Garbage means all putrescible animal and vegetable matter resulting from the handling, preparation, cooking and consumption of food, including wastes attendant thereto.

1.1.19 Heavy fuel oil means a petroleum product or similar material with a boiling point higher than that of diesel fuel.

1.1.20 Household waste means any solid or liquid material normally generated by a family in a residence in the course of ordinary day-to-day living, including but not limited to garbage, paper products, rags, leaves and garden trash.

1.1.21 Open burning means any burning of combustible materials resulting in emission of products of combustion into open air without passage through a chimney or stack.

1.1.22 Person means any individual, public or private corporation, partnership, association, firm, trust, estate, the state or any department, institution, bureau, or agency thereof, any municipal corporation, county, city and county, or other political subdivision of the state, or any other legal entity whatsoever which is recognized by the law as being subject to rights and duties. (Section 26-24-2 (5) UCA, 1953, as amended)

1.1.23 Refuse means solid wastes, such as garbage and trash.

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* See Section 26-24-2 UCA, 1953, as amended.

1.1.24 Ringelmann Chart means the chart published by the U.S. Bureau of Mines (Information Circular 7718) which illustrates graduated shades of grey to black for use in determining the light obscuring capability of particulate matter.

1.1.25 Salvage operation means any business, trade or industry engaged in whole or part in salvaging or reclaiming any product or material, including but not limited to metals, chemicals, shipping containers or drums.

1.1.26 Total suspended particulate means any dispersed matter, collected by the high volume sampler procedure.*

1.1.27 Trash means solids not considered to be highly flammable or explosive, including, but not limited to clothing, rags, leather, plastic, rubber, floor coverings, excelsior, tree leaves, yard trimmings and other similar materials.

1.1.28 Waste means all solid, liquid or gaseous material, including, but not limited to, garbage, trash, household refuse, construction or demolition debris, or other refuse including that resulting from the prosecution of any business trade or industry.

1.1.29 Equivalent opacity means the relationship of opaqueness or percent obstruction of light to the Ringelmann chart for shades other than black and is approximately equal to the following:

Equivalent Opacity (%)	Ringelmann No.
20	1
40	2
60	3
80	4
100	5

1.1.30 LPG means liquid petroleum gas such as propane or butane.

1.1.31 Federal Ambient Air Standards means the allowable concentrations of air pollutants in the ambient air specified by the Federal Government and can be found in Title 40 Code of Federal Regulations, Part 50.

1.2 Air Pollution Prohibited Emission of air contaminants in sufficient quantities to cause air pollution as defined in paragraph 1.1.3 is prohibited.**

1.3 Air Quality Degradation Regulated In areas of present high air quality where measured or estimated ambient levels of controllable pollutants are below the levels specified by applicable standards, any emission of pollutant to the ambient

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* Daily sampling as specified in Title 40 Code of Federal Regulations Part 50 as published in the Fed. Reg. Vol. 36, No. 228, Thurs. Mar. 25, 1971 pages 22384 - 22397

** The State Statute provides for penalties up to $50,000/day for violation of State Statutes, Regulations, Rules or Standards. (See Section 26-24-13, UCA, 1953, as amended, for further details.)

air must be shown to result in pollution levels, as determined by appropriate evaluating procedures, within applicable ambient air standards, and will be prohibited in any case unless shown to be fully controlled under methods of modern technology.

1.4 Periodic Reports of Emissions - Availability of the Information The owner or operator of any stationary air-contaminant source in Utah shall furnish to the Committee the periodic reports required under Subsection 26-24-5 (3) Utah Code Annotated, 1953, as amended, and any other information as the Committee may deem necessary to determine whether the source is in compliance with Utah and federal regulations and standards. The information thus obtained will be correlated with applicable emission standards or limitations and will be available to the public during normal business hours at the appropriate office of the Division.

1.5 Variances Authorized Variance from these regulations may be granted by the Committee as provided by law (See Section 26-24-11 (5), UCA, 1953, as amended).

a. To permit continued operation of an air pollution source for the time period involved in installing or constructing air pollution control equipment in accordance with a compliance schedule negotiated by the Executive Secretary and approved by the Committee.

b. To permit continued operation of an air pollution source where there is no practicable means known or available for adequate prevention, abatement, or control of the air pollutants involved. Such a variance shall be only until the necessary means for prevention, abatement, or control become known and available, subject to the use of substitute or alternate measures the Committee may prescribe.

c. To permit continued operation of an air pollution source where the control measures, because of their extent or cost, must be spread over a considerable period of time.

Variance requests may be submitted by the owner or operator who is in control of any plant, building, structure, establishment, process or equipment.

1.6 Notice of Intent to Construct Required

1.6.1 Except for the exemptions listed herein, any person planning to construct a new installation which will or might reasonably be expected to become a source of air pollution or to make modifications to an existing installation which will or might reasonably be expected to increase the amount or change the effect of, or the character of, air contaminants discharged, so that such installation may be expected to become a source of air pollution, or any person planning to install an air cleaning device or other equipment intended to control emission of air contaminants from a stationary source, shall submit to the Executive Secretary a notice of intent to construct prior to initiation of construction.

1.6.2 Within 15 days of receipt of such notice, the Executive Secretary may require the submission of plans, specifications and such other information as he deems necessary to determine whether the proposed construction, installation, or establishment will be in accord with applicable sections of Utah Air Conservation Regulations, Environmental Protection Agency Regulations on Standards of Performance for New Stationary Sources, and National Primary and Secondary Ambient Air Quality Standards.

1.6.3 Within 90 days of receipt of plans, specifications and other information required under this section, the Executive Secretary shall issue an order prohibiting the proposed construction, installation or establishment if he deems any part of it inadequate to meet pertinent regulations including the Environmental Protection Agency Regulations on National Primary and Secondary Ambient Air Quality Standards and Standards of Performance for New Stationary Sources, or if he needs more time, not to exceed three 30-day extensions, to review the proposal.

1.6.4 Failure of such an order to issue within the 90-day period and any extensions required shall be deemed a determination that the construction, installation or establishment may proceed, but it must proceed in accordance with the plans, specifications, or other information, if any, required to be submitted.*

1.6.5 Prior to approving or disapproving the construction of a new installation, the Executive Secretary will advertise notice of his intent to approve or disapprove the construction in a newspaper of general circulation in the locality of the proposed construction site. A 30-day period will be allowed for submission of public comment; at least one location will be provided where the information submitted by the owner or operator and the State's analysis of the effect of the facility on air quality will be available for public inspection. Any comments received during the 30-day period will be considered before issuing an approval notice or an order prohibiting the construction.

1.6.6 Whenever the Executive Secretary determines that the plans, specifications and other information submitted, with such revisions as he may require, are in accord with applicable requirements, he will issue an approval order permitting the proposed construction, installation or establishment, with the further stipulation that all such devices be maintained in good working order. To accommodate state construction of a large facility, he may issue approval notice of an initial stage prior to receipt of detailed plans for the entire facility provided he is satisfied through a review of general plans that the facility is feasible under the intent of these regulations. Subsequent detailed plans will then be received and processed as prescribed in this section.

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* See Section 26-24-9, UCA, 1953, as amended.

1.6.7 The following information should be submitted with the notice of construction:

a. A description of the nature of the process(es) involved; the nature, procedures for handling, and the quantities of raw materials; the type and quantity of fuels employed; and the nature and quantity of finished product.

b. Expected composition and physical characteristics of effluent stream both before and after treatment by an air cleaning device, including emission rate, volume, temperature, and concentration of air contaminants.

c. Size, type, and performance characteristics of air cleaning devices.

d. Location and elevation of the emission point and other factors relating to dispersion and diffusion of the air contaminant in the relation of the emission to nearby structures and window openings, and other information necessary to appraise the possible effects of the effluent.

e. The location of planned sampling points and the tests to be made of the completed installation by the owner when necessary to ascertain compliance.

1.6.8 The following types of installations are exempt from the notice of intent to construct requirement:

a. Comfort heating equipment, boilers, water heaters, air heaters, and steam generators with a rated capacity of less than one million BTU per hour.

b. Comfort ventilating systems.

c. Unit space heaters.

d. Vacuum cleaning systems used exclusively for commercial or residential housekeeping.

e. Exhaust systems for controlling steam and heat which do not contain combustion products.

f. Fuel-burning equipment using no other fuel than natural gas, or L.P.G., or other mixed gas distributed by a utility in accordance with the rules of the Public Service Commission of the State of Utah, unless there are emissions other than combustion gases.

1.7 Requirements of Pollution Control Equipment Specified

In all areas of the State, air pollution control equipment and processes shall be selected and operated so as to afford the highest efficiencies and the lowest discharge rates that are reasonable and practicable. Reasonableness and practicability as determined by the Committee shall take into account, among other things, the concentration and characteristics of the air contaminant in the gas stream, technical feasibility for control, and cost benefit relationships.

UTAH STATE DIVISION OF HEALTH

AIR CONSERVATION REGULATIONS

PART II

EMISSION STANDARDS* (Adopted by the Committee and Board after public hearing)

2.1 Open Burning. (Effective date 3/5/69)

2.1.1 Community Waste Disposal - no open burning shall be done at sites used for disposal of community trash, garbage and other wastes except as authorized through a variance or as authorized for a specific period of time by the Air Conservation Committee on the basis of justifiable circumstances reviewed and weighed in terms of pollution effects and other relevant considerations at appropriate hearing following written application.

2.1.2 General Prohibitions - no person shall burn any trash, garbage or other wastes, nor shall conduct any salvage operation by open burning except in conformity with the provisions of Sections 2.1.3 and 2.1.4 below.

2.1.3 Permissible Burning - Without Permit - when not prohibited by other laws or by other officials having jurisdiction and provided that a nuisance is not created, the following types of open burning are permissible without the necessity of securing a permit.

a. In devices for the primary purpose of preparing food such as outdoor grills and fireplaces.

b. Camp fires and fires used solely for recreational purposes where such fires are under control of a responsible person.

c. Indoor fireplaces.

d. Properly operated industrial flares for combustion of flammable gases.

e. Burning, on the premises, of combustible household wastes generated by occupants of dwellings of four family units or less in those areas only where no public or duly licensed disposal service is available.

2.1.4 Permissible Burning - With Permit - Exemptions - when not prohibited by other laws or other officials having jurisdiction and when a nuisance is not created, the types of open burning listed as a, b, c, d and e, below, are permissible: (1) under the terms of individual permits issued by authorized local authority under a "clearing index" system approved and coordinated by

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* Sections 1.3 and 1.7 may require more stringent controls than listed herein; in any event the requirements of Sections 1.3 and 1.7 must be met.

the Utah State Division of Health, or (2) when specifically exempted by the Air Conservation Committee, following written application and appropriate hearing. Application under (2) may be made by a political subdivision of the State as well as by an individual citizen.

a. Open burning of tree cuttings and slash in forest areas where the cuttings accrue from pulping, lumbering and similar operations, but excluding waste from sawmill operations such as sawdust and scrap lumber.

b. Open burning of trees and brush within railroad and public road rights-of-way provided that dirt is removed from stumps before burning, and that tires, oil more dense than #2 fuel oil or other materials which can cause severe air pollution are not used to start fires or keep fires burning.

c. Open burning of solid or liquid fuels or structures for removal of hazards or eyesores or for fireman training purposes when conducted under the direct control and supervision of organized fire departments.

d. Open burning, in remote areas, of highly explosive or other hazardous materials, for which there is no other known practical method of disposal.

e. Open burning for special purposes, or under unusual circumstances when approved by the Division following formal request therefore.

2.2 Visible Emissions (Effective date 4/25/71)

2.2.1 Single sources of emission from existing installations except incinerators and internal combustion engines shall be of a shade or density no darker than a No. 2 Ringelmann Chart (40% black) or an equivalent opacity except as provided in Section 2.2.6.

2.2.2 Single sources of emission from any incinerator or any other new installation except internal combustion engines shall be of a shade or density no darker than a No. 1 Ringelmann Chart (20% black) or an equivalent opacity, except as provided in Section 2.2.6.

a. For the purposes of this Section, "new installation" shall mean a plant, process or process equipment, construction of which began following the effective date of the regulation concerned. A modified process unit or system shall be construed as a new installation if a physical change in, or change in the method of a process unit or system, increases the amount of any air pollutant by such unit or system or results in the emissions of any air pollutant not previously emitted. An increase in either production rate or hours of operation alone shall not be considered a change in method of operation.

2.2.3 No owner or operator of a gasoline powered vehicle shall allow, cause or permit the emission of visible contaminants except for starting motion no farther than 100 yards or for stationary operation not exceeding 3 minutes in any hour.

2.2.4 Emissions from diesel engines manufactured after January 1, 1973 shall be of a shade or density no darker than a No. 1 Ringelmann Chart (20% black), or an equivalent opacity, except for starting motion no farther than 100 yards or for stationary operation not exceeding 3 minutes in any hour.

2.2.5 Emissions from diesel engines manufactured before January 1, 1973 shall be of a shade or density no darker than a No. 2 Ringelmann Chart (40% black), or equivalent opacity, except for starting motion no farther than 100 yards or for stationary operation not exceeding 3 minutes in any hour.

2.2.6 Exceptions

a. Excessive emissions resulting from the unavoidable break-down of equipment or procedures must be reported immediately (within 24 hours) to the Executive Secretary. Within five days of the beginning of such an incident, a written report shall be submitted to the Executive Secretary which shall include the cause and nature of the event, estimated quantity of pollutant, time of emissions, and steps taken to control the emission and to prevent recurrence. Such emission shall not be deemed in violation providing this report is considered acceptable to the Executive Secretary. If such emissions are predictable, they are covered by the variance procedure.

b. When conducting a procedure or using equipment necessary to the operation of a process other than planned maintenance such as, but not limited to, building a new fire, tube blowing, initial warm-up or start-up locomotives, or cleaning grates, the limits specified in these regulations may be exceeded when it can be demonstrated to be unavoidable, except as otherwise provided in Section 2.5.2.

c. For all other excessive emissions the variance procedure may be employed.

d. An emission failing to meet the standard because of the effect of uncombined water shall not be in violation.

2.2.7 Compliance Method - emissions shall be brought into compliance with these requirements by reduction of the total weight of contaminants discharged per unit of time rather than by dilution of emissions with clean air.

2.3 Particulate Emissions (Effective date 1/23/72)

2.3.1 The following existing individual sources of emissions shall attain and maintain a minimum of 85% control* of particulate emissions (based on source

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*Note: The calculation of 85% control is based on data from the 1970 inventory of emissions.

emissions at maximum operating capacity while control devices are not operating), subject to the further restrictions imposed by Sections 1.3, 1.7 and 2.2, of these Air Conservation Regulations.

a. Process units or systems emitting 100 tons or more of particulates annually, based on zero control. (Excluded are particulates which are the products of combustion of fuel oil, LPG or natural gas.)

b. All coal-fired steam-electric power generating units.

c. All coal-fired space-heating units with rated input capacities of 10 million BTU's per hour or greater.

2.4 Sulfur Content of Fuels (Effective date 9/26/71)

2.4.1 Coal or oil burned in any fuel burning or process installation shall contain no more than 1.0% sulfur by weight or 1.5% sulfur by weight, respectively,** except as provided in Section 2.4.2.

2.4.2 Any person engaged in operating fuel burning equipment using coal or fuel oil, may apply for an exemption from the sulfur content restrictions of Section 2.4.1. His application shall furnish evidence, to the satisfaction of the Executive Secretary, that the fuel burning equipment is operating in such a manner as to prevent the emission of sulfur dioxide in amounts greater than would be produced under the limitations of Section 2.4.1. Control apparatus to continuously prevent the emission of sulfur greater than provided by Section 2.4.1 must be specified in the application for an exemption.

2.4.3 In case an exemption is granted, the operator shall install monitoring devices approved by the Executive Secretary. The operator shall provide the Executive Secretary with a monthly summary of the data from such monitors. This summary shall be such as to show the degree of compliance with Section 2.4.1. It shall be submitted no later than the calendar month succeeding its recording.

2.4.4 Methods for determining sulfur content of coal and fuel oil shall be those methods of the American Society for Testing and Materials.

2.5 Emissions of Sulfur Compounds

2.5.1 All new installations with a potential for emission of sulfur compounds as gaseous or mist effluent shall control sulfur oxides emissions as required to meet National Primary and Secondary Ambient Air Quality Standards and Federal Standards of Performance for New Stationary Sources.

**Note: Coal containing 1.0% sulfur and oil containing 1.5% sulfur have approximately the same atmospheric SO_x potential per million BTUs of heat production. Any combination of fuels not exceeding this potential will be acceptable.

2.5.2 All existing installations shall control emission of sulfur compounds to meet ambient air quality standards at all times and under all conditions and applicable emission limitations except as hereinafter allowed.

2.5.3 Existing non-ferrous smelters shall employ (a) desulfurization units using reasonable available technology with rated capacity to treat all process off-gases (except fugitive gases) from reactors, converters and molybdic oxide plants; except as specified in Section 2.5.6;(b) the best engineering practices to capture fugitive emissions of sulfur oxides; (c) such additional controls as are necessary to limit the monthly average discharge to the atmosphere to 14% or less of the sulfur input to the process (dryer through converter stages); (d) a supplemental control system, approved by the Committee, continuously available for use to achieve additional control necessary to meet requirements of short term ambient standards for sulfur compounds.

2.5.4 Excessive emissions resulting from the unavoidable break-down of equipment or unavailability of equipment must be reported immediately (within 24 hours) to the Executive Secretary. Within five days of the beginning of such an incident a written report shall be submitted to the Executive Secretary which shall include the cause and nature of the event, estimated quantity of pollutant, time of emissions and steps taken to control the emission and to prevent recurrence. Such emission shall not be deemed in violation of emission control requirements providing the reports are acceptable to the Executive Secretary.

2.5.5 The Executive Secretary shall be notified prior to each shut down of a desulfurization unit for scheduled maintenance.

2.5.6 Any gases by-passing a desulfurization unit during a period of scheduled maintenance shall be otherwise processed by available gas cleaning equipment normally in use preceding the desulfurization unit.

2.6 Automobile Emissions

2.6.1 Automobile Emission Control Devices (Effective date 1/23/72) Any person owning or operating any motor vehicle or motor vehicle engine registered in the State of Utah on which is installed or incorporated a system or device for the control of crankcase emissions or exhaust emissions in compliance with the Federal motor vehicle rules, shall maintain the system or device in operable condition and shall use it at all times that the motor vehicle or motor vehicle engine is operated. No person shall remove or make inoperable within the State of Utah the system or device or any part thereof, except for the purpose of installing another system or device, or part thereof, which is equally or more effective in reducing atmospheric emissions from the vehicle.

UTAH STATE DIVISION OF HEALTH

AIR CONSERVATION REGULATIONS

PART III

EMERGENCY CONTROLS* (Adopted by the Committee and Board after public hearing)(1)

3.1 Air Pollution Emergency Episodes (Effective date 1/23/72)

3.1.1 Determination of an episode and its extent or stage shall be made by the Executive Secretary taking into consideration the following levels of pollutant concentrations:

		Ambient Pollutant Concentration		
Pollutant	Time	Stage I	Stage II	Never to be Exceeded(1)
Particulate (ug/m^3)(2)	24 hours	500	800	1000
Particulate (COH units)(3)	24 hours			8
Sulfur Oxides (ppm)(4)	24 hours	0.5	0.8	1.0
Product of Particulate and Sulfur Oxide, both in ug/m^3	24 hours	300,000	450,000	490,000
Product of Particulate expressed in COH units and Sulfur Oxide expressed in ppm				1.5
Carbon Monoxide (ppm)	1 hour	80		125
	4 hours			75
	8 hours	30	40	50
Nitrogen dioxide (ppm)	1 hour	1.0	1.4**	2.0
	24 hours	0.3	0.4	0.5
Oxidants (ppm)	1 hour	0.3	0.5**	0.7
	2 hours			0.6
	4 hours			0.4
	24 hours	0.1	0.2	

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(1) The levels listed under "Stage I" and Stage II" are values set by the State; the values under the "Never to be Exceeded" column are Federal requirements applicable throughout the United States.

(2) ug/m^3 is micrograms per cubic meter.

(3) COH unit is a measure of the light obscuring capability of sampled air.

(4) ppm is parts per million.

* A more detailed description of the Emergency Episode procedures is contained in the Utah Implementation Plan.

** These Standards were inserted as an interpretation and submitted on May 18, 1972.

3.1.2 The Executive Secretary shall also take into consideration, to determine an episode and its extent, rate of change of concentration, meteorological forecasts, and the geographical area of the episode, including a consideration of point and area sources of emission, where applicable.

3.1.3 If an episode is determined to exist, the Director, with concurrence of the Governor shall:

a. Make public announcements pertaining to the existence, extent and area of the episode.

b. Require corrective measures as necessary to prevent a further deterioration of air quality.

3.1.4 Episode termination shall be announced by the Director, with concurrence of the Governor, once monitored pollutant concentration data and meteorological forecasts determine the crisis is over.

APPENDIX A

Part I - Federal Ambient Air Standards*

A. Particulate

1. Federal Primary Ambient Air Standard for Particulate - 75 micrograms per cubic meter of air, annual geometric mean; and 260 micrograms per cubic meter of air, maximum 24-hour concentration not to be exceeded more than once per year.

2. Federal Secondary Ambient Air Standard for Particulate - 60 micrograms per cubic meter of air, annual geometric mean, as a guide to be used in assessing implementation plans to achieve the 24-hour standard; and 150 micrograms per cubic meter, maximum 24-hour concentration not to be exceeded more than once per year.

B. Sulfur Oxides

1. Federal Primary Ambient Air Standard for Sulfur Oxides - .03 ppm annual arithmetic mean measured as sulfur dioxide; and .14 ppm maximum 24-hour concentration, not to be exceeded more than once per year.

2. Federal Secondary Ambient Air Standard for Sulfur Oxides - .02 ppm annual arithmetic mean measured as sulfur dioxide; and .1 ppm maximum 24-hour concentration not to be exceeded more than once per year, as a guide to be used in assessing implementation plans to achieve the annual standard; and .5 ppm maximum 3-hour concentration not to be exceeded more than once per year.

C. Carbon Monoxide

1. Federal Primary and Secondary Ambient Air Standard for Carbon Monoxide - 9 ppm maximum 8-hour concentration not to be exceeded more than once per year; and 35 ppm maximum 1-hour concentration not to be exceeded more than once per year.

D. Photochemical Oxidants

1. Federal Primary and Secondary Ambient Air Standard for Photochemical Oxidants - .08 ppm maximum 1-hour concentration not to be exceeded more than once per year.

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*Federal Ambient Air Standards are found in 42 Code of Federal Regulations, part 410, Federal Register, Volume 33, No. 84, Friday, April 30, 1971. Measurement of standards are by methods stated in above publication and are to be corrected to a reference temperature of 25° C and a reference pressure of 760 millimeters of mercury.

E. Hydrocarbons

1. Federal Primary and Secondary Ambient Air Standard for Hydrocarbons - The hydrocarbon standard is for use as a guide in devising implementation plans to achieve oxidant standards and is .24 ppm maximum 3-hour concentration (6 to 9 A.M.) not to be exceeded more than once per year.

F. Nitrogen Oxides

1. Federal Primary and Secondary Ambient Air Standard for Nitrogen Oxides - .05 ppm annual arithmetic mean measures as nitrogen dioxide.

APPENDIX A (continued)

Part II- Federal Standards of Performance for New Stationary Sources

A. Standards of Performance for Fossil-Fuel Fired Steam Generators

1. Standard for Particulate Matter - emission of particulate matter shall not exceed 0.18 grains per million calories heat input (0.10 lbs. per million BTU) derived from fossil fuel.

2. Standard for Sulfur Dioxide - emission of sulfur dioxide shall not be in excess of (a) 1.4 grains per million calories heat input (0.80 lbs. per million BTU) derived from liquid fossil fuel (b) 2.2 grains per million calories heat input (1.2 lbs. per million BTU) derived from solid fossil fuel (c) when different fossil fuels are burned simultaneously in any combination the applicable standard shall be determined by proration using the following formula:

$$\frac{y\ (1.4) + a\ (2.2)}{y + z}$$

where:

y = the percentage of total heat input derived from liquid fossil fuel.

z = the percentage of total heat input derived from solid fossil fuel.

(d) compliance shall be based on total heat input from all fossil fuels burned, including gaseous fuels.

3. Standard for Nitrogen Oxides - no emission of nitrous oxides, expressed as NO_2, shall be in excess of: (a) .036 grains per million calories of heat input (0.20 lbs. per million BTU) derived from gaseous fossil fuel (b) 0.54 grains per million calories of heat input (0.30 lbs. per million BTU) derived from liquid fossil fuel (c) 1.26 grains per million calories heat input (0.70 lbs. per million (BTU) derived from solid fossil fuel (except lignite) (d) when different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration using the following formula:

$$\frac{x\ (.036) + y\ (0.54) + z\ (1.26)}{x + y + z}$$

where:

x = the percentage of total heat input derived from gaseous fossil fuel.

y = the percentage of total heat input derived from liquid fossil fuel.

z = the percentage of total heat input derived from solid fossil fuel (except lignite).

B. Standards of Performance for Incinerators

1. Standard for Particulate Matter - particulate emissions shall not exceed 0.18 g/dscm (0.08 gr/dscf) corrected to 12% CO_2*.

C. Standards of Performance for Portland Cement Plants

1. Standard for Particulate Matter - (a) particulate emissions from any kiln shall not exceed: (1) 0.15 kg per metric ton of feed (dry basis) to the kiln (0.30 lbs. per ton), (2) 10 percent opacity (excluding the presence of uncombined water) (b) particulate emissions from any clinker cooler shall not exceed: (1) 0.050 kg per metric ton of feed (dry basis) to the kiln (0.10 lbs. per ton), (2) 10 percent opacity (excluding the presence of uncombined water) (c) no emissions of any gases may be discharged into the atmosphere from any affected facility other than the kiln or clinker cooler which exhibit 10% opacity or greater, (excluding the presence of uncombined water).

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*Methods for calculating the adjusted CO_2 percentage are contained in title 40 CFR, Part 60, Subpart E, paragraph 60.54.

D. Standards of Performance for Nitric Acid Plants

1. Standards for Nitrogen Oxides - emissions of nitrogen oxides, expressed as NO_2 shall not exceed: (a) 1.5 kg per metric ton of acid produced (3.0 lbs. per ton), the production being expressed as 100 percent nitric acid (b) 10% opacity (excluding the effects of uncombined water).

E. Standards of Performance for Sulfuric Acid Plants

1. Standards for Sulfur Dioxide - no emissions of sulfur dioxide shall exceed: (a) 2 kg per metric ton of acid produced (4 lbs. per ton) the production being expressed as 100 percent H_2SO_4.

2. Standard for Acid Mist - no emissions of acid mist, expressed as H_2SO_4 shall exceed: (a) 0.075 kg per metric ton of acid produced (0.15 lbs. per ton) the production being expressed as 100% H_2SO_4, (b) 10% opacity or greater (excluding the effect of uncombined water).

F. Standard of Performance for Asphalt Concrete Plants

1. Standard for Particulate Matter - particulate emissions shall not exceed: (a) 90 mg/dscm (0.04 gr/dscf) (b) 20% opacity (excluding the effect of uncombined water).

G. Standards for Performance of Petroleum Refineries

1. Standard for Particulate Matter - (a) no emissions of particulate matter from any fluid catalytic cracking unit catalyst regenerator or from any fluid catalytic cracking unit incinerator-waste heat boiler shall exceed: (1) 1.0 kg/1000 kg (1.0 lbs./1000 lbs.) of coke burn-off in the catalyst regenerator, (2) 30 percent opacity or greater, except for 3 minutes in any 1 hour (excluding the effects of uncombined water) (b) in those instances in which auxiliary liquid or solid fossil fuels are burned in the fluid catalytic cracking unit incinerator waste heat boiler, particulate matter in excess of that permitted in paragraph (1) (a) of this section may be emitted to the atmosphere, except that the incremental rate of particulate emissions shall not exceed 0.18 g/million calories (0.10 lbs./million BTU) of heat input attributable to such liquid or solid fuel.

2. Standard for Carbon Monoxide - no emission of carbon monoxide from a fluid catalytic cracking unit catalyst regenerator shall exceed: (a) 0.050 percent by volume.

3. Standard for Sulfur Dioxide - no fuel gas may be burned in any fuel gas combustion device which contains H_2S in excess of: (a) 230 mg/dscm (0.10 gr/dscf), except as provided in paragraph (b) below. The combustion of process upset gas in a flare, or the combustion in a flare of process gas or fuel gas which is released to the flare as a result of relief valve leakage, is exempt from this paragraph, (b) the owner or operator of a petroleum refinery may elect to treat the gases resulting from the combustion of fuel gas in a manner which limits the release of SO_2 to the atmosphere if it is shown to the satisfaction of the Administrator that this prevents SO_2 emissions as effectively as compliance with the requirements of paragraph (a) above.

H. Standards of Performance for Storage Vessels for Petroleum Liquids

1. Standard for Hydrocarbons - petroleum liquids shall be stored as follows: (a) if true vapor pressure of the petroleum liquid, as stored, is equal to or greater than 78 mm Hg (1.5 psia) but not greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a floating roof, a vapor recovery system, or their equivalents, (b) if the true vapor pressure of petroleum liquid is greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a vapor recovery system or its equivalent.

I. Standards of Performance for Secondary Lead Smelters and Secondary Brass and Bronze Ingot Production Plants

1. Standard for Particulate Matter - (a) no emission of particulate matter from a blast (cupola) or reverberatory furnace shall exceed: (1) 50 mg/dscm (0.022 gr/dscf), (2) 20% opacity (excluding the effects of uncombined water) (b) emissions of particulate matter from any pot furnace shall not exceed: (1) 10 percent opacity (excluding the effects of uncombined water).

J. Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

1. Standard for Particulate Matter - (a) no particulate emissions from a reverberatory furnace shall exceed: (1) 50 mg/dscm (0.022 gr/dscf), (2) 20 percent opacity (excluding the effects of uncombined water) (b) no particulate emissions from any blast (cupola) or electric furnace shall exceed: (1) 10 percent opacity (excluding the effects of uncombined water).

K. Standards of Performance for Iron and Steel Mills

1. Standards of Performance for Particulate Matter - emissions of particulate matter shall not exceed: (a) 50 mg/dscm (0.022 gr/dscf).

L. Standards of Performance for Sewage Treatment Plants

1. Standards for Particulate Matter - particulate emissions from any sewage sludge incinerator shall not exceed: (a) 0.65 g/kg dry sludge input (1.30 lbs./ton dry sludge input) (b) 20 percent opacity (excluding the effects of uncombined water).

APPENDIX B

Utah uses a "Clearing Index" as a determining factor in granting permission for certain classes of open burning. The clearing index is directly related to atmospheric stability, indicating periods of ambient pollutant increase. The critical value has been found to be 500; lower values indicate atmospheric stagnation.

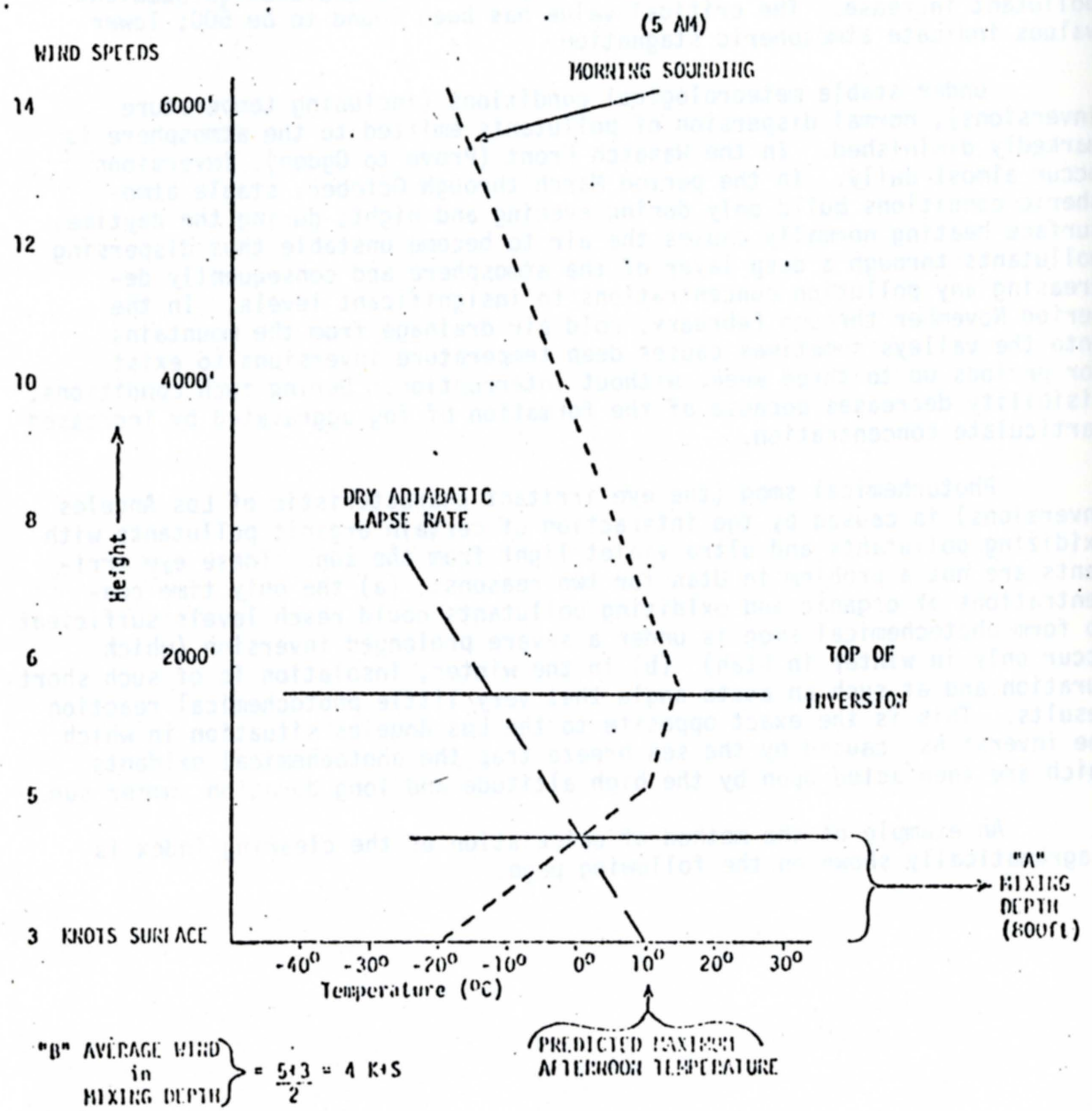
Under stable meteorological conditions (including temperature inversions), normal dispersion of pollutants emitted to the atmosphere is markedly diminished. In the Wasatch Front (Provo to Ogden), inversions occur almost daily. In the period March through October, stable atmosheric conditions build only during evening and night; during the daytime, surface heating normally causes the air to become unstable thus dispersing pollutants through a deep layer of the atmosphere and consequently decreasing any pollution concentrations to insignificant levels. In the period November through February, cold air drainage from the mountains into the valleys sometimes causes deep temperature inversions to exist for periods up to three weeks without interruption. During such conditions, visibility decreases because of the formation of fog aggravated by increased particulate concentration.

Photochemical smog (the eye irritant characteristic of Los Angeles inversions) is caused by the interaction of certain organic pollutants with oxidizing pollutants and ultra violet light from the sun. These eye irritants are not a problem in Utah for two reasons: (a) the only time concentrations of organic and oxidizing pollutants could reach levels sufficient to form photochemical smog is under a severe prolonged inversion (which occur only in winter in Utah) (b) in the winter, insolation is of such short duration and at such an acute angle that very little photochemical reaction results. This is the exact opposite to the Los Angeles situation in which the inversions caused by the sea breeze trap the photochemical oxidants which are then acted upon by the high altitude and long duration summer sun.

An example of the method of calculation of the clearing index is diagramatically shown on the following page.

Appendix B-2

CLEARING INDEX



$$\text{CLEARING INDEX} = \frac{\text{"A"}}{100} \times \text{"B"} = \frac{600}{100} \times 4 = 32$$

GLOSSARY

acre foot	- The quantity of water needed to cover 1 acre to a depth of 1 foot. Equals 43,560 cubic feet= 325,851 gallons.
alluvial fan	- A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where the gradient lessens abruptly. Some alluvial fans are cone shaped and are at the base of mountains.
alluvial plain	- A series of alluvial fans that have coalesced.
alluvuim	- Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
ambient air	- The surrounding or outside air.
anaerobic	- Able to live and grow where there is no air or free oxygen, as certain bacteria. Without air.
arable land	- Suitable for agriculture.
BOD	- Biochemical Oxygen Demand. A measure of the living and nonliving organic demand for oxygen imposed by wastes of various kinds. A high BOD may temporarily, or permanently, so deplete oxygen in water as to kill aquatic life. The determination of BOD is perhaps most useful in evaluating impact of wastewater on the receiving water bodies.
BTU	- British Thermal Unit. A unit of heat equivalent to 252 calories. The quantity of heat required to raise the temperature of one pound of water from 62° F to 63°F.
cfs	- Cubic foot per second. Equals 448.831 gallons per minute or 722 acre feet per year.
coagulation	- A process where a liquid becomes a soft semisolid mass.
coliform bacteria	- A large and varied group of bacteria which flourish in the guts and feces of warm-blooded animals, including man.
demographic	- Vital statistics on populations of people.
DO	- Dissolved Oxygen. DO concentration of unpolluted water depends pretty much on atmospheric pressure and temperature. Nonliving organic matter and various chemicals react with oxygen in water, depleting the oxygen and causing stress from lack of oxygen on aquatic life.

effluent - The outflow of a stream, device or process.

ephemeral - Short lived, transitory, lasting only one day.

evapotranspiration - Water extracted by evaporation and transpiration is usually combined and called evapotranspiration.

ground water reservoir - Reservoirs present beneath the surface of the earth which do not connect with the surface by any means.

megawatt - One million watts or 1000 kilowatts.

MPN - Most Probable Number. A statistical evaluation of degree of water pollution based on presence of coliform bacteria. The MPN interprets test results in terms of results observed.

pictographs - A picture representing an idea, as in primitive writing.

PPM - Parts Per Million.

topography - The surface feature of land areas.

transpiration - The giving off of moisture through the pores of the stem or through the surface of leaves and other parts of plants.

$\mu g/m^3$ - Micro Grams per Cubic Meter

water table - The level below which the ground is saturated with water. Changes with changes in runoff, precipitation and levels of bodies of water.

wind rose - A diagram showing wind direction and strength by differing length of lines radiating from a central point.